The values of meaning and the meanings of ‘values’: Environmental language in text and concept system in a Wet Tropics World Heritage context

Thesis submitted by
Denise Bridget DILLON BPsych/BSocSc (Hons) *Qld*
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James Cook University

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Declaration on Ethics

The research presented and reported in this thesis was conducted within the guidelines for research ethics outlined in the National Statement on Ethics Conduct in Research Involving Humans (1999), the Joint NHMRC/AVCC Statement and Guidelines on Research Practice (1997), the James Cook University Policy on Experimentation Ethics, Standard Practices and Guidelines (2001), and the James Cook University Statement and Guidelines on Research Practice (2001). The proposed research methodology received clearance from the James Cook University Experimentation Ethics Review Committee (approval number H1713).

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Statement on the Contribution of Others

The research described and presented in this thesis was undertaken by the author under supervision by Dr David Cottrell and Dr Joseph Reser, both of whom provided editorial and academic advice.

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I can say in all sincerity that these postgraduate years have been the best of my life (so far), even though I readily (and vociferously) acknowledge the challenges, obstacles, and pitfalls of postgraduate research. Any negatives notwithstanding, the truth is that I have gained the ultimate affirmation not only in being allowed, but also being paid, to do what I have loved.

Abstract

There is growing concern about and evidence of emergent language and meaning problems in the environmental domain, where natural science and social science terminology and assumptions, management speak and lay language come together without a common understanding. This research examined environment-specific meanings and uses of the abstract word ‘values’ that are dependent upon lexical and experiential context through language and prior knowledge. The aims were to examine and document an environmental vocabulary and associated meanings in naturally occurring contexts that appear to have multiple cultures of use and meaning, and to consider theoretical and practical implications concerning multifarious meanings of terms and constructs.

The research investigated naturally occurring language use in the protected area domain of a World Heritage Area (WHA). This applied context encompasses multiple language and meaning issues in natural resource management, research and monitoring, and community consultation and participation, where effective communication is essential between stakeholder groups with often differing cultures of use and meaning for particular core terms and constructs. Theoretical perspectives that informed the research embrace cognitive scientific and social psychological theories of mental and social representations, and knowledge acquisition, elicitation and representation. The principle methodologies employed were text analysis, a lexical decision task, and concept mapping. Participants and document samples were drawn from three groups involved in environmental research, management and conservation activism in the Wet Tropics WHA in Australia.

Study 1, involving text analysis, indicated that meanings commonly assigned to ‘values’ in the WHA context reflect intersecting semantic domains of economic worth, abstract moral principles, and biophysical attributes. Study 2 compared environment-specific word use with general use in the British National Corpus, and confirmed that word associations with ‘values’ in general use differ from those in the specific WHA context. Study 3 examined the role of specific background knowledge on word recognition. Results suggest that experts and novices use qualitatively different strategies for recognising low-frequency environment words. Study 4 examined the conceptual content and structure of an ‘environmental values’ construct, revealing 81 items in seven clusters along two dimensions (affect and social orientation). The content and structure are similar to ‘values’ typologies derived from different theoretical and methodological approaches, pointing to an underlying conceptual structure within broader ‘values’ research. The four studies, taken together, clearly establish that serious language use and meaning problems and confusions exist relating to ‘environmental and world heritage values’, that there is potential for problems with effective communication and credible natural resource management and science because of these unresolved language and meaning issues, and that these problems are evident in underlying language and concept processing as well as in text-based and informal communication contexts. A clear management challenge in the protected area management domain is the management of environmental discourse for effective research, monitoring, and management of protected environments. It is recommended that the importance and role of language in designating, specifying, and communicating about important environmental constructs relating to human-environment interactions, conservation, and management be given a clearer and distinct status as an important and neglected research area and need.

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Typographic Conventions

This document is a thesis, not a manuscript being submitted for publication. As such, APA formatting and typographic conventions have been used throughout except for certain purposes, where APA conventions have been ignored in favour of readability. The following conventions in this thesis are noted for the reader.

Italics
Italics are used for the quotations at the beginning of each chapter. In these cases, quotations are as per their original source with the exception of this typographic use of italics.
Italics are also used to emphasise some words or phrases, and to identify the anchors of a scale.

SMALL CAPITALS
To identify them as study items, keywords and keyword phrases from the text analysis are printed in small capitals

LARGE CAPITALS
Large capitals are used to identify themes, concepts and some linguistic examples.

Quotation marks: Double or Single
"Double inverted commas"
For any material quoted from other sources double quotation marks are used, with the exceptions of block quotations and quotations within quotations. Quotation marks are omitted from block quotations, and single marks are used for quotations within quotations.

'Single inverted commas'
APA guidelines suggest that double marks be used for any first use of ironic comments, slang, and invented or coined expressions. For improved readability of this thesis, in all such instances I adopt the use of single inverted commas as suggested in the Australian Government *Style manual* (6th ed.). Single inverted commas are also used throughout to maintain awareness of 'values' as the item under study.

Spacing: Single or Double
While APA convention specifies double spacing throughout, in this thesis single spacing is used for all block quotations and all Tables.

[*sic*]
To draw attention to spelling errors or gendered language in quoted material I use the italicised word *sic* in square brackets. An exception has been made in the case of *behavior*, simply because it occurs in quoted sources with some frequency, and is not a misspelling, as such, but rather the convention of another country.

Indigenous
In accordance with advice in the Australian Government *Style manual* (6th ed.), capitalisation of the first letter in this word is maintained throughout, as it refers specifically to Australian Indigenous people as distinct from indigenous peoples of the world.

Glossary

Much of the work contained in this thesis is interdisciplinary in nature, and employs terms that are either specific to one discipline or that are used in different ways in two or more disciplines. Consequently, this glossary has been provided to explain terms used herein that might not be familiar to the reader, or familiar but in a different sense to that adopted here. Glossary entry descriptions and definitions are from several sources, which are listed at the end of the glossary. Sources are indicated within the entries. Where only one source is provided, that is the sense adopted for this thesis; where no source is given the current author has specified the relevant sense.

Application/s: The natural occurrence of a word in written or spoken discourse; the intended meaning. In this thesis, 'application' is used interchangeably with 'use'.

Concept: Reber and Reber (2001) provide two denotations for concept: "A complex of objects all of which share some attribute(s) or properties", and "the internal, psychological, representation of the shared attributes". The latter is similar to Babbie's (1999) 'conception': "The technical term for those mental images in our mental file drawers, is conception….The terms associated in our separate minds make it possible for us to communicate and eventually agree on specifically what we will mean by those terms. The process of coming to an agreement is conceptualization and the result is called a concept." Rather than considering a 'concept' as a collective, agreed-upon and shared image, this thesis adopts Cruse's (2004) description: "Concepts are vital to the efficient functioning of human cognition. They are organized bundles of stored knowledge which represent an articulation of events, entities, situations, and so on in our experience." A 'conceptual system', on the other hand, is here considered as a multidimensional collation of individual representations.

Connotation: (cf. denotation) Anderson's (1990) definition of connotation is adopted here: "The connotation of a word is the set of distinctions, or rule [*sic*], for deciding whether an object, action, or property is a member of the class of objects, actions, or properties that constitutes the denotation of the word. This use of connotation should not be confused with the common meaning of affective coloration."

Construct: "The least confusing way to use this term is to treat it as a rough synonym of concept, at least in so far as both are basically logical or intellectual creations. Essentially one infers a construct whenever one can establish a relationship between several objects or events" (Reber & Reber).

Content Analysis: "A research technique for the objective, systematic, and quantitative description of the manifest content of communication" (Smith, 2005).
"The analysis of frequencies in manifest content of messages using the identification and counting of key units of content as the basis of its method" (O'Sullivan et al., 1994).

Content Words: (cf. function words) "These are the *semantically* important parts of a sentence, that is to say, the nouns, verbs, adjectives, adverbs. They are often described as an "open class" of words because new ones are constantly being invented and there seems no limit to how many of them there can be" (Smith).

Context: Two of the senses by which Reber and Reber define context are pertinent here: "Generally, those events and processes (physical and mental) that characterize a particular situation and have an impact on an individual's behaviour (overt and covert)", and "in linguistics, the surrounding words, phrases and sentences that are components of the meaning of any given word, phrase or sentence".
In this thesis, 'context' is considered in both of these senses: Firstly, the specific circumstances (i.e. temporal, cultural, physical, historical, emotional) within which an action or event takes place and, secondly, in the surrounding words, phrases and sentences.

Co-occurrence: "Simultaneous, but not necessarily contiguous, presence of occurrences of two given words in a fragment of text (sequence, sentence, paragraph, neighbourhood of occurrence, corpus part, etc.)" (Lebart, Salem, & Berry, 1998).

Corpus: "Limited set of texts upon which the study of a linguistic phenomenon is based. In lexicometrics, a set of texts that are combined for comparison purposes, serving as a basis for a quantitative study" (Lebart, Salem, & Berry).

Dendrogram: "Graphic representation of a hierarchical cluster analysis, showing the progressive inclusion of clusters" (Lebart, Salem, & Berry).

Denotation: (cf. connotation) Reber & Reber define denotation thus: "Meaning conveyed by the objects or instances to which a word refers or, by extension, by the generic idea or concept that is represented by that word."
This thesis adopts Anderson's description: "To maintain a distinction between specific and general reference, I will use the traditional term denotation to indicate the entire class of entities associated with a word."

Discourse Analysis: "The systematic analysis of a spoken or written discourse, and thus an important source of objective research data for the study of higher-order cognition" (Smith).

Function Words: (cf. content words) "These are the *syntactically* important parts of a sentence, that is to say, the prepositions, conjunctions, and pronouns. Unlike content words, they are often described as a "closed class" of words because there are comparatively few of them to start with and new ones are only rarely added" (Smith).

Keyword: The term 'keyword' comes from computer technologies whereby search statements are constructed using keywords or phrases that are significant to the topic content, and used to find information (synonym: Type).

Meaning: "The import of a signification. The product of culture" (O'Sullivan et al.).
"On its face, the thesis that resolving word meanings requires a considerable amount of reasoning based on context and world knowledge may seem to be incompatible with the view that accessing word meanings is a 'module' that is 'impenetrable' to such influences. However, I am not necessarily saying that stereotyped word senses do not get accessed, nor that the early stages of the process could not be routine. What I am saying is that it is a mistake to equate these transient throughputs with meaning" (Anderson, p. 15).

Occurrence: "A singular instance of 'use'. Each instance of a keyword in a corpus" (Lebart, Salem, & Berry). (synonym: Token)

Operationalisation/operationalism: "Conceptualization is the refinement and specification of abstract concepts, and operationalization is the development of specific research procedures (operations) that will result in empirical observations representing those concepts in the real world" (Babbie).
"Essentially, it argues that the concepts of science be operationalized - that they be defined by, and their meaning limited to, the concrete operations used in their measurement….In the final analysis, many of the critical terms and concepts of psychology carry a 'thingness' or a 'deep' meaning that is simply not captured by even the most thorough operational characterization" (Reber & Reber).

Phrase: A phrase consists of several words, but is not grammatically complete enough to constitute a clause. Alternatively, it is "a syntactic structure that consists of more than one word but lacks the subject-predicate organisation of a clause". (Smith)

Practice: "The repetition of an act or series of acts (Cruse).
"Any behavior that is customary or traditional, particularly within a particular culture" (Reber).
For this thesis, 'practice', 'application' and 'use' are used interchangeably throughout.

Pragmatics: "Pragmatics is the science of communicational motivation, that is to say, 'of the aspects of meaning and language use that are dependent on the speaker, the addressee, and other features of the context of utterance'" (Smith).
"The study of the interpretation of utterances and more specifically how the context of situation influences their meaning. Traditionally the study of meaning has focused upon the meaning of words or sentences as if meaning inhered within the linguistic expression itself and was ultimately determined by the linguistic system. Pragmatics, however, emphasizes the role of context in determining meaning" (O'Sullivan et al.).

Referent: "Literally, the thing referred to [hence often seen as "noun referent"]. 'A term used in philosophical linguistics and semantics for the entity (object, state of affairs, etc.) in the external world to which a linguistic expression relates'" (O'Sullivan et al.).
"The entity in the real world that is indicated or picked out by word, phrase or expression. Strictly speaking only concrete objects or events can be considered as referents, although some authors will stretch the term to cover abstractions which can be operationalised" (Reber & Reber).

Representation: "A thing that stands for, takes the place of, symbolizes, or represents another thing. In studies of perception and cognition one often sees reference to the mental representation of a stimulus event which, depending upon theoretical orientation, may be characterized as a direct mapping of the stimulus (direct realism), an elaboration of the stimulus (constructivism), a mental code of it (idea, image) or an abstract characterization of it (proposition)" (Reber & Reber).

Rhetoric: The persuasive use of a word for linguistic effect.

Sense: "I will define the sense of a word as the set of distinctions the word conveys in a particular circumstance of use. A more common usage is to equate sense with the set of circumstances in which the word is used in a serious, literal-minded fashion. To keep the two meanings of sense straight, I will use another traditional term, connotation, for the nonspecific meaning" (Anderson).

Token (cf. type)**:** “A specific utterance in linguistic form of a linguistic expression. In 'happiness begets happiness' there are three word tokens but only two word types” (Reber & Reber). Used throughout this thesis as a synonym for ‘occurrence’.

Type (cf. token, keyword)**:** “The form of a word corresponding to identical occurrences in a corpus” (Lebart, Salem, & Berry).
“A class of utterances or words defined so as to represent a coherent group for the purpose of determining a type-token ratio” (Reber & Reber). ‘Type’ is used throughout this thesis as a synonym for ‘keyword’.

Type-token ratio (TTR): “In studies of language, the ratio of the number of types to the number of tokens in a corpus of language. In the most frequently used sense the count of tokens is the total number of words in the corpus and the count of types is the total number of different words. The closer to 1.0 the ratio is the greater the verbal diversity the person displays. Such ratios are often used in analysis of verbal sophistication of children” (Reber & Reber).

Use: “[use, law (or principle) of. The not surprising generalization, first formalized around the turn of the century by E. L. Thorndike, that responses, functions, associations, etc., which are practiced, exercised or rehearsed (I.e. 'used') are strengthened relative to those which go unused” (Reber & Reber). Naturally occurring word instantiations; in practice (used interchangeably with ‘application’)

Vocabulary: “Set of distinct words (types) found in a corpus” (Lebart & Salem).
“The full compendium of words that an individual knows”, or “any specifically circumscribed list of words. When this last meaning is intended, a qualifier is typically used to denote the conditions” (Reber).

Glossary Sources

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1. Posing the Question: Introduction

What is time, then? If no one asks me I know what it is. If I wish to explain it to him [sic] who asks, I do not know.[1]

It is a common observation that people experience great difficulty in providing adequate definitions for words that they have no trouble using or understanding in everyday discourse.[2]

To be able to explain what 'time' is, people need to know something about the nature of time. However, although knowledge is necessary for clarification, it is not sufficient. As Augustine (trans. 1961) confessed, people can know about time without being able to explain what it is. The inability to articulate ideas is often unproblematic, as communication consists largely of socially determined meanings, and the meanings of commonly occurring words or concepts such as time are rarely questioned. However, when a 'troublesome' term, phrase, or concept becomes a focus of scientific communication and is also of public interest, it is important that specialised knowledge can readily translate to shared or social knowledge. The consequences of assuming knowledge about 'values', not 'time', are pertinent to this thesis. To paraphrase Augustine, "What are values, then?"

This thesis considers the communication challenges and implications when the troublesome term 'values' is used either alone or in conjunction with other words and constructs relevant in a real world context. There appear to be serious and consequential problems of language and meaning in particular multidisciplinary and

[1] In his Confessions, written in AD 397-8, St. Augustine (trans. 1961, p. 264) observed the difficulty experienced when attempting to define and describe something abstract and intangible.

[2] Sixteen centuries later, Miller and Charles (1991, p. 6) similarly noted the difficulty of showing how semantic information is characterised within contextual representations.

applied contexts. In its use as a social activity, language imbues the world with meaning through interplay among language, thought and experience. How complex words and ideas are conceptualised depends on different cultures and languages of use, including public and scientific cultures, and meanings are often altered through popular media.

Ask what 'values' are in a public forum on morals, and a researcher might receive reasonably comparable replies involving beliefs, principles or standards used to guide behaviour. Consider in contrast the responses of psychologists, ecologists, and natural resource managers to a similar question in their preparation for collaborative, multidisciplinary research. Consider the analogy to the biblical story of Babel, when "the Lord did there confound the language of all the earth" (Gen. 11:9, New King James Version), so that even those working towards a common goal are nevertheless caught up in confusion and miscommunication.

There is a tradition of public respect for scientific clarity, but the encroachment of scientific jargon words into general use can be disturbing rather than reassuring. Even within the sciences, there are different cultures of conceptualisation and understanding. Public understandings of science are clouded by these internal confusions surrounding meanings within the sciences themselves. Environmental discourse is a topical case in point, where scientific knowledge and terms are often given to imprecise use and fashionable misuse as 'vogue' words. As an instance of fashionable word use, Gowers (1948/1973), in his *Complete Plain Words*, placed the term 'resources' amongst a class of 'seductive' words that are effective if used correctly: "My warning is only against the temptation to prefer them to other words which would convey better the meaning you want to express" (p. 117). Public language exerts its power and influence onto specialised discourses through practices that weaken vocabularies and neutralise expression (Watson, 2003). Concerns involving the ‘decay’ of public language are fostered by examples showing that words are not chosen or used with any great care or, conversely, are carefully chosen only for an emotive influence.

Past concerns of some respected authorities indicate that problems with the misunderstanding of scientific language are longstanding. For instance, Gowers (1948/1973) argued that writing in some disciplines had become pretentious due to a desire for academic esteem, but that ‘expert’ language leads only to obscurity. Similarly, Empson (1930/1973) noted a tendency for scientific writing to be “determinedly unintelligible from any but the precise point of view intended” (p. 234). In contrast to public language, in formalised, scientific cultures of use, underlying theoretical frameworks and discipline-specific normative language are often relied on to differentiate explanations from each discipline, and to specify operational procedures for measuring and recording a construct of interest.

For instance, framing a question in a specific way designates the context in which the question and its key words are to be understood. Consider, for example, the different responses the following questions might elicit:

What is the value of community?

What are the key values of the community?

The singular, ‘value’, in the first example sentence context implies worth, and ‘community’ refers to fellowship, or a commonality in character. In contrast, the plural, ‘values’, in the second context requires an understanding that values, as principles or standards, might exist within the community, as a collective group of people. In a research survey, these differences would be avoided through careful adherence to operationalised criteria. In a public forum, however, such questions might easily be raised together without specification or contextual cues, through an expectation that everyone would understand and appreciate the nuances of meaning. Thus, in addition to the linguistic context, other factors that influence understanding must be considered. Such pragmatic factors include the target audience to whom a message is addressed, the background or prior knowledge of the respondents, and the single or multiple theoretical standpoints of the researchers. ‘Background’ is intended here as a person’s cumulative experience with language and with the world, especially in an academic or job context, but also in a generalised sense.

In the broader environmental domain, multiple, divergent cultures of language use and meaning with respect to particular constructs and terms converge in the more specific and applied natural resource and protected area management domain. The prominence and problematic use of the word ‘values’ in internationally disseminated discussions about environmental matters led to the focus for this thesis, but similar concerns apply for other words and turns of phrase adopted from specialised disciplines that move into and out of fashionable use. For example, core notions and constructs such as ‘sustainability’ and ‘sustainable development’, ‘natural capital’ (Hinterberger, Luks, & Schmidt-Bleek, 1997), ‘natural’ (Harré, Brockmeier, & Mühlhäusler, 1999), ‘biodiversity’ (Takacs, 1996), and even ‘environment’ (Harré et al., 1999) are also endowed with multiple meanings and can also be considered as troublesome through unqualified use. When using such terms and expressions in one context, it is often necessary to broaden the scope of intention, and take into account what the term or expression might mean from another perspective. The weight of influence from one discipline or theory in determining how terms and expressions are used can have a profound impact on other discourses. For instance, whereas some choose to consider ‘natural capital’ as physical quantities, others consider the same notion in monetary dimensions. A further difficulty is added when attempting to decide on a correct monetary value for natural capital considered as non-market commodities, such as the amount people would be willing to pay to retain the visual amenities of 'open spaces' and 'greenways' instead of allowing urban development (Hinterberger et al., 1997).

Considered as a central concept within the core of meanings in societies, and through which individuals build a way of life (Kluckhohn & Strodtbeck, 1961), 'values' - and, in particular, environmental values - provides a particularly interesting and challenging theoretical and empirical focus. The disciplinary vantage point brought by the present author to this inherently interdisciplinary focus encompasses current psychological and psycholinguistic perspectives on meaning in language and communication contexts. Reference is also made to the emergent environmental discourse domain, in which environmentally salient language and meaning considerations are approached from a spectrum of social science, cultural studies, and philosophy perspectives.

The language used to discuss 'values' in the applied context of natural resource and protected area management is problematic due to what some would refer to as ambiguity. However, ambiguity is not always considered troublesome. Empson (1930/1973), for instance, noted that ambiguity in some instances reflects a richness or complexity of meaning that can add nuance to the commonplace. The more amenable might even take the poet's path of philosophical acceptance through the 'negative capability' described by Keats, "that is, when a man is capable of being in uncertainties, mysteries, doubts, without any irritable reaching after fact and reason" (Forman, 1947, p. 72). Nevertheless, 'ambiguity' has a specific meaning in psycholinguistics and other language-related fields, and indicates that a word or sentence has two or more meanings, or interpretations. It is thus more instructive to talk instead of 'values' as having 'indeterminate reference', which leads to 'semantic shift' between everyday meanings, scientific meanings, and public understandings of science (Harré et al., 1999; Johnson-Laird, 1987). A referent is generally considered to be a real world entity that stands in direct relation to a word or expression. As an operationalised construct and general use term, 'values' is referentially indeterminate in that it has no single real world referent. The meanings associated with the expression can thus shift according to the context of use.

Although most of these meaning domains share origins with everyday understandings of 'value' as worth or importance, and also of 'values' as principles or standards, some meanings are more precise. A strictly scientific meaning of 'values' in mathematics refers to numerical quantities that are either calculated or assigned and, in the natural sciences and pure sciences, 'values' refer to instrument readings. In the social and behavioural sciences such as psychology and sociology, the theorized construct, 'values', is typically understood as an underlying intrapsychic, psychological parameter and underlying behavioural disposition. However, there is little consensus on a unified social and behavioural sciences meaning for 'values'. In natural resources contexts, environmental managers' understandings of values quite possibly stem from the adoption of expressions from economics discourse such as 'management of resources' and 'resource allocation' (Gowers, 1948/1973). When considered from an economics perspective, the term 'resources' refers to financial gains and expenditure, and natural resources are considered along those lines. It is merely another step to consider 'natural values' as natural resources, combining the economic connotations of both 'resource' and 'value'.

These diverse meaning domains all feed into the uncertainty surrounding the nature of ‘values’, and how to consider and discuss them effectively, clearly, and in relation to the environment. Effective communication is further complicated by the increasing presence of social science into the environmental science domain, with each discipline grounded in its own vocabulary of specialised terms. Some examples of social science research relating to the environment include environmental impact assessments, behavioural assessments and modifications, attitude change, and impacts on beliefs and social norms (Vining & Ebreo, 2002). Beliefs, norms, attitudes and opinions are all related to, and often considered as synonymous with, human values, even within the social science disciplines. Indeed, the extensive research literature indicates that ‘values’ as a core construct is often operationalised and measured with little or no regard for the continuing calls for clarity of values systems, their content and their structure (e.g. Bengston, 1994; Bentrupperbäumer, Day, & Reser, 2006; Dietz, Fitzgerald, & Shwom, 2005; Hull, Richert, Seekamp, Robertson, & Buhyoff, 2003; Reser & Bentrupperbäumer, 2005; Rohan, 2000; Satterfield, 2001; Shaw & Zube, 1980; Vining, 1992).

There is widespread agreement that measurements or assessments of environmental values must be multidimensional, in consideration of the multiple meanings and representations of ‘values’ across diverse groups. Nevertheless in many instances, although research may have been framed as a study of ‘values’, the measurement has in fact been used for documenting and tracking changes in public ‘perceptions’ and ‘attitudes’. For example, Kellert’s biophilia hypothesis, drawing on nine categories of ‘values’, derives from various studies of human perceptions of wildlife (Kellert, 1984b, 1993b), human attitudes towards animals (Kellert, 1980, 1985), and the assessment of wildlife as a commodity (Kellert, 1984a). With respect to Kellert, he referred to and measured values not only as attitudes, but also as 'perceptions' and 'commodity assessments'. Similarly, Schultz and others have ostensibly studied 'values', but only as a convenient measure of changes in environmental attitudes (Schultz & Zelezny, 1999) and as indicators of environmental concern (Schultz, 2001). Speculation about what individual projects might or might not actually have been targeting simply harkens back to the need to more critically examine the nature of values discourse, and highlights how people from differing backgrounds and with different agendas understand and use the term and construct of 'values'. People talking about or measuring values in the guise of other concepts is at the crux of this communication and credible science problem.

Although it is undoubtedly the case that people may discuss the concept of values in the guise of discussions of goals, attitudes, beliefs or worldviews, or talk about 'values' when they actually are talking about 'attitudes' it is also the case that many nonpsychologists as well as psychologists use these terms interchangeably and often synonymously. It is noteworthy that Eagly and Chaiken (1993), for example, maintained that "values should be regarded as attitudes toward relatively abstract end states of existence" (p. 149). This matter should be and indeed is taken into consideration in this thesis by starting with an exploration of the meanings of 'values' as used in environmental discourse. However, the additional and principal matter being addressed in the thesis is that a large segment of the environmental sciences and environmental management population is using the word 'values' to refer to and mean very different things, often in the same context, with these domains of reference and meanings including not only the more conventional and social science understanding of values, but understandings and uses of 'values' for attributes and processes of the biophysical environment, for instrument readings, for socioeconomic valuation, etcetera. This creates very thorny and consequential problems when legislation mandates the monitoring, measurement, protection, presentation, and management of ‘environmental values’. It is, of course, a moot point as to what extent some of this ‘same word but different intended sense’ is occurring, but a very genuine attempt has been made here to empirically address the extent to which dramatically different reference domains are being invoked and referred to.

Further confusion stems from economic connotations of environmental values as natural resources. Such studies are useful and important sources of information about their respective topics, but restraint in the seductive use of ‘values’ might have better served the research aims. Admittedly, there are cogent reasons for the widespread use of the term ‘values’, given its status as a foundational construct relating to why people behave the way they do and how they ‘should’ behave. Clearly, the word ‘values’ (and its underlying concepts and construct domains) has some shared meanings, which might not be easily articulated. However, as with other words that carry a complex and polysemous semantic load, and are differentially used in lay contexts as well as specialized contexts, there are aspects and domains of meaning that are not generally shared, but rather are specialized within particular discourses. It is typically not only shared meanings, but differentiated meanings and often possibly confused meanings that need to be clearly articulated, clarified and communicated in research or applied science contexts. As this literature review suggests, this often does not happen. Nevertheless, values systems and meanings attributed to expressions such as ‘environmental values’ are diverse, and the term requires further critical, reflective consideration and analysis. Such analysis is complicated because individually specific and at the same time independently different constructs of values are used and referred to by different groups – among them scientists, natural resource managers, academics, and the public.

This thesis adopts an approach that places language and meaning at the centre of interest. The problems associated with the current applications of 'environmental values' in a restricted real world, social and workplace milieu and context are treated as an important case study. The focus of the thesis on the study of language use and meaning, rather than directly on 'values', requires different approaches from those adopted by other researchers purportedly interested in the measurement of values. Pertinent to the fundamental relationship between language and reality, the focus on language use and meaning in naturally occurring language requires a real world context for situating the study. The Wet Tropics World Heritage Area (WTWHA) in Australia's North Queensland provides the real world social and applied context for the study. Its geographic location is shown in Figure 1.

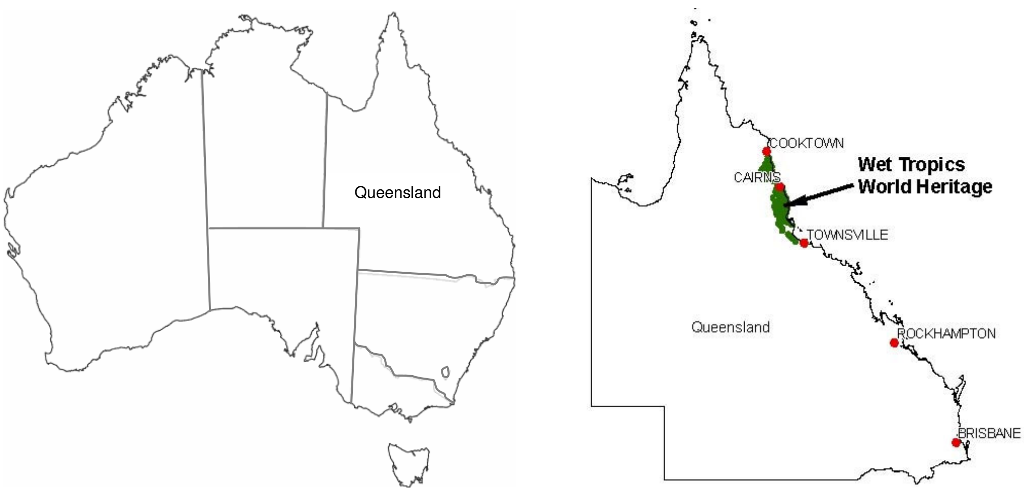

Figure 1. Australia, (c) copyright Commonwealth of Australia (Geoscience Australia), and the Wet Tropics World Heritage Area in north eastern Queensland (www.wettropics.gov.au).

The construct of 'environmental values' was integral to the listing in 1988 of the WTWHA on the World Heritage register (UNESCO, 1972) and to the

WTWHA's continuing management. The WTWHA actually consists of 733 separate parcels of land, many of which are privately owned (Wet Tropics Management Authority, 2003). National parks, state forest and public land leases constitute the bulk of the Area. Reflecting the diversity in ownership and tenure, those involved in the management of the WTWHA (either directly or indirectly) range from private landowners to government agencies. Research, management and environmental conservation groups, Indigenous community groups and private landowners variously seek to understand, manage, maintain, preserve and present the 'natural values', 'cultural values', 'conservation values', 'environmental values' and 'biodiversity values' of the WTWHA.

The WTWHA's universal significance as a unique and irreplaceable property, as a source of scientific interest, and its local, economic importance for tourism, makes the study and discussion of Wet Tropics environmental values a multidisciplinary and extra-disciplinary (i.e. non-academic) endeavour. Scientists devote research time and money in their endeavours towards further understanding the area's diversity. Environmental management agencies use some of the information garnered from this research to better protect and conserve the area's natural heritage. Conservation groups work with and against government agencies in their own efforts to protect the environment, to advance public awareness of perceived threats to the area, and to promote pro-environmental behaviours. Stakeholder groups with interests in the WTWHA include federal, state and local governments, natural resource management agencies, scientists, conservation groups, Indigenous owners, landholders, farmers with land bordering the WTWHA, local and foreign visitors to the area, and local residents. In an applied sense, protected area management legislation implicates 'environmental values' as a core aspect of the environment to be protected, managed, and presented, as well as needing to be measured and monitored. A challenge for the enactment of this legislation is the fact that environmental values are also understood as a key aspect of human landscapes and environments.

Research Focus

The research focus of the thesis is an investigation of the pragmatic uses and meanings of the term and construct, 'values', along with its conventional modifiers (e.g. environmental, natural, heritage), in the context of the Wet Tropics World Heritage Area, a World Heritage Area bioregion in Northern Australia. The focus on uses and meanings of values is considered with respect to those various stakeholder groups and communities of concern who live and work in this region. Of particular interest in this research are possible problems in the changing and differing applications and meanings of values in the WTWHA context of natural resource and protected area management. For practical reasons and considerations, groups of interest for this research were limited to management agency staff, research scientists, and community conservation group members.

Research Objectives

The multiple objectives of this research were to:

- document the linguistic uses and meanings of the term and expression 'values' in the context of the natural environment of the region encompassing the Wet Tropics World Heritage Area, and its management and conservation;
- examine and analyse possible problems as a consequence of multiple applications and meanings for differing groups;
- use this applied case study as a window for considering a number of salient theoretical and practical issues regarding word and construct meanings, and

conceptual and operational definitions, in increasingly multidisciplinary and applied research and policy contexts such as environmental sustainability, monitoring, and effective management, and

- suggest possible strategies for addressing the identified problems of language and meaning, and communication, and for managing this discourse.

Research Questions

The empirical questions of this research were broad, and more exploratory than confirmatory:

- Does the seeming confusion in the application of, and reference to, ‘environmental values’ in the applied context of management of a World Heritage Area, such as the Wet Tropics World Heritage Area, actually exist?
- Do these possible confusions appear to have practical consequences with respect to effective communication, credible research and effective management, and public understanding of science?
- What are some of the factors and/or underlying processes which appear to be creating language slippage and confusion, and communication breakdown about environmental values and meaning?
- What insights or understandings are found in contemporary psychological and psycholinguistic theory and research findings which can illuminate or assist in addressing these problems of language, meaning, and communication in practical and applied contexts such as the natural resource and protected area context studies?

Thesis Structure and Outline

Chapter 2 explores the meanings of ‘values’, with particular reference to the discourse of environmentalism as a source of potential confusion. Beginning with a broad overview of potential problems, the chapter subsequently narrows to specific definitions of ‘value’ and ‘values’. The final section is a critical examination of approaches employed in researching values, together with suggestions for suitable approaches to the measurement of meaning, both as customary use and as conceptual system.

Chapter 3 explores the nature of meaning, and also reviews some current psychological and psycholinguistic perspectives on meaning in language and communication contexts, and the relevance of those perspectives to the current research. Also reviewed are psychological theories regarding the role of background knowledge and the processes involved in the development of linguistic and world knowledge, together with the characteristics of language as a stable system.

Chapter 4 details a text analysis of naturally occurring, printed documents, showing the differential uses of the target word, ‘values’, and patterns of relationships between ‘values’ and other words. The discussion draws on insights from the book, *Greenspeak* (Harré et al., 1999).

Chapter 5 is a comparative examination of co-occurrences of the target word ‘values’ with a selection of keywords in a large corpus of general texts (the British National Corpus) as a comparison with the co-occurrence patterns found in the Wet Tropics document sample.

Chapter 6 describes an experimental investigation of ‘expert’ and ‘naïve’ participant responses to a set of ‘environment’ words compared with a set of control words, to determine the effects of lexical facilitation from background knowledge.

Chapter 7 explores the conceptual domain of environmental values in a Wet Tropics context through a concept mapping procedure, together with a discussion of the findings and some comparative interpretations of the findings.

Chapter 8 critically considers and discusses unresolved issues and questions, theoretical insights and implications. This discussion encompasses a summary of the main conclusions, and suggests future directions regarding discussions and studies of values pertaining to the environment.

2. Confusion about Values in the Environmental Context

"When I use a word", said Humpty Dumpty in a rather scornful tone, "it means just what I choose it to mean, neither more nor less".[3]

Introduction

The dynamic nature of language is such that language 'slippage' occurs when people assume understanding, but their reception is in fact different from the speaker's or author's intention. In addition to such misguided assumptions, other factors obscure clarity and understanding. The first of these is ambiguity, whereby different meanings are assigned and assumed for commonly used terms or expressions (e.g. environmental values; environmental sustainability) that are, by the nature of their widespread and informal use, ambiguous. The problem is compounded when group dynamics is added to the mixture, with people often unaware that they are talking past each other, or that this slippage is taking place. While such unawareness makes the problem a hidden one, it is nevertheless very consequential to actual communication breakdown.

Reser and Bentrupperbäumer (2005), for example, argued that ambiguous constructs that have elusive meanings foster situations where "shared labels, but differing constructs and assumptive worlds, dominate, drive and increasingly divide discussions of management issues, stakeholder concerns, research directions, agency responsibilities, and the very nature and 'attributes' of the environment in question"

[3] Lewis Carroll's fantasy world beyond the looking glass (Carroll & Gardner, 1960, p. 269) featured the same arbitrary use of language as in the world we know as *real*.

(p. 126). Similar calls for clarity and the resolution of ambiguity in public language (Harré et al., 1999; Watson, 2003), and in the 'environmental values' domain in particular (Hull et al., 2003; Reser & Bentrupperbäumer, 2005; Satterfield, 2001), are abundant.

Where expressions are ambiguous, the rhetoric of environmental discourse often conflates all of the meanings of a commonly used word or expression so that to talk of 'values', for instance, can be to some extent meaningless. Harré, Brockmeier and Mühlhäusler (1999) discussed the potential of words to lose their meaning, or at least their impact, when subjected to overuse and under-differentiated use. Of course, such use is arguably due to referential indeterminacy rather than ambiguity (Harré et al., 1999; Johnson-Laird, 1987), as reference involves knowing the situation, the specific discourse conventions, and the ability to make inferences. An additional problem is that certain expressions function as 'buzzwords' or 'catchphrases' to invoke an emotive reaction (Little, 1999). A potential likelihood is that such mistreated terms might thereby be dismissed as poorly defined and inconsequential (Callicott, Crowder, & Mumford, 1999). Unless it is essential to interpretation of the discourse, gaps in knowledge do not hinder the ability to understand, and any reference found in context will help to disambiguate a word. In a pragmatic sense, 'context' is not limited to the linguistic environment, but extends to physical, social and epistemic contexts, as object surroundings, social relationships, and beliefs and knowledge. Temporal and historical contexts might also be pertinent.

Problems with the Discourse of Environmentalism

The potential for looseness in meaning is widespread, and Rohan (2000) decried the abuse and overuse of the word 'values' by psychologists and nonpsychologists. In the environmental arena, the problem is not specific to values, and extends to related environmental discourse (Aiello & Bonaiuto, 2003; Callicott et al., 1999; Carolan, 2006; Harré et al., 1999; Schultz & Zelezny, 2003; Shaw & Zube, 1980; Smith, M., 2001). Constructs such as 'natural', 'environment', 'sustainability', and 'biodiversity' all present problems stemming from changing functions and meanings, and from the overburdened use of such terms and constructs. Everyday language abounds with metaphor and simile, and specialist expressions become the idiom of the everyday. Ecological discourse involves many metaphorical terms that highlight some features of reality at the expense of others: "We should thus be more reflexive regarding our use of concepts and terms, and work to continually improve on them when possible" (Carolan, 2006, p. 927). A currently salient example of metaphorical language in environmental discourse is the notion of 'global warming'. An implied metaphor here is to equate the warming of the globe to the warming of one's home; it is the individual's responsibility to moderate the thermostat to avoid overheating (Harré et al., 1999). However, the processes behind global warming require much more than simple moderation of domestic heating.

In their study of environmental rhetoric, or 'Greenspeak', Harré, Brockmeier and Mühlhäusler (1999) noted attempts to combine geophysical discourse and evaluative discourse:

> In rather oversimplified terms, what this means is that geophysical discourse assumes a set of accreditational values such that a properly trained expert can formulate and prove propositions about an independent spatio-temporal reality (the earth, the climate, animal populations, etc.) that lies outside language. Truth is a matter of how your assertions are accredited, that is, whether the models they determine match or fail to match, within the limits set by the context, with states of affairs in this independent reality, while acknowledging that which aspects of this reality are available to an investigators [*sic*] are partly a function of the repertoire of concepts and the stock of apparatus at hand. Whereas moral and aesthetic discourse assumes, for one thing, that there is a further dimension of truth altogether, which is occupied by moral truths, and

> these cannot be reduced to truths of the kind recognized in geography, geology and the other natural sciences. So they have to be given some other kind of accreditation. (pp. 46-47)

There is a spate of literature highlighting the problems associated with unclear language, and particularly so for 'values', as a problematic yet widely used expression. Meanings of values integrate biophysical and moral connotations. The power of language to influence decisions pertaining to environmental management, planning and policy is evident: "the terms employed in the environmental sciences do more than describe—they also guide attitudes, frame discussions and shape policy" (Carolan, 2006, p. 929). Indeed, ambiguous applications and understandings of expressions such as 'environmental values' in natural resource management-related fields combining social sciences and natural sciences are clouding communication regarding management practices and the politically driven policies that dictate them.

In order that issues about environmental values are usefully and meaningfully communicated and reported on, the current ambiguities and misunderstandings must be resolved (Bentrupperbäumer et al., 2006). Reser and Bentrupperbäumer (2005) articulated some of the unresolved questions within the current state of environmental values discourse specific to the natural resource arena, and argued for the clear conceptual and operational specification of core constructs.

Emotive Rhetoric and Normative Language

Another issue clouding the waters of understanding is that communication about environmental values is potentially subject to emotive rhetoric, with differences of opinion between managers, public land users, and environmental activists regarding appropriate land use and function (Vining, 1992; Vining & Tyler, 1999). Indeed, differences of opinion even extend to the language that expresses concerns. Tindall (2001) reported a Forestry academic's address to a public forum audience of interested, general public members: "Forestry is about science. What you are talking about are values. Values are beyond the realm of science" (p. 57). Such a stance represents an extreme view that is not necessarily shared by all, or even many, environmental professionals. Nevertheless, a reflective acknowledgement of differences in meaning and application is better than assuming that understandings about 'values' are universally shared.

Any perception of universal understanding increases the potential for people to erroneously assume that others will think and respond in the same way as they do, and is thus "a potent source of conflict when the management of public lands is at stake" (Vining, 1992, p. 10). A suggested means by which to avoid such conflict, which is largely emotionally driven, is that any specialised understandings of environmental managers, scientists, and lobbyists are framed in normative terms when not specified as operationalised criteria (Vining, 1992; Vining & Tyler, 1999). This solution relies on an assumption of shared knowledge. People with common agendas and knowledge backgrounds will likely share a normative vocabulary, with terms and expressions understood according to mutually shared knowledge (Clark & Marshall, 1981), along with semantic and grammatical conventions of language use.

Contrast such mutual understanding with the misunderstanding likely to occur when people with different agendas and knowledge backgrounds collaborate for a common goal. There are many socially shared criteria for correctness of meaning, but, when meanings are not shared, interpretation and subsequent communication are detrimentally affected. Language slippage occurs in everyday situations, but it also occurs in research endeavours where confounding conditions, including the vocabulary in which the research is phrased, are purportedly controlled.

Operational versus Normative Terminologies

The precision of operational terminology is in contrast to normative terminologies, that are often ill-defined and emotionally driven (Callicott et al., 1999). Operationism integrates theoretical and methodological considerations, both of which are pertinent to the traditions of 'values' research. Operational definitions specify entities or phenomena in definitive, explicit operations as measured or produced by a particular procedure, technique or instrument.

Problems of research interest are operationally characterized such that theory and fact are integrated for the sake of investigation. Whereas theory is a pillar of science, method is equally supportive of scientific goals. Adherence to scientific principles involves the determination of systematic procedures used in hypothesis testing. The procedural methods used to elicit the data, and the statistical methods employed to treat the data, are integral to the research outcomes. Such precision is vital to scientific principles of replication and validation, but is not always transferable to everyday application, which is more the realm of normative language that allows for idiosyncratic, rhetorical nuance. In the interests of clarity and precision, research results are interpreted according to the theoretical and knowledge backgrounds upon which the research was based. However, in the act of interpretation, the researcher relies on a mental model in which individual knowledge is organised and accessed. The act of interpretation grants results their ultimate meaning and phenomenological existence.

Language is the means through which ideas are expressed and communicated, and thus many research endeavours become investigations of meaning. The notion of 'values' provides a compelling example of an abstract mental representation that is also a theoretical and hypothetical construct of the social sciences. There are conventional, everyday understandings of 'values', and specialised philosophical notions of 'values', as well as social psychological understandings and operationalisations of 'values' as a theorised construct. The dominant application of the word 'values' appears to rest within an older, physical science culture of practice, where values are understood as indices of instrument readings[4]. In addition, in past and contemporary integrations of the cognitive and biophysical worlds, 'values' are considered as having quantitatively measurable existence within the environment. This latter understanding highlights the need for clarity in research and general communication, for studies linking 'values' and the environment are often conducted using constructs of values that differ from those of the social sciences, and yet many social scientists study environment-related 'values'.

Many environmental studies amalgamate the conventional and natural-science-based natural resource management challenges as well as people-related matters such as the presentation of, respect for, and interpretation of the environment. The development of a normative terminology regarding 'value', 'values', and 'valuation' in environmental discourse requires reflective understanding of the current state of affairs surrounding meanings and applications of these words by environmental professionals and the public. The application of terminology takes many forms, as speech, text, and individual thought, all of which are representative expressions of underlying meanings. Commonly occurring general and operational definitions specific to 'values' research are considered in the following review.

Defining and Operationalising 'Value' and 'Values'

Etymologically, *value* comes from the Old French, *valoir*, meaning 'to be worth', and from the Latin *valere,* 'to be strong', 'to be worth', hence, *value* as a

[4] A search using the Google Internet search engine for the word values without any reference to instrument readings revealed that only .39% of "hits" were without such reference.

singular noun often denotes price or worth. The study and consideration of *value* (singular) has a long and venerable tradition. The branch of philosophy devoted to axiological ethics focuses interest on the epistemology of value, with roots in Platonic and Aristotelian accounts of value. Philosophical concerns regarding value are threefold. Firstly, what are the properties or characteristics of what it means to *have value*? Secondly, can value be found in objects or is it imposed by the way people feel towards the object? Finally, what is the nature of the decision process regarding what *has value* or *is valuable*? (Honderich, 1995)

Spinoza (1677/1994), the seventeenth-century Dutch philosopher, asserted that the human tendency is to deem an object good, and therefore valuable, because it is desired, wished and strived for. The act of valuation creates the value. Spinoza also claimed that the converse of this (desiring, wishing and striving for anything because it is valued) does not occur. People might argue for the desirability of beauty due to its aesthetic value, but, if beauty is in the eye of the beholder, it is still the act of valuation that creates the value.

In the eighteenth century, Kant's moral philosophy (1785/1947) addressed intrinsic worth, or value which cannot be replaced by an equivalent and instead has a 'dignity', beyond market price or affective price. It does not have worth that is relative to any other, and is not measured by human want, need or preference, but is worthy unto itself. Hartmann's (1932) values doctrine[5], one of the major works in axiology, holds that "Values are not only independent of the things that are valuable (goods), but are actually their prerequisite…they are that through which things are valuable" (p. 186). Each person has a presupposed, a priori standard by which to decide if experience with goods is useful, serviceable, or advantageous (Hartmann).

[5] Hartmann's work is a synthesis of ancient and modern ethics, drawing on the foundational writings of Aristotle and the relatively new ideas of Kant and Nietzsche.

Whether it is possible for objects to possess value independent of conscious human evaluation is at the centre of a still-unresolved debate in the discipline of environmental ethics regarding intrinsic value. See, for example, Callicott (1995), Rolston (1994), Lee (1994) and Zimmerman (1995) for conflicting positions in this debate.

The history of the conceptualisation and measurement of ‘value’, ‘values’, and ‘value systems’ in the social sciences is briefer than axiological traditions, but consistently punctuated with similar concerns that also encompass human behaviour. The distinction between ‘value’ and ‘values’ is more complex than simple plurality; the two words at times signify distinctly different concepts. As a plural noun, the lexical form ‘values’ denotes a range of ideas, depending on the context of use. Major studies of values include Allport, Vernon and Lindzey’s (1960) *The Study of Values*, first published in 1931 and based on Spranger’s *Lebensformen* (Types of Men), published in 1913 (Teo, 2000). Other formative studies and scholarly articles about values in the fields of social anthropology, sociology and psychology form the basis for much of the later ‘values’ research (E.g. Becker, 1968; Dunlap & Van Liere, 1978; Fallding, 1965; Feather, 1973; Firth, 1953; Goldschmidt, 1953; Kluckhohn, 1967; Kluckhohn & Strodtbeck, 1961; McClintock, 1978; Rokeach, 1973; Schwartz & Bilsky, 1987).

Schwartz and Bilsky (1987) identified five common definitive features: “Values are (a) concepts or beliefs, (b) about desirable end states or behaviours, (c) that transcend specific situations, (d) guide selection or evaluation of behavior and events, and (e) are ordered by relative importance” (p. 551). Aligned with Schwartz and Bilsky’s observation, in psychological parlance, ‘value’ (singular), denotes a theoretical construct: “An abstract and general principle concerning the patterns of behavior within a culture or society which, through the process of socialization, the members of that society hold in high regard" (Reber & Reber, 2001, p.783).

Contrast the previous denotation with the primary definition (customary for psychology): "The quality or property of a thing that makes it useful, desired or esteemed. Note the pragmatic aspect implied by this definition: the value of a thing is given by its role in a (social) transaction; the thing itself does not possess value" (Reber & Reber, p.783). This primary sense of values, perceived as qualities or properties of things assigned as acts of valuation, is often implicit in current applications of the word 'values'.

Returning to environmental meanings of values pertaining to protected area and natural resource management (e.g. World Heritage values, environmental values), Reser and Bentrupperbäumer (2001) argue that in spite of these implied meanings, explicit references to values repeatedly feature attributes, elements, and processes of the ecosystem, with values located *in* the environment. While theorised notions of values can be specific to a research paradigm, even some common-use, dictionary meanings of values share elements in common with psychological theory. For example, 'beliefs', 'principles' and 'standards' (that contribute to behaviour*)* feature in a range of values denotations. Table 1 lists a selection of definitions from various sources (the first three from noted social scientists).

Although it is in no way a rigorous survey of all available definitions, the selection of definitions in Table 1 does illustrate the many elements shared among common-use and relatively specialised definitions. It is noteworthy that the definition in the relatively specialised Thesaurus of Psychological Index Terms is not essentially distinctive from more generalised sources, such as MSN Encarta and the Ultralingua Online Dictionary.

Table 1

A Selection of Definitions for Value and Values

Source	Definition
Rokeach (1973)	"A *value* is an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence" (p. 5).
Kluckhohn (1967)[a]	"Value may be defined as that aspect of motivation which is referable to standards, personal or cultural, that do not arise solely out of immediate tensions or immediate situation" [original in italics] (p. 425).
Schwartz (1994)	"I define *values* as desirable transsituational goals, varying in importance, that serve as guiding principles in the life of a person or other social entity" (p. 21).
Thesaurus Of Psychological Index Terms (2001)	*n. pl.* personal values – set of ideals that an individual deems worth-while and that influences his/her behavior *n. pl.* values – qualities, principles or behaviors considered to be morally or intrinsically valuable or desirable.
Cambridge Advanced Learner's Dictionary (2006)	*n. pl.* the beliefs people have about what is right and wrong and what is most important in life, which control their behaviour: *family/moral/traditional values*
Collins Cobuild English Language Dictionary (1987)	*n. pl.* the values of a person or group are the moral principles and beliefs that they think are important in life and that they tend to live their lives by
Msn Encarta (2006)	*n. pl.* principles or standards: the accepted principles or standards of an individual or a group
Oxford English Reference Dictionary (1996)	*n. pl.* one's principles or standards; one's judgement of what is valuable or important in life
Ultralingua Online Dictionary (2006)	*n. pl.* beliefs of a person or social group in which they have an emotional investment (either for or against something); "he has very conservative values."
The Macquarie Encyclopedic Dictionary (1990)[b]	*n.* that property of a thing because of which it is esteemed, desirable, or useful, or the degree of this property possessed; worth, merit or importance

Note. n. pl. denotes the noun plural form of the word; *n.* denotes the noun singular form

[a] Kluckhohn, an anthropologist, offered this as a definition suited to psychological purposes.

[b] A notable absence is a definition from the Macquarie Dictionary, the Australian standard dictionary reference. There was no noun plural listing for *values* in the *Macquarie Encyclopedic Dictionary*, where the emphasis of the singular sense meaning is on object properties, rather than human beliefs, principles, or standards.

The definitions in Table 1 focus on the sense that is closest to the psychological construct definition, and exclude other common definitions based on economic ideas of worth, or of values as numerical quantities. Kluckhohn's definition is of 'value', not 'values', and it also indicates a locus of value or values in motivations, not objects or events. In contrast, as noted earlier, many explicit references to environmental values feature ecosystem attributes, elements and processes (Reser & Bentrupperbäumer, 2001). Lay understandings of 'values' in generalised contexts are thus very likely aligned with beliefs, principles or standards, each of which feature in most primary definitions of values. It appears likely that public understandings of science are more closely aligned with social science than environmental science, at least concerning values.

The broad scale adoption of the values concept in social science disciplines including psychology, sociology, anthropology and political science, as well as economics, has led to the employment of a variety of related terms used to clarify connotative characteristics of values, and an array of techniques used to measure values.

'Values' as a Concept and Theorised Construct

Psychologists, among other social scientists, have long considered the 'values' concept to be difficult and ambiguous (Borgatta & Montgomery, 2000; Frankena, 1967; Williams, 1968). Fallding (1965) noted a persistent confusion in the study of values, stemming in part from a tendency to equate 'values' with 'things that are valued'. He advocated empirical classification as a means to better understand values: "Using an analogy of the neural network, but implying more than an analogical connection with it, …value is simply a conceptual system, … a way of making categories out of the varieties of satisfaction life offers" (Fallding, 1965, p.

228). Hechter (1992) found the values concept largely abandoned in social scientific discourse through falling into disfavour (at least in the areas of sociology, political science and anthropology), due in part to definitional inconsistency and inadequate theoretical specification. Rohan (2000) also noted definitional inconsistency in values theory and research particular to social science approaches, and suggested that 'values' be distinguished from 'ideologies' and 'world views'.

In the social and behavioural science domains, 'values' are deemed to exist at individual, social and cultural levels, and are considered influential in social action (Hitlin & Piliavin, 2004; Kluckhohn & Strodtbeck, 1961; Rohan, 2000; Rohan & Zanna, 2001; Seligman, Olson, & Zanna, 1993). Values linked to diverse social and cultural conditions are often compared according to social policy, individual experience, behaviour, and attitudes. Nevertheless, the systems used for determining different types of values are arguably mutually incommensurable. Schwartz (1994) recognised the prospect of incommensurability in his search (from a social psychology perspective) for universal characteristics of a 'values' construct. His participants were not forced to make direct comparisons of values expressing 'personal' goals against those expressing 'social' goals, for instance, as Schwartz considered that these goals lacked parity. His participants instead rated each goal separately according to its importance as a guiding principle in life, after first anchoring those ratings along a continuum from the most important goal to the least important goal. Thus, the method might be considered a mixture of a ranking and rating procedure in that the process of anchoring the extremes of the scale involves a global ranking of the items.

As another example, some values are measured according to their market worth, which is incommensurable with measurements of non-commodity values, measured via non-economic units (Steinhoff, 1980). Even among non-commodity values, commensurable measurement is not guaranteed. For instance, ‘aesthetic values’ are not measurable in the same units as ‘ecological values’ represented by species diversity, although some economists would reduce all measurement to monetary value. The contingent valuation method is a socio-economic attempt to measure those values with no market price per se. Values are elicited through a willingness to pay to maintain an ecological resource, for instance, or conversely a willingness to accept compensation for the loss of resources or services (Gregory, Lichtenstein, & Slovic, 1993/2005; Lampietti & Dixon, 1995; Lawrence, 2000; Mitchell & Carson, 1989; Sagoff, 1998). Although contingent valuation methods are widely used, and largely suit the specified purposes of their application, they are inappropriate measures of the meanings underlying stated preferences or opinions (Kahneman & Knetsch, 1992/2005), and cannot measure the conceptual characteristics of values (Tindall, 2001). Valuation in monetary terms is vastly different from personally held, moral values, for instance.

In a review on the current state of environmental values research, Dietz, Fitzgerald, and Shwom (2005) concentrated on the literature linking values to environmentalism, and echoed the common observation that the term, ‘values’, is used in incommensurate ways across research traditions. In another broad overview of ‘values’ research, Kalof and Satterfield (2005) compiled a collection of readings “devoted to helping define the meaning, representation and study of environmental values in the context of policy decisions about land management and conservation efforts” (p. xxi). Although the book goes some way to highlighting issues specific to these aims, with readings from authors based in economics, philosophy, anthropology, social ecology, and psychology, there is a bias towards sociological research traditions.

Admittedly, interest in 'values' is not confined to the social sciences. Reser and Bentrupperbäumer commented at length on misperceptions and misunderstandings characterizing multidisciplinary collaborations in the context of protected area management. An instance of an understanding that is divergent from many social scientists' ideas of 'values' concerns an environmental report about 'World Heritage values' in the Hinchinbrook area in Australia (Valentine, 1994). The report declared evidence of values that included elements such as complexity and diversity of life forms and ecosystem; uniqueness; aesthetic beauty; and dugong and turtle food resources. In this localised example it is clearly biophysical features and attributes that are being considered as 'values', but similar use of 'values' in a physical sense is widespread. Consider an example in the North American forestry context, where "values are often thought of as physical things in the woods" (Tindall, 2001, p. 58), instead of being accepted as cultural ideas or goals. Connotations of 'values' as physical entities do not sit well in light of the many studies purportedly measuring environmental values, with operational definitions based on the theorized psychological construct, and "understood as residing in people, not places or things" (Reser & Bentrupperbäumer, p. 41).

In contrast with such understandings, environmental, protected area discourse often centres on the need for protection, management and presentation of the values' biophysical reality. For environmental scientists the measurement of values might involve the recording and maintenance of species biodiversity and the minimisation of impacts on timber plantations. For management agencies, the protection and management of values is largely dependent upon how they are defined in government policies, and in the Wet Tropics region these stem from World Heritage listing. Conservation groups, on the other hand, focus predominantly on advocacy, campaigning, and community action. Group agendas determine group rhetoric in communication about issues of the environment, but, "while there are members of the public who try to speak for the environment, they have considerably less power than do environmental professionals at developing the language of nature" (Hull et al., 2003, p. 11). Moreover, there are emotive influences in communication between natural resource managers and users. Vining (1992) conducted a content analysis on written responses of resource managers, community organisations and an environmental organisation to a hypothetical problem. Resource managers showed fewer tendencies to preserve nature than the other groups, but they shared the public reverence for nature. However, the management workplace milieu appears to be such that emotional reactions are suppressed (Vining & Tyler, 1999).

In another example of research focussing on 'values' as public concern for nature, Vining and Tyler (1999) conducted a content analysis of written public comments on plans to manage the Hoosier National Forest, in Indiana. What sets their study apart is the inclusion into the picture of emotionality, as a "commonplace, necessary and functional characteristic of public involvement in issues of environmental concern" (p. 22). Forty-eight content categories, within eight meta-categories, organised the content of 4,832 letters. The eight meta-categories were *Values, Environmental values, Time, Negative consequences, Ethics/responsibility, Individual values, Social values*, and *Emotions*. A comparison of code category frequencies against qualitative analysis made it obvious that category frequencies are inadequate when searching for depth of meaning. Admittedly, between-group differences could hypothetically be observed through statistical analysis of response patterns, where differentiated values structures might emerge for different groups (Dietz et al., 2005). However, it is in the underlying, individual and collective conceptual systems of ‘values’ that true meaning lies.

Aspects of human values, worldviews and ideologies fit the three ‘cultural value types’ described by Leopold (1949). Firstly, ventured Leopold, value lies in experiences that point to people's origins, both national and evolutionary. The second locus of value is in experiences that reinforce the nature of the human place within the biotic food chain. Finally, value lies in experience wherein individual conscience dictates action, such as the restraint exercised under the collective guise of ‘sportsmanship’. Leopold consistently described cultural value as residing within lived experience, from the general to the personal.

Kluckhohn and Strodtbeck (1961) espoused a theory of variations in ‘value orientations’ to explain basic value systems, or human-constructed ways of life. According to value orientations theory, these principles occur in definite patterns of cultural existence through interaction between cognitive, affective and directive elements in the evaluative process. Proponents of the theory claim that all cultures express value orientations to varying degrees, depending on their specific need to order and direct their thoughts and behaviours. Cultural commonalities are summarised in five crucial problems from which five different orientations are drawn: Human nature, (Hu)man[6]-nature, Time, Activity, and Relational. Table 2 summarises the five common concerns and their respective ranges.

[6] In deference to contemporary conventions for inclusive language, I have replaced Kluckhohn and Strodtbeck’s original ‘man’ in the man-nature orientation with ‘human’.

Table 2

Kluckhohn's Five Value Orientations Common to all Human Groups

Orientation	Range of possible variations		
Human nature	Evil	Neutral	Good
Human-nature	Subjugation to nature	Harmony with nature	Mastery over nature
Time	Past	Present	Future
Activity	Being	Being-in-Becoming	Doing
Relational	Lineality (hierarchical order)	Collaterality (grouped organization)	Individualism

The 'human nature' orientation represents aspects of the character of innate human nature, whereas the 'human-nature' orientation represents the range of appropriate relationships between humans and nature. The third orientation, 'time', represents the temporal focus of human life. The modality of human activity is expressed in the range of the 'activity' orientation and, finally, the modality of human relationships is found in the range of the 'relational' orientation.

The value orientations system is one of many used in attempts to unravel the complexities of values. Steinhoff reviewed the literature in 1980 to identify systems used to classify and assess 'wildlife values', to determine the feasibility of a comprehensive conceptual system of values: "No such system yet exists partly because ideas have developed independently in several major disciplines, including economics, resource economics, sociology, psychology, philosophy, outdoor recreation, ecology, and wildlife biology" (p. 11). Putnam (1975) outlined an explanation of such a problem as the 'division of linguistic labour', where the associated criteria for some terms are known only to a subset of speakers. Use of the terms by other speakers requires structured cooperation with those whose world knowledge situates them within the knowledgeable subset. The desirability for such structured cooperation in understanding the conceptual complexity of the values construct, and for useful approaches to such understanding, remains relevant. Some measure of understanding is accessible through an exploration of the methodologies used to assess and measure 'values'.

Measuring 'Values'

The diversity in conceptual systems is reflected in the variety of assessments and measurement approaches. For 'wildlife values', for instance (although the same argument could be applied to other environmental values), measures can be separated into at least three types of assessment: economic, social/psychological, and ecological (Shaw & Zube, 1980). Each type of 'values' assessment originates from its associated discipline, but there is overlap in what each is measuring. Shaw and Zube explained the overlap:

> In the discussion of these papers, it became clear that these disciplines are not mutually exclusive in their ability to assess wildlife values. On the contrary, they might best be thought of as different measures or scales of the same human phenomenon. Thus, imbedded in a travel cost estimate of value of a wildlife-oriented experience (economic scale) is the reality that people exhibit this behavior because they have attitudes and beliefs or derive satisfactons [*sic*] (socio-psychological scales) from the activity. Furthermore, one of the reasons that they have these values may be that they understand the biological significance (ecological measure) of the wildlife resource or its habitat. (p. 6)

Economic, socio-psychological, and ecological measures of values are all relevant to studies in the Wet Tropics World Heritage Area, which is listed on the World Heritage register for its outstanding universal significance. For example, desiring satisfaction through environmentally-friendly behaviours might build upon one's sense of self-worth, contingent upon the success or failure to carry out the desired behaviours (Crocker & Wolfe, 2001). Measurement methods and procedures for studying values are numerous. Albeit their important status as powerful and enduring determinants of attitudinal and behavioural decisions, values are nevertheless intangible and must therefore be assessed by relatively subjective means. It is the psychometric tradition, and a convention in psychology, to develop procedures for constructing psychological ‘yardsticks’ by which to quantify and measure human perceptions and judgements about both internal, intrapsychic, and external stimulus objects.

The choice of a measurement method, or methods, depends on the operational definition of ‘values’ designated by the researcher, and the theoretical and conceptual foundations upon which the research is based. In social and behavioural science research, surveys are popular for several reasons. The survey is a relatively easy method by which to gather a lot of material, and a large sample can be accessed. Common operational survey procedures include ranking, as practiced by Rokeach in his Value Survey (1973), or anchored rating, as used by Schwartz in his search for a universal values structure (Schwartz & Bilsky, 1987; Schwartz, 1992, 1994). Another survey method involves content analysis of open questions, to identify common themes in the responses. Less commonly employed in values research is the concept mapping methodology, whereby the concept system surrounding ‘values’ can be identified and mapped. Much of the ‘values’ research in the social and behavioural sciences, as well as in forestry research into non-commodity values, is based on variations of the ranking and rating methods. Neither is without problems (Alwin & Krosnick, 1985; Braithwaite, 1994; Feather, 1973; Ovadia, 2004; Rohan, 2000), but each method also has its merits.

Ranking

The Rokeach Value Survey (Rokeach, 1967, 1973) employs value rankings to measure 18 instrumental values (desirable modes of conduct) and 18 terminal values (desirable end-states of existence). Individuals rank the alphabetically listed values in their order of importance as guiding principles in life. Rokeach (1973) justified the use of the ranking method by claiming that it is a relatively simple way to ascertain the psychological significance of a particular value for each individual.

By ranking these series of values according to importance, an individual forms a unique and personalised set of value priorities. Rokeach reasoned that the ability to validate one's personal values is achieved through complex cognitive processes that develop as a function of experience and maturation. Rokeach did not set out with a theory of value types in mind; the Values Survey is a list of words located in the values literature and reduced through statistical analyses (Rohan, 2000). The prioritised relationships between items are thus difficult to interpret within a larger system of values (Rohan, 2000; Schwartz, 1994).

Ranking found disfavour with other researchers due to the difficulty in ranking large numbers of items. Rokeach noted this drawback and developed his gummed-label technique[7] to facilitate the ease of the task for participants; even so, the two sets of 18 values are considered the maximum number of items that should be used (Feather, 1973; Rokeach, 1973). Furthermore, ranking is difficult to use in collaborative studies where individual researchers desire to add their own items, as adding items interferes with comparability between studies. A third problem with ranking, as used in the Values Survey, is that participants are forced to overstate differences between items, as distances between items are assumed to be constant, but participants might feel that items are either very similar, or tied.

Ranking is an advantage if one adopts Rokeach's assumption that values inherently involve choice, in that they guide the selection or evaluation of behaviour. It is nevertheless improbable that ranking is the most appropriate task to represent a values 'system', or is reflective of how values are realistically compared (Alwin &

[7] The gummed-label technique allows participants to readily modify rankings as they progress through the task, and movement of the labels provides a constant visual picture of the ordering. A ranking procedure where numerical rankings are written beside items does not afford the same visualisation.

Krosnick, 1985; Ovadia, 2004). Values Survey participants in fact reported experiencing difficulty with the task, and were not confident in having completed it reliably. Furthermore, while ranking ostensibly requires concentration, participants felt they had performed the ranking randomly (Rokeach, 1973).

Rating

Schwartz (1994) preferred the rating method for methodological and conceptual reasons. Schwartz's respondents rate each value on a nine-point scale ranging from 7 (supreme importance) to -1 (opposed to my values). In an anchored rating procedure, respondents first anchor their responses by reading through the list and choosing the one value most important to them and the one value least important to them, or to which they are most opposed. The inclusion of the -1 option allows respondents to indicate either the value they consider least important or to which they are most opposed. Indicating a value that is least important does not preclude the assumption that the value is important to all people – that is, universal, as Schwartz proposed his list of values are – it is just important to varying degrees, or in the way those values are prioritised. Schwartz's proposed value orientation system is a two-dimensional, circular structure, with opposing values aligned along each of the bipolar dimensions and compatible values following a continuum around the circumference. Schwartz applied a number of measurement techniques, but his anchored rating technique was the most commonly used in the study of the values system structure.

Schwartz considered rating superior to ranking for three reasons. Firstly, the large number of values (56 in his core survey) would have made ranking difficult. Secondly, other researchers could add other values without interfering with comparisons between individual item ratings in different samples. Finally, negative values could be measured, as values considered desirable in one culture might be rejected in another. Schwartz considered rating to be phenomenologically superior to ranking, as it more closely corresponds to the way that people naturally make decisions about values. Instead of the relatively close concentration to the task required for ranking, rating requires only loose concentration to the task, as each item is considered independently once the anchor items are identified.

Such an argument finds support in the work of Maio and Olson (1998), who advanced the idea that 'values' are widely shared beliefs that are rarely questioned. Because people agree strongly with the beliefs, they do not spend time in constructing supportive arguments for them. When Maio and Olson asked individuals to analyse the reasoning behind particular values, ratings for those values changed, but the task of rating arguably does not require such a high level of reasoning awareness. In contrast, ranking requires constant revision of the listed values in order to prioritise them.

In rating, the benefit gained through ease of completion is balanced by a loss of precision (Alwin & Krosnick, 1985; Feather, 1973; Ovadia, 2004). Participants might be less willing to indicate extreme ratings if there is no need to consider items in relation to other items. Consequently, one of the drawbacks of the rating method is that it produces relatively uniform responses, as most scale ranges are restricted enough that they invite non-differentiation between highest and lowest scores, and responses are often clustered within a narrow subset of scores. Moreover, scales have potential for inconsistencies, as they are often specified as equal interval for the purposes of analysis, while in reality equal intervals on most conventional rating scales cannot be ensured. This argument notwithstanding, the assumption of equal intervals is widely accepted in the social sciences, provided departures from intervalness are moderate (Jaccard & Wan, 1996). Many scales do, in fact, approximate interval level characteristics.

The decision to use either ranking or rating to measure ‘values’ depends on which characteristic feature of values is of interest. In a comparative study of the two procedures, Alwin and Krosnick (1985) reported similar results for both in ordering items according to relative importance, but differences between the two in the latent structure of the values. Ranking produced a single bipolar factor whereas rating produced two separate factors. Ovadia (2004) suggests that the ranking technique is probably suitable if one assumes a hierarchical, rank-ordered values system, whereas the rating technique is more suited to an assumption that individual items within a values system are independent of one another. It is important to recognize that, here, a ‘hierarchical system’ refers to results of ranked tasks, where values are aligned along a single bipolar dimension ranging from most important to least important. More complex hierarchical models have certainly been proposed – Nordlund and Garvill (2002), for instance, proposed a hierarchical model of the effects of general values, environmental values, problem awareness and personal norms on proenvironmental behaviour – but this point relates directly to ranking.

To go further, if one adheres to the idea of meaning as a concept, and assumes that a values system exists as an interactive network of concepts, it appears that neither the ranking nor the rating technique constitutes a particularly suitable approach or measure. Traditional knowledge-elicitation techniques including interviews and self-reports are commonly subject to bias and error in addition to lengthy time requirements for transcription and manual analysis (Rugg, Corbridge, Major, Burton, & Shadbolt, 1992). There are, of course, less reactive methods that also have greater linguistic relevance to the exploration of natural language uses and meanings in applied contexts. Alternative techniques including various sorting procedures have increasingly found favour due to advantages such as ease of automation, and because they were found to be at least as productive, or more productive, than interviews and self-reports (Cooke, 1999; Rugg et al., 1992; Rugg & McGeorge, 1997). In a combination of listing and sorting, one of these methods is the concept mapping technique (Rosenberg & Kim, 1975; Trochim, 1989a, 1989b; Trochim & Linton, 1986), incorporating brainstorming and multidimensional sorting elements.

The concept mapping technique has the dual advantages that knowledge is both elicited and represented empirically, and is based on psychological theories of knowledge representation and categorisation (Cooke, 1999). Applications of the sorting technique include the study of human dimensions of social learning in natural resource management (Pahl-Wostl & Hare, 2004) and the study of managerial cognitions and belief structures (Budhwar, 2000). Difference in expert and novice knowledge is another focus for study using sorting techniques. For example, Chi, Feltovich and Glaser (1981) noted that experts in physics categorised their knowledge at a deeper level in contrast to the surface level categorisation of knowledge used by novices. Such applications acknowledge the importance of knowledge content and structure, as well as the specifics of the context within which knowledge is elicited. A second alternative is text analysis.

Concept Mapping

A concept map is an objective representation of a structured conceptual system, the content and structure of which is determined by a group of people. Ideas are visually represented in a mapped ‘conceptual space’ according to their interrelationships, statistically determined by nearness or distance within the space.

Concept mapping offers a relatively unconstrained methodological approach towards understanding the latent organisation of semantic characteristics within the conceptual space of a values system. Rather than imposing a set of pre-ordained items for participants to evaluate through a ranking or rating process, the concept mapping procedures allow participants to be active in listing conceptual elements, and sorting them into categories.

Meaning is conceptual in nature, and concepts are understood here as described by Cruse (2004): "organised bundles of stored knowledge which represent an articulation of events, entities, situations, and so on in our experience" (p. 125). The mental organisation of concepts and natural languages into categories is a well-researched phenomenon, found in Rosch's (1973) work in the seventies, followed by the work of Medin and others (e.g. Medin, Goldstone, & Gentner, 1993; Medin & Ross, 1996; Medin & Schaffer, 1978). Knowledge of the world is stored categorically according to experiences that determine individual ontology learning. Shared experiences that help in the formation of shared categories are essential for human communication (Cruse, 2004). In Putnam's (1975) terms, this distinction is akin to the relationship between individuals' concepts, as intension, and socially determined concepts, as extension. Once formed, concepts provide access to categorical information about related entities.

The sorting method draws on the cognitive processes of categorisation, in such a way that each item is not submitted to the exhaustive inspection necessary for item ranking or paired similarity judgements. Items need only be sorted together as clusters that belong together in some designated way. An advantage is that any of the underlying psychological dimensions that subjects use to sort items into categories are completely free from contamination by the researcher (Rosenberg & Kim, 1975), and will not necessarily even be identified by the subjects.

The combination of brainstorming and sorting procedures involved in concept mapping can be readily supplemented with a rating task, and offers an effective, psychologically real measure of an underlying conceptual system. Nuances of difference in understandings between groups emerge through multidimensional scaling and clustering analyses, and the low-dimensional maps provide an overview of complex systems.

Text analysis

Although the concept mapping technique has not been previously applied to the study of 'values', Schwartz produced a similarly mapped representation of what he considered a universal system of values as motivations. A values system more specifically aligned with environmental values is Kellert's biophilia typology. Kellert used content analysis of open-ended survey questions to form items used in studies of people's perceptions of and attitudes towards wildlife. Many social scientists and other researchers working in the field of natural resources use computer-aided text analysis in their research, often involving open-ended survey questions, or unstructured interviews (Bengston, 2000).

Text analysis is a second, linguistically relevant alternative to the more explicit ranking and rating techniques, and is a commonly used method for studying naturally occurring language, with written word examples including survey responses, emails, Internet discussions, or other media. Hermeneutic analysis (the study of meaning within texts) had its origins in the meanings of scriptural and sacred texts, but has extended its reach to the meanings in more ordinary texts, including newspapers and academic journals. Vining and Tyler's (1999) analysis of written public comments on forest management plans and projects covering a six year period is an example of content analysis applied to values research. Expressions of values and emotions were sought for and found within the text sample as a mixture of spiritual reverence, positive and negative affect, beliefs, desires, concerns, perceptions, and moral elements.

The production of texts for a specific purpose, albeit for communication across a broad spectrum of knowledge realms, is both commonplace and unique to each situation. Content analysis is unobtrusive, in that the text is already available, and efficient, in that computer-aided techniques allow for increasingly sophisticated analyses (Krippendorf, 2004). Some of the criticisms of content analysis are specific to qualitative approaches that are interpretive, rather than objective, although even objective approaches are necessarily interpretive to some degree (Antaki, Billig, Edwards, & Potter, 2006; Eco, Rorty, Culler, & Brooke-Rose, 1992; Smythe, 1992).

The use of content analysis to define and organise pre-existing conceptual categories within text is a subjective measure that has been criticised for lacking inter-rater reliability (Litkowski, 1996). Such a problem can be mitigated via the use of dictionaries prepared through review and refinement by specialists within their areas of expertise (e.g. Bengston & Xu, 1995, used this approach), or simply reporting inter-coder reliability coefficients. The problem can be avoided altogether with the use of quantitative, statistical association approaches. This type of relational content analysis is a search for meaningful relationships between identified target (key) words in context (Carley & Palmquist, 1992; Hogenraad, McKenzie, & Péladeau, 2003).

Relational analysis has a predominant focus on meaning in context, which involves the identification of 'keywords'[8] within their naturally occurring context, and the relationships between them (e.g. how frequently they occur together in close proximity). Naturally occurring applications of keywords such as 'values' can be explored comprehensively using text analysis, and the method is useful for revealing lexical relationships between words. These lexical relationships indicate semantic relationships between words, and can offer insights into group differences and commonalities in lexical function and meaning. While conceptual analysis is possible via text analysis, such an approach is not the best way to access and explore the conceptual domains of values, and concept mapping is offered as a more appropriate approach.

Methodologies and Measurements Suited to a Study of Language Use and Meaning

Measures employed in values research have not always followed a reflective approach to language and meaning. Particularly when moving outside the social science realm, meanings assigned to 'values' do not always adhere to the theoretical and conceptual underpinnings of scientific research. Environmental scientists practising 'hard' science inevitably also have pre-conceived meaning domains which they call upon in discussing environmental values, as do members of the public, not all of whom will fully understand ideas communicated by scientists (Bentrupperbäumer & Reser, 2000; Carolan, 2006; Christidou, Dimopoulos, & Koulaidis, 2004; Pardo & Calvo, 2004). Lay understandings and applications are also influential, and specialists bring their own lay understandings and language into their respective specialist domains. The resulting assemblage of ideas, concepts, and social representations does not necessarily form a unified whole, with individuals free to

[8] The term 'keyword' comes from computer technologies whereby search statements are constructed using keywords or phrases that are significant to the topic content, and used to find information.

exercise what Locke (1689/1975) described as that "inviolable liberty to make words stand for what ideas he [or she] pleases" (p. 491).

It is for reasons such as these that the measurement of 'values' must be considered secondary to the conceptual issue and, as a part of this, the structural issue. Furthermore, the complexity and multidimensionality of the values concept must be considered in any attempt to access applications and meanings of 'values' (Gregory et al., 1993/2005; Kuntz, 1970; Steinhoff, 1980), and the multidimensionality of any values conceptual system is grounded firmly in language and meaning. It is thus language and meaning that must be investigated, initially and foundationally, in the study of 'values'.

Miller (1971) discussed four general empirical methods used to investigate similarities among semantic 'atoms'. The first of the four methods is *scaling*, which requires a matrix of similarity scores for estimates of magnitude. The second method, *association*, involves spontaneous responses to auditory or visual word stimuli. The *substitution* method, using distributional similarity or co-occurrence, is now commonly used for text and data mining applications. Finally, *classification* is based on categorical judgements according to similarity of meaning. Miller advocated the classification method as the best for probing the structure of the subjective lexicon.

Text analysis relying on distributional co-occurrence and concept mapping employing the tenets of classification are the methods selected as being most suited to the aims and purposes of this thesis. Clear advantages of these techniques, particularly in an exploratory study, include their indirectness, validity, and the stability of their outcomes (Cooke, 1994; Rugg et al., 1992). However, it is first necessary to understand something about the elements involved in understanding, and to more closely consider some of the theories of mental representation.

Meanings, like ‘values’, are abstract entities, and the nature of meaning as fundamental to all communication also warrants detailed consideration.

3. Past Theory, Measurement and Meanings

What makes relations problematic, and also exchanges between individuals and groups, is the circulation of representations which nevertheless co-exist in the same public space. Existence in common proves to be impossible if this margin of uncertainty persists and becomes important. In that case the members of a group risk remaining as strange in familiar conversations as if they belonged to different groups.[9]

Comprehension of words, sentences, and discourse could not be simply a matter of applying linguistic knowledge. Every act of comprehension involves one's knowledge of the world as well.[10]

Introduction

Mutual understanding in lexical and conceptual domains is partially dependent on underlying differences between individuals or groups in the dynamic construction of meaning. The social construction of meaning combines knowledge of language and the world (Berger & Luckmann, 1966; Carugati, 1990; Semin & Gergen, 1990), but there are also psychological processes involved in the acquisition and development of meaning (Anderson, 1990; Johnson-Laird, 1987). Consequent to the research aim of documenting the linguistic uses and meanings of the term and expression 'values' in a specific real world context, it is necessary to establish the nature of meaning being discussed, as 'meaning' is another multidimensional and complex concept that can be understood in many ways. It is also necessary to highlight the problems that might be encountered when trying to measure meaning.

[9] In describing the nature and role of social representations in communication, Moscovici (1998) explained how social representations reduce the 'vague' by providing people with a commonly accessible repertoire of ideas and interpretations.
[10] In their research on the role of knowledge structures in language comprehension, Anderson, Reynolds, Schallert and Goetz (1977, p. 369) adopted Immanuel Kant's use of the term *schemata* as the links between conceptual understanding and empirical intuitions.

This chapter outlines the nature of meaning and the role of background knowledge in the development of meaning, with information drawn largely from psycholinguistic and communication theories, which together provide a basis for the exploration of meaning as use, via text analysis.

The Nature of Meaning

In this study, meaning is considered from cognitive and social constructionist perspectives acknowledging that, while true meaning inheres in the mind of the individual, meanings can be approximated for a chosen purpose. A reasonable and psychologically infused perspective is the pragmatic view that meanings exist in the purposive applications of language—each individual is involved in the construction of meaning and differentiation through a social history of experience with concepts and their categorical relationships (Aiello & Bonaiuto, 2003; Anderson et al., 1977; Bower, Black, & Turner, 1979; Carugati, 1990; Cohen & Murphy, 1984; Gergen, 1998; Lee, 2003). This idea of an individual's concept is aligned with Putnam's (1975) 'intension', while the approximations are the socially determined 'extensions', which are very clearly not fixed in any one person. While the idea of constructed meaning is not contentious, and is agreed upon by some of the prominent theorists (e.g. Anderson, 1990; Johnson-Laird, 1987; Putnam, 1975), there are nuances of difference in their understandings of what meaning is. For the sake of clarity, this thesis adopts Anderson's (1990) terminology for aspects of word meanings such as sense, reference, denotation and connotation. Specifically, 'sense' is a specific reference, 'reference' is situational, particular to an occasion of use, 'connotation' is non-specific reference, and 'denotation' is general reference.

In essence, however, meaning is a concept (an intellectual creation), and the idea of meaning only makes sense when considered in a context (i.e. relative to other meanings). Nevertheless, the intensional aspect of meaning is not assumed to inhere *in* texts or speech but *is* a priori its expression. This assumption is aligned with Wittgenstein's (1923/1974) meaning-as-use theory, and with Saussure (1983), who considered the nature and role of language in the meaning structure as purely a social phenomenon. A more cognitively aligned but nevertheless complementary explanation of meaning is that general knowledge about the world is stored in memory, and relatively permanent memories are stored and categorised with meaning as their basis.

The nature of theorised mental structures in which memory is stored is dependent upon the semantic theory to which an individual ascribes. Schemas (Anderson et al., 1977), scripts (Schank, 1980), and semantic networks (Rumelhart & Ortony, 1977) are examples of theorised structures used to explain the underpinnings of meaning access, storage and retrieval. Bridging the divide between the mental and physical worlds, Hardy (1997) argued that attention should be paid to the active role that meaning plays in the organizing process whereby the mind shapes (and is in turn shaped by) reality:

> Attributing meaning is omnipresent in any mental process—from the most complex conceptual abstractions to the most basic category recognition. But we can easily see that attributing meaning also has real effects on the external world; while giving a new meaning to an object, we modify the way we perceive its form and use, and adapt our behavior accordingly….Let us take another example: the status of trees of the same type, in three different cultures. In an animist culture, it is a tree/spirit, feared, worshipped, and protected. In another, it is simply a useful source of fire-wood: the tree/fire-wood is just functional, and is neglected, exploited and harmed. In still another culture or epoch, the tree regains some of its "specialness", being valued for its beauty and ecological import. This tree/nature-art is attended to, protected, perceived aesthetically in a whole landscape. By the very nature of the diverse meanings projected onto the three trees, human beings will interact with them in different ways; hence, the trees' existence will be different. In a dynamic, evolving culture, conceptual developments are thus perceptible through the constant shifts in meaning-encoded objects and surroundings. In other words, conscious beings and their environment are participating in a circular dynamic of constant

> semantic interaction, thus shaping and modifying the consensual reality. (pp. 163-164)

Hardy’s explanation of the interactive and dynamic relationship between meaning and object integrates the cognitive processes with the social and cultural processes involved in the construction and communication of meaning. Rather than one homogenous idea of tree as an object referent, tree exists as a concept that is differentially understood in the three separate cultures dependent upon cultural existence. Although true meaning can only be surmised, humans are able to communicate using complex, abstract ideas due to shared knowledge, language and experience. We can understand the status awarded to trees in the three separate ways without bonding with or immersing ourselves in the respective cultures, albeit that fully equivalent understanding is merely assumed, as my understanding might be subtly different from yours. Conventionally agreed-upon meanings, based on knowledge and experience, are representable insofar as different types of definitions are representative of meaning to varying degrees. Nevertheless, meanings are not always easy to define.

Connotative Meaning

Connotative (representational, emotive) meaning is the internal relationship that a word has with either a mental representation of the ‘thing’ it refers to (Cruse), or to other words in the language (Honderich, 1995). For example, one sense of *tree* is understood by its relations to *shrub* (different from), *plant* (a type of), and *root* (possesses). Hardy described some of the other senses by which trees might be understood. For example, *tree* can be understood for its function, its symbolism, or its aesthetics. Connotation is also known as emotive meaning, due to the emotional associations that a word can express and evoke. Symbolic and aesthetic meaning associations are emotionally valenced, with either positive or negative connotations.

Idiosyncratic interpretations are prone to influence from previous experience and held beliefs, so that a word or phrase might have positive or negative connotative meaning for any number of individuals (consider a *family tree*, for instance, or the *tree of life*). Presence of a word can thus produce both connotative and denotative meaning.

Connotative meaning, as defined and measured using the semantic differential technique (Osgood, Suci, & Tannenbaum, 1957), is a psychological “process or state in the behavior of a sign-using organism which is assumed to be a necessary consequence of the reception of sign-stimuli and a necessary antecedent for the production of sign-processes” (p. 9). In plainer words, the sense of ‘meaning’ adopted by Osgood et al. depends on an individual’s learning, based on experience. The meaning an individual attaches to a concept - for instance, TREE - depends on the learned association from a history of experience with trees. Such experience is completely idiosyncratic and dependent upon the particular mediational processes or the internal state evinced by a particular concept: “Words represent things because they produce some replica of the actual behavior toward these things, as a mediation process” (Osgood, 1952, p. 204). The words used in the semantic differential task are bipolar adjective pairs that purportedly represent semantic dimensions such as evaluation, activity and potency.

As a combination of associational and scaling procedures, the semantic differential technique represents the meaning of any chosen concept by positioning the concept in a semantic space that consists of the nominally opposite adjective pairs. For example, bipolar adjectives in seven-step scales represent *evaluation* as good/bad and ugly/beautiful, *activity* as slow/fast and static/dynamic, and *potency* as small/large and weak/strong (Osgood et al., 1957). Such scales are used to measure concepts, which are then plotted according to positions within the semantic space. Concepts used in semantic differential tasks consist either of real stimuli (e.g. paintings, colours, sounds), or noun representations of stimuli (e.g. MY MOOD TODAY, SIN, BOULDER, LAKE).

The semantic differential technique is widely recognised in the literature, with a flourish of studies in the nineteen fifties and sixties led by Osgood and others (e.g. Allison, 1963; Baxter, 1961; Jenkins, Russell, & Suci, 1959; Kahneman, 1963; Manis, 1959; Mordkoff, 1963; Norman, 1959; Osgood, 1952; Staats & Staats, 1969; Suci, 1960). The technique offered diverse applications, from those with a cross-cultural focus to developmental, clinical, personality, aesthetics, and communication research (Snider & Osgood, 1969). However, the methodological assumptions of the semantic differential were not universally accepted (Carroll, 1959). For example, some of the scales are asymmetrical and thus not functionally antonymous (Mordkoff, 1963), and it is possible that the dimensions purportedly found to be inherent in the stimuli are in fact dimensions of the series of adjectival scales (Carroll, 1959).

Moreover, the technique at best measures only affective meaning, a limitation acknowledged by Osgood (1952):

> Our method can be criticized on the ground that it only gets at connotative meaning, not denotative meaning. This is a limitation. Both SIMON LEGREE and WAR might be allocated to approximately the same point in semantic space by our method. This would indicate similar connotative meaning, to be sure, but it would not indicate that these signs refer to the same object. Our differential will draw out the *hard, heavy, cold, ugly, threatening* connotations of the sign HAMMER, but it will not indicate that HAMMER is “an instrument for driving nails, beating metals, and the like, consisting of a head, usually of steel, fixed crosswise to a handle” (Webster’s *Collegiate Dictionary*). In part, this limitation stems from our method of selecting descriptive scales in terms of frequency of usage rather than in terms of a logically exhaustive coverage, as given in Roget’s *Thesaurus*, for example. (p. 231)

Although Staats and Staats (1969) demonstrated that the semantic differential does possess validity insofar as it measures semantic generalisation, affective meaning is but one characteristic of connotative meaning and there are other characteristics of meaning, such as perceptual-cognitive and pragmatic meaning, that the semantic differential technique does not measure.

Denotative Meaning

In contrast to connotative expressions of meaning, more conventionalised definitions offer denotative (referential, cognitive) meaning, as words have both internal and external relationships with the world. A word's denotation is an external relationship, where the word *tree*, for instance, has physical referents as individual trees (Cruse, 2004). *Tree* can also refer to a class of trees, which all possess a set of attributes that constitute *treeness*: perennial, self-supporting, and woody.

For everyday purposes, denotations as socially determined definitions offer the means to delimit meaning boundaries, and are commonly collated as dictionaries. For scientific purposes, where precision is desirable, several definitional procedures are considered suitable (Reber & Reber, 2001). A *nominal definition* is the most basic, and consists merely of assigning a name to a set of observations or events. A *formal definition* (e.g. taxonomy) specifies features and characteristics in common to all members of a class, category, or set that distinguish them from another class, category or set. An *enumerative definition* simply lists all members of a class, which is a limiting feature of this type of definition. Meaning is clarified through enumerative definition only when the list of members is brief. While these types of definition serve their purpose, the *operational definition* is the most influential in psychological research, amidst argument for and against the continued relevance of its use (Grace, 2001; Green, 1992; Hibberd, 2001; Koch, 1992).

Operationism.

The dominance of operational definitions in psychological research comes from the benefits deriving from their objectivity and precision. Abstract concepts such as HAPPINESS or LOVE, or hypothetical constructs such as INTELLIGENCE or AGGRESSION, can be operationally defined based on the set of concrete operations used in their measurement. Additionally, operational definitions have heuristic value, and are a useful foundation for studying unknowns, provided they are not mistaken for the ideals they represent (Putnam, 1975). Although the benefits of operation definitions are many, there is a danger in undue reliance on what they are deemed to represent.

Although many of the critical terms and underlying constructs used in psychological research are abstract and must be operationally defined, the measures used do not necessarily capture the deeper meanings that many abstract concepts or constructs contain (Green, 1992). The fact that TIME, for instance, can be measured by the protracted unwinding of a spring, or the progression of regular changes in phenomena, and that it can be measured with reliable accuracy, goes only some small way to explaining what time *is*. Gergen (1998), from his social constructionist perspective, stated the matter thus: “Psychological accounts are rhetorically fashioned, essentially creating their subject matter” (p. 184).[11]

Operationism opens the door to belief in direct, unmediated relationships between words (or the constructs they represent) and things, a positivist stance no longer considered tenable (Carolan, 2006; Stam, 1992). Another concern underlying an undue reliance on operationism is that, although a theoretical construct can be defined by any number of different operations, it does not follow that each operation

[11] Incidentally, there is also some argument that psychologists’ reliance on statistical methods in many instances replaces the foundation of research upon theoretical grounds (Essex & Smythe, 1999).

is measuring the same construct. Arguments regarding this issue range from the assertion that it is never safe to assume equivalence of any two operations, to the assertion that different operations can define the same construct as long as operations are equivalent, or result in the same response (Green, 1992). The latter assertion is also unsafe.

Although they are in some ways at odds, operationism and social constructionism are nevertheless similar in that each relies on a specific operation or a specific context of use to define meaning. Psychologists relying on the principles of operationism and social constructionists opposing its use would nevertheless agree that a construct's meanings reside in its various expressions, rather than in the characteristics of the phenomenon being studied (Berger & Luckmann, 1966; Hibberd, 2001; Reser & Bentrupperbäumer, 2001). It must be acknowledged that the operationism undergirding modern scientific paradigms and discourses does blatantly tip the scales toward a natural-science-based, measurable universe of manifest dimensions and parameters. Such bias marginalizes domains of meanings and experience that are inherently less amenable to operationalization.

Complete reliance on or belief in operational definitions as being representative of real meanings is also problematic if the results they evince are taken as authoritative proof: "To achieve truth is to claim superiority over (and thus to marginalize) all competing forms of discourse" (Gergen, 1998, p. 154). If scientists (or those who rely on science to help form management initiatives and policy) are regarded as experts who know more than the public, it is likely that the public will yield to their authority. This leaves scientists in a position of responsibility to communicate ideas clearly while remaining cognizant of how their ideas might be interpreted by others who are unaware of the nature of their theorised, hypothetical notions (Reser & Bentrupperbäumer, 2001). Conversely, those in authority also need to consider how they might misconstrue public concerns and desires expressed as public comment (Vining & Tyler, 1999).

No fully adequate alternative to operationism has emerged, and the current author had adopted Green's (1992) suggestion to use "a combination of empirical and intellectual weaponry" (p. 316), which is the basis for any research endeavour..

The Development of Background Knowledge

Developing knowledge of word meanings is a largely cognitive task that the human mind can do with relative ease. Word meanings can be acquired either by being told what a word means, or by encountering the word in a linguistic context (Johnson-Laird, 1987). Even though some words are not readily definable, or easily placed in a context (Schwanenflugel, Harnishfeger, & Stowe, 1988), most words can be widely understood given enough context (McDonald & Shillcock, 2001; Taft, 1991)[12]. A general consensus in psychology is that associative habits develop and increase in strength consequent to their frequency of occurrence, and a general assumption stemming from this notion is that meanings are associative habits (Miller & Charles, 1991). There is evidence, however, that information processing in text reading and comprehension is reliant upon central concepts, which are readily maintained while reading and are accessed quickly (Mo, Chen, Li, Chen, & He, 2007). These concepts, or mental representations, are constructed from two integrated sources of information: background text information (knowledge of language) and world knowledge (knowledge of the world) (Mo et al., 2007).

Studies in vocabulary instruction and acquisition have shown that children learn word meanings incrementally (and incidentally), through repeated exposures to

[12] See Taft for a comprehensive review of word recognition studies, some findings from which suggest that a sufficiently predictive context negates the need for exposure to the target word.

words in similar or different contexts during normal reading and listening activities (Nagy, Herman, & Anderson, 1985). Learning of word meanings occurs even for low-frequency words that are less likely to be encountered very often, and partial meaning can be evinced from even a single exposure (Nagy, Anderson, & Herman, 1987). On a less positive note, Schatz and Baldwin (1986) argued that interpretations of low-frequency word meanings are often wrong, and subjects have often only been able to acquire meanings because studies have used contrived passages rather than naturally occurring prose. Indeed, Nagy, Herman and Anderson (1987) hold that complete learning of word meaning usually occurs over many years during which the word is encountered many times and in many contexts (presumably due to the progressive integration of linguistic and world knowledge). Comprehension of a text comes from the ability of the reader to apply his or her own background knowledge to understanding the text. Schatz and Baldwin's concern about incorrect interpretations are partially justified, but do not give enough credit to the role that background knowledge plays in meaning acquisition.

In fact, prolonged exposure to a specialised vocabulary can account for substantial bias towards one meaning or a selected set of meanings for a polysemous word. For instance, Foley and MacMillan (1943) demonstrated the influence of occupational status on associations to ambiguous words, and noted that at least one dimension of verbal association is established partly due to professional training. More recent studies (Chiesi, Spilich, & Voss, 1979; Means & Voss, 1985; Tanaka & Taylor, 1991) are supportive of claims that knowledge structures differ between experts and novices. Semantic network theories and social representations theory offer valid explanations of how knowledge is acquired and stored, and they are critically discussed in the following review.

Semantic Network Theories

Semantic network theories focus on relationships between concept 'nodes' and the 'links' between them, corresponding to word meanings. Semantic networks are representations of the conceptual spaces within which semantic word meanings operate and are stored (Collins & Loftus, 1975; Collins & Quillian, 1969). A semantic network represents concept meaning as the network in its entirety, due to the interactive nature of networks. Bi-directional relational links that are either inhibitive or facilitative link each concept node to other nodes. These include super-ordinate and subordinate links (e.g. FRUIT > APPLE > GRANNY SMITH APPLE), modifier links (e.g. *RED* APPLE, *GREEN* APPLE), disjunctive sets of links (e.g. APPLE *or* PEAR *or* BANANA), conjunctive sets of links (FRUIT *and* RED *and* HARD) and a set of links specifying relationships when the relationship itself is a concept (see Collins & Loftus, 1975).

An important point about the different types of links is that they have varying strengths in their accessibility, and are themselves concepts (consider, for instance, links representing the concept TOWARDS, as opposed to links representing the concept AWAY FROM). The more often the links, or associations, are used or accessed, the stronger the association and the shorter the duration taken for access (Collins & Loftus, 1975). Furthermore, concepts acquired earlier are likely to have a higher level of interconnectivity than newly acquired concepts, which are likely to be assimilated into an existing 'semantic neighbourhood' of interconnections between concepts that are already understood (Steyvers & Tenenbaum, 2005).

Problems with semantic network theories.

Johnson-Laird, Herrmann and Chaffin (1984) noted several shortcomings of semantic network theories, the main one being the failure to connect word meanings with the world. Johnson-Laird et al. argued that a theory of meaning should define the form of any mental representation, such as whether word meaning comes from another word in a localised lexical context or from a relationship with its referent. Semantic networks represent only those relationships among words, or concepts; they do not represent relationships between concepts and their external referents. The notion of meaning construction through integration of language and the world, with the assistance of prior knowledge, encompasses a social-constructionist approach to the acquisition and development of meaning and understanding.

Social Representations Theory

Social representations theory offers a social-constructionist approach to meaning, whereby meanings are constructed via the communicative process (Harré, 1998; Latane, 1996; Pardo & Calvo, 2004; Semin, 1990; Sensales, 1994). Unlike semantic network theories, social representations theory looks beyond the individual to the broader influences of society and culture. Social representations consist of knowledge and beliefs that are central to a culture or community and are socially shared (Christidou et al., 2004; Lau, Chiu, & Lee, 2001). Such representations exist and find expression as media images, texts, language itself, in social interaction, institutions, legislation, and shared cultural assumptions and understandings. Social representations theory stems from a European social psychology tradition, beginning with Durkheim's (1895/trans. 1982) idea of collective representations. The general consensus is that social representations have a collective nature and are a mix of perceptions, images and ideas (Carugati, 1990; Flick, 1998a, 1998b; Moscovici, 1984, 1998; Rommetveit, 1984).

The inclusion of images into social representations sets them apart from schemata, which do not similarly include imagery, although Lee (2003) contends that social representations are the reification of socially shared schemata, in a circular process through which social representations initiate the construction of schemata. Lee also holds that ‘social representations’ and ‘schemata’ are interchangeable terms, with the former favoured by European social psychologists and the latter by mainstream U.S. social cognitivists (p. 52).

As already mentioned regarding cognitive structures, relationships between language and the world, and language and the mind, are essential elements of the structure. According to social representations theory, the relationship between physical and mental reality is such that the intervention of representations is necessary in order to discern the difference between the two. Representations “direct us towards that which is visible and to which we have to respond; or which relate appearance and reality; or again which define this reality” (Moscovici, 1984, p. 5). To explain this position further, the two primary roles of social representations involve their intervention in cognition.

The first mode of intervention is to conventionalise (by making familiar) objects, persons and events. This role, also known as ‘anchoring’, is similar to Piaget’s (1954) notions of adaptation via assimilation and accommodation. Assimilation is the absorption and incorporation of new information into existing knowledge. Individuals’ ability to conventionalise the information, or make it familiar, depends on their ability to accommodate the information by adjusting their conceptions of the world (Piaget, 1954).

A second way in which social representations intervene in cognition is through ‘objectification’. Whatever is unfamiliar becomes anchored to some aspect of objective reality. An example of an objectified image is ‘public perception’ made quantifiable through the percentage, an “icon of scientific authority in the coverage of elections and topical issues" (Roiser, 1987, p. 421). However, belying their semantic associations of stability, 'anchors' and 'objects' are phases of a dual process, and are thus transitional rather than fixed (Bauer & Gaskell, 1999, p. 172). Moscovici described the power of social representations thus:

> All the systems of classification, all the images and all the descriptions which circulate within a society, even the scientific ones, imply a link with previous systems and images, a stratification in the collective memory and a reproduction in the language, which invariably reflects past knowledge, and which breaks the bounds of current information (p. 10).

This argument reinforces the importance of background knowledge in the dual process of anchoring and objectifying, where cultural conditioning assists individuals in understanding their world, whether their knowledge is grounded in science or common sense (Lievrouw, 1990, p. 172). Popular culture constructions of reality form the knowledge tree from which specialist 'branches' stem, and each branch has its own categories in which to anchor the stray metaphors and catch phrases specific to that branch of knowledge. Conversely, the circulation of specialist scientific knowledge eventually infiltrates into the common sense idiom through the transformation of the abstract and unfamiliar into the concrete and objective (Bauer & Gaskell, 1999, p. 165). How readily specialist information is received depends on both the authority of the 'experts' and the interest of the public (Bauer & Gaskell, 1999), although there is some argument that what emerges are social representations of scientific knowledge, which anchor the knowledge by using 'real world' objectifications.

As an example of research relying on social representations theory, environmental-discourse analysis focuses on the language characteristics of social representation (Aiello & Bonaiuto, 2003). Aiello and Bonaiuto reviewed literature on the use of a rhetorical approach to social and discursive psychology, specifically pertaining to environmental issues, and found that studies using discourse analysis showed that people create and recreate common-sense categories during the course of naturally occurring conversational interaction. Furthermore, group processes are evident in the negotiation of categories pertaining to local environmental management, with different agents or agencies constructing environmental issues in different ways. People construct their environment through social, discursive interactions within various contexts (Aiello & Bonaiuto, 2003). Bauer and Gaskell (1999) have also argued that social representations are carried by and find functional reference in social milieus, in groups that are with or without self-referential identities. Examples of self-referential groups within the Wet Tropics context include environmental management agencies, scientific research collaborations, and community conservation groups.

Of course, detractors of discourse analysis argue that it does not capture the processes underlying meaning construction, and that analysis results are misleadingly offered as having empirical credence. Furthermore, while interpretations of discourse analyses provide insight into the nature of the process, they are themselves extraneous to the actual process (Puddifoot, 1997, p. 57). There is also a temporal dimension to social representations, and a longitudinal component is thus considered essential for a methodology that adheres strictly to social representations theory (Bauer & Gaskell, 1999; Puddifoot, 1997).

Background Knowledge and its Influence on the Construction of Meaning

A recurring theme in the various theories proposed to explain knowledge structures is the development of associations, or links between ideas, concepts, or images, through habitual exposure or use over time and in different contexts. Another important feature in the development of associations is the varying levels of impact that people have in their ability to influence others to adopt their beliefs and practices. It is likely that people who negotiate meanings for specific situations, events or contexts will share representations of those situations, events or contexts, and such representations will influence their habitual way of interpreting reality (Latane, 1996; Lau et al., 2001). Thus, a representation of ‘values’ shared by researchers might be misconstrued, or simply re-interpreted, once extended for use in a management context, or used by those whose primary agenda is conservation.

The construction and negotiation of meanings through social interaction permeates all forms of discourse. There is a highly political level within discussions of the environment and the ‘values’ pertaining to its collective importance to a community. Another important feature of meaning construction is emotional valence, which is assigned through arguments and discussions and enjoins an audience or listener to agree or conform through moral and normative persuasion: “When a valued environment is threatened (by development or inappropriate uses) these positive affective or emotional responses are disrupted and replaced by negative emotions … decisions to preserve urban and rural nature are accompanied by negative emotions, probably because of the threat to positive emotional associations with natural environments” (Vining, 1992, p. 10).

Lau, Chiu and Lee (2001) offered evidence that strongly influential people gather around them those who tend towards similar beliefs and practices and, as this influence continues to spread outwards, beliefs and practices tend to become more general rather than specialised. Such filtering out of strong ideas reputedly occurs with the communication of scientific knowledge for public consumption (Lievrouw, 1990), in a cycle with paths of influence between conceptualization, documentation and popularization. Once popularized, public understanding of scientific information can greatly influence the acceptance or otherwise of management strategies and research interests (Hull et al., 2003; Vining, 1992). The onus is on the disseminators of the original information to ensure its clarity at the stages of conceptualization and documentation: "If a term fails to reflect the environmental qualities society understands and cares about, it is likely to be ignored or ineffective in influencing environmental decisions, regardless of how scientifically precise, reliable, and theoretically rigorous it might be" (Hull et al., 2003, p. 11).

The importance of social representations, as opposed to other theories of knowledge storage and representation, is in their role as reference points that bridge the gap between the social and physical worlds. Such reference points can be a single word or a sentence, and there is a tradition of substantive research into the social representations of words such as 'charisma', 'madness', 'race', and 'illness', among others (Semin, 1999). Social representations of 'values' conceivably co-exist, as reference points, with referential and associational domains of meaning. However, Semin (1999) noted the difficulty of finding a suitable empirical approach by which to properly perform analyses of language at a social level.

Such an approach is possible, however, if the processes explained in the various theories of knowledge acquisition and its structure are integrated with the considerable advances in the knowledge of distributional patterns in language from the field of computational linguistics. Psycholinguistics as a discipline brings together studies of language and the psychological processes underlying its production, storage and comprehension. The study of meaning is but one feature of psycholinguistic inquiry, and the study of meaning is shared among many other disciplines including linguistics, philosophy, neurology, and semiotics (Cruse, 2004). The concept of meaning describes a relationship between some more or less arbitrary symbols, interrelated with each other in a complex and partially structured way, human experience, and human cognition. For the purposes of this thesis, it is assumed that the nature of meaning is such that it is largely conceptual, and most easily studied through the medium of language (Cruse, 2004). This cognitive stance forms a contrast to the ideas of emotion, learning, or behaviour theorists such as Osgood (1952).

The shortcomings of Osgood's semantic differential technique have been noted previously, and a survey of the current literature indicates that there is no generally accepted alternative method for measuring meaning. Increasingly, however, word meanings are represented as distributional patterns of use, in relationships with other words within large language corpora. Such objective methods for representing meaning are used with some frequency (Bullinaria & Huckle, 1997; Dunning, 1993; Huckle, 1995; Katz, 1996; Levy & Bullinaria, 2001; Levy, Bullinaria, & Patel, 1998; Lowe, 1997; Lund & Burgess, 1996; McDonald & Brew, 2004; Pereira, Tishby, & Lee, 1993; Redington, Chater, & Finch, 1998). Proponents of such measures argue that word co-occurrence relationships (Osgood described them as 'semantic habit strengths') contain semantic information, a claim that is verified against behavioural data from empirical measures of semantic similarity and semantic priming effects (Landauer, Laham, Rehder, & Schreiner, 1997; McDonald, 2000; Rapp, 2002).

The associative nature of knowledge and semantic information through individual habituation is explained in semantic network and spreading association theories, and the natural tendency of humans to rely on probabilistic information in communication stems from the background and shared knowledge that develops over time and in various contexts. Representations of meaning as distributional patterns in naturally occurring language rely on co-occurrence relationships that also draw on associative processes.

Text analysis can thus be employed to good effect to locate statistical regularities characterising language including distributional information (such as word associations and keyword collocations) within naturally occurring texts. Associative word pairing through frequency of proximal co-occurrence is one of the distributional characteristics of any communication, be it spoken or written, and these and other distributional characteristics can be probabilistically determined given a large enough sample of communication. This is an increasingly common measure in psycholinguistic studies of the processes underlying lexical access (Levy & Bullinaria, 2001; Levy et al., 1998; Lund & Burgess, 1996; McDonald, 2000; McDonald & Shillcock, 2001). Shannon and Weaver (1964) explained the natural regularities within language, and their application to theories of communication, in their mathematical model of communication.

Language, Communication and Meaning Representation

Language is a stochastic process, governed by probabilities concerning how symbols (letters or words in language, notes in music) are produced sequentially (Shannon & Weaver, 1964; Simon, 1955). The nature of communication is such that the probability of selecting the next symbol to follow depends on previous (or future) choices. Selection probabilities that are dependent on previous or future choices are typical of a special type of stochastic process, called a Markov process (or Markov chain). For example, given the phrase ‘In the event’, it is highly probable that the next word in the sequence will be ‘that’, and highly improbable that the next word will be ‘elephant’ (Shannon & Weaver).

Language is also subject to ergodic processes. For instance, two text samples, chosen independently by different methods, would show similar trends in their statistical properties in alignment with the growth of each sample size. Every sequence of letters or words is homogenous in its statistical properties, so, provided the samples are reasonably large, they can be taken as representative of the whole. Ergodic systems typically exhibit statistical regularity, and the regularity of the English language is such that "about half of the letters or words we choose in writing or speaking are under our free choice, and about half (although we are not ordinarily aware of it) are really controlled by the statistical structure of the language" (Shannon & Weaver, 1964, p. 13).

The 'Orderliness' of Language

In detailing what he called the psychobiology of language, Zipf (1935) described some of the ways in which English and other languages conform to certain standards of orderliness. For instance, few words in the English language occur at very high frequencies and most words occur at very low frequencies. The roughly inverse proportion of a word's frequency to its frequency rank is commonly referred to as 'Zipf's law'. To illustrate this phenomenon, Zipf ranked samples of words in their order of frequency and plotted these ranks on the ordinate and the frequencies on the abscissa of a bilogarithmic plot. For any naturally occurring sample of words drawn from a relatively large corpus, this results in a characteristic distribution that is highly skewed with a long upper tail. The word ranked first, with the highest frequency, occurs twice as often as the word ranked second, which occurs twice as often as the word ranked fourth, and so on.[13]

[13] Incidentally, this type of distribution is not unique to language. Ijiri and Simon (1977), in an examination of stochastic models related to the size of business firms, described a class of these highly skewed distributions that include the word frequency distributions described by Zipf, distributions of cities by population, of incomes by size, and of biological genera by species.

Word selection probabilities are a function of their frequencies, but are also under the influence of associative and imitative processes (Simon, 1955). Any sequence of words is a fragment of linguistic communication. The word frequencies within any given (written) sample are dependent upon an author's processes of association and imitation. As an example, in Joyce's novel, *Ulysses*, 'Bloom' is ranked 30th in frequency, in contrast to the word's relatively low frequency in general language. Simon attributed the relatively high frequency of this word in the context of this particular novel to association, as any other name could have been used. The process of association involves a situation where words already selected will trigger associations with other words. Thus, once Joyce had selected Leopold Bloom as the name of his everyman character, the frequency of the word 'Bloom' in the novel depends on any event or incident in which the character features.

In contrast to the enhanced appearance of 'Bloom' in the novel, the position of 'they', ranked 27th for frequency in *Ulysses,* was similar to its rank in the then-used Dewey count, and Simon attributed this similarity of ranking for common words as imitation. Uncommon words, used only through processes of association specific to a text, can thus have a high frequency ranking in a specific text, yet have a very low frequency ranking in general.

There is some agreement that it is a combination of the associative and imitative processes that produces stable statistical properties (Chen & Leimkuhler, 1989; Ijiri & Simon, 1977; Shannon & Weaver, 1964; Simon, 1955). Authors select words for a text through association, by selecting subsequent words based on those already chosen, and through imitation, by selecting subsequent words from those encountered any time previously. The selection of words in sentence construction is a syntagmatic process.

Paradigms and Syntagms

The idea of paradigmatic and syntagmatic associations within language comes from Saussure (1983), who described language (*langue*) as a system of forms, from which are selected subsets of signs, such as everyday speech (*parole*). Any instance of *parole* is a syntagmatic association, where a sequence of elements is combined to form a linguistic unit. Meaning is created through the sequential ordering of the elements. For instance, *The dog bit the man* is understood through the conventional subject-verb-object sequence of word ordering. In contrast, paradigmatic associations are such that one element can replace another within the sequence.

The grammatical categories of nouns and verbs are paradigms from which differentiating elements are chosen, and meaning is dependent upon this selection. The substitution of 'dog' for 'man', and vice versa, produces a sentence with the same syntagmatic relationship, but a very different paradigmatic association: *The man bit the dog*. The process of sentence construction involves a linear selection in which one particular word will be selected preferentially over a set of possible words, depending on the idea an individual wants to get across. This selection process limits the available choices for the subsequent word, which in turn limits choices for the third word and so on. Freedom of choice in text selection, and the ultimate received meaning of the message, thus depends on a combination of factors.

Firstly, to whom is the message directed? Texts are written with a readership in mind, and the level of expected prior knowledge of the reader will influence the style of language used (e.g. formal, informal, technical). Secondly, what is the context of use? A message will be framed in a manner suitable to its real-world context. For instance, in the context of World Heritage listing, 'Wet Tropics environmental values' might be suitably expressed as biophysical features, attributes, processes and conditions, but such expression would not be suitable in the context of a psychological study of environment-related behaviours.

Thirdly, what has already been written? The rules of grammar and sentence parsing are one feature of this factor, but semantic and associative relationships between words are also influenced by prior content. If two words are habitually used in combination as a catchphrase, then the presence of one of the words in a text will probabilistically indicate the other. Further, if two words can operate interchangeably due to semantic equivalence, the presence of one word can also probabilistically indicate the other, albeit not as easily or as reliably as associative co-occurrence. Finally, how extensive is the author's vocabulary? Word selection is either restricted or enriched depending on the availability of alternative choices, which is also incumbent upon prior or background knowledge, and requirements of linguistic style.

Vocabulary Richness

Vocabulary diversity is another characteristic of language orderliness. Indices of vocabulary diversity or 'richness' are often used in studies of children's language acquisition to show vocabulary growth over time, and they are also used to characterise texts into different categories and to discriminate among texts where authorship is contested (Chen & Leimkuhler, 1989; Lebart, Salem, & Berry, 1998). One index of vocabulary diversity is the type-token ratio, which can be used as another way to describe the rank-frequency relationships ascribed to Zipf's law. Essentially, the type-token ratio (TTR) is calculated by dividing the number of unique words, or types (V), by the number of word occurrences, or tokens (T). Chen and Leimkuhler derived a type-token 'identity' as a statistical model of text generation. The type-token identity is a relationship between the type-token ratio

(TTR = V/T) and the more stable bilogarithmic type-token ratio (TTR' = LogV/LogT).

Chen and Leimkuhler showed, using examples from 38 works of Shakespeare, 33 texts in the Czech language, and a selection of texts in a variety of other languages, that the bilogarithmic ratio of approximately 0.8 features in most texts. The type-token identity, as the sum of the type-token ratio and its bilogarithmic alternative, is approximately equal to one, except when T is relatively small or large (i.e. when T is less than 1099, or greater than 884,646) (Chen & Leimkuhler, 1989). The number of words (types) contained in a corpus is not proportional to the corpus size, as the number of new words will decrease as the number of word occurrences (tokens) increases. The stability of the type/token ratio, together with other stable characteristics of language, makes text analysis of small corpora using statistical association not only a feasible, but an effective approach to the study of meaning in texts through the study of distributional information.

Using Distributional Information to Represent Meaning

The objective measurement of lexical variation through patterns in distributional information is generally validated using large language corpora. Such corpora include the 90 million-word British National Corpus (2006a) based on 3,209 texts; Usenet, an Internet discussion system with approximately 160 million available words (Mahoney, 2000); and Lexis-Nexis (http://global.lexisnexis.com/us), an electronic academic and congressional database. A number of researchers have employed distributional statistics to create high-dimensional models of semantic space, claiming that context-based representations can approximate the essential nature of word meaning (Landauer & Dumais, 1997; Landauer et al., 1997; Lund & Burgess, 1996; McDonald, 2000; McDonald & Shillcock, 2001) and the psychological processing of such meanings (Levy et al., 1998). Moreover, lexical, contextual, syntactic and probabilistic information influences language processing, and differential exposure to statistical regularities in language accounts for at least some of the constraints in syntactic processing (Reali & Christiansen, 2007).

For instance, Rapp (2002) drew on the law of association by contiguity as found in distributions of words in large corpora. His statistical models computed first-order and second-order associations that correlated respectively with paradigmatic and syntagmatic associations as described by Saussure. Rapp used tasks requiring free associations and the generation of synonyms to demonstrate that the performance of a statistical system equates with the performance of human subjects. It appears that the human mind forms associations in a manner equivalent to co-occurrence counting (the frequency with which two words appear in close contiguity within a text) or performing statistical tests (Rapp, 2002). While findings from Mo et al. (2007) suggest that concept centrality derived from the central event of a text is more important than frequency of mention, at least in script-based texts, central concepts might be defined differently for different types of texts. It is thus highly plausible that frequency could still define centrality for some types of text (Rizzella & O'Brien, 2002).

For instance, as further support of such a notion, in a comparison of human participants and Latent Semantic Analysis (LSA), Landauer, Laham, Rehder and Schreiner (1997) showed that there was little difference between human and LSA performance on a judgement task determining the amount and correctness of topic-relevant knowledge demonstrated in student essays. In LSA, samples of text are represented as a matrix of words by contexts. Landauer et al. stressed that LSA does not measure similarity using simple co-occurrence statistics, but is instead reliant upon singular value decomposition of the word-by-context matrix. The main finding of Landauer et al. was that much of the meaning in a text is inherent in words independent of their order, which suggests that syntax is not directly useful in the representation of meaning and that a 'bag of words' is sufficient to reconstruct the meaning of a text.

Such findings are in contrast to Pinker's (1979) argument against the use of a distributional analysis heuristic as applied to natural language learning, and his assertion that, "It is practically impossible to state natural language regularities in terms of contiguous word classes in sentences" (p. 238). However, Pinker grounded his argument on language learning studies, which question, among other things, how children come to learn and to recognise word senses. His argument was thus more against the use of distributional analysis in mechanistic programs devised to mimic natural language learning rather than against distributional analysis per se.

Firth (Ed. Palmer, 1968) used the term 'collocation' to describe "statements of the habitual or customary places of that word in collocational order but not in any other contextual order and emphatically not in any grammatical order" (p. 181). A collocation is not the context, and is not meant to be taken as giving the whole meaning of a concept, but it does provide part of the meaning by showing characteristic word accompaniments. Firth explained it thus (italics appear as in the original):

> It can safely be stated that part of the 'meaning' of *cows* can be indicated by such collocations as *They are milking the cows, Cows give milk*. The words *tigresses* or *lionesses* are not so collocated and are already clearly separated in meaning at the *collocational level*. (p. 180)

Research using LSA supports Firth's claims, and suggests that the rules involving contextual features may be partially independent of syntactic, or grammatical, properties. Furthermore, semantic considerations appear to influence distributional properties (Landauer et al., 1997), through processes of association. The statistical regularities within language can thus be exploited using a statistical association approach to text analysis, through the exploration of keyword co-occurrences in text. The sentence contexts surrounding a target word can be used to predict meanings, through co-occurrence associations with other words.

The psychological processes underlying the development of background knowledge can be expected to influence the production of texts as well as their comprehension, and it was expected that differences in language use and meaning between three groups engaged in writing about ‘values’-related issues would emerge through such analysis. It is a major premise of this thesis that some of the specific and often differing meanings of ‘values’ can be discerned through their linguistic context, in their expression as naturally occurring communication in publicly available documents. For practical reasons, the research relates primarily to a sample of written language documents and texts about the Wet Tropics World Heritage Area, produced by and publicly available from the principal, loosely defined user groups of interest for this research. Research strategies include content analysis of selected text samples from the documents themselves, and elicitation and analysis of selected research participants’ responses to structured questions and tasks about meanings and referents of provided values-terms and expressions.

4. A Text Analysis of 'Values' Discourse

Being unable to seize the concrete entities or units of language directly, we shall work with the word.[14]

Any analysis, including content analysis, is a kind of interpretation, and it must arise from the same source that gives rise to other classes of linguistic interpretation. This means that it is determined not by theories of psychological processes but by the needs of a particular analysis. Psychological theory, however, may inform such analyses.[15]

Introduction

The statistical association approach employed in this study draws on theories and empirical findings regarding the orderliness of language, and the insights into group meanings to be gained by examining words in contexts. Such an approach differs from the commonly used human coding systems whereby an analyst will reduce large amounts of text by coding word patterns into equivalent categories or themes. Instead, text is reduced by considering meaning in categories or themes as a function of the proximal co-occurrences of 'keywords' (Landauer & Dumais, 1997; Landauer et al., 1997; Levy et al., 1998; Lund & Burgess, 1996), relying upon the processes governing lexical distribution as described by Zipf (1935) and others (Jorgensen, 1990; Shannon & Weaver, 1964; Sichel, 1975; Simon, 1955).

An advantage of computer-aided analysis is that any structure within the data can emerge (up to a point) rather than being imposed by the analyst (Krippendorf,

[14] Ferdinand de Saussure (1983, pp. 111-119) saw language as a combination of thoughts and signs, with words approximating the real terms he wished to identify.
[15] The American psychologist James Deese (1969, p. 41) (1921-1999) was an early advocate of grounding content analyses on psychological theories, to guide and provide limits to the interpretations of findings.

2004). The qualification is important; whereas many analyses conducted using statistical methods are structure seeking in nature, they can also be structure imposing depending on the methods and measures being used (Aldenderfer & Blashfield, 1984). Computational content analysis programs make most (but by no means all) of the necessary decisions about the relationships between words. The need for human coding is thus negated, along with some of the inherent potential for error, inconsistency and subjectively motivated interpretation. Of course, decisions were made for the current study that affected structure observation, and the rationales for the parameter choices for the most important of these decisions are detailed in the appropriate sections. Thematic searches are a common feature of content analysis, and the computerised text analyses used in this study were selected for their relatively unbiased, consistent processing of letter strings.

Meaning Operationalised

The text analysis undertaken in the current study draws on the characteristic orderliness of language in adopting a statistical association approach, using frequency of proximal co-occurrence of content words (keywords) in naturally occurring context as a measure of similarity, or association. Meaning was thus operationalised as the relationships between words according to co-occurrence in a defined ‘window’ of words.

Method

In the interests of replication, text analysis for this study consisted of four components listed by Krippendorff (2004, p. 83) as fundamental to the analytic procedure: sampling, unitizing, recording and reducing. Details of each of these components and their respective procedures are described as separate method sections.

Sampling

As the study involves differential analysis of the naturally occurring applications of 'values' by groups with various environmental interests, sampling involved two parts: group selection and document selection.

Group Selection

Stakeholder groups with interests in the Wet Tropics World Heritage Area are diverse, and there was no readily accessible text archive representative of most groups. There were nevertheless three environmental organisations, involved respectively in environmental management, environmental research, and environmental conservation activism, with readily accessible, archival information. The three organisations, together with their respective primary activity, were the Wet Tropics Management Authority (WTMA) – management; the Cooperative Research Centre for Tropical Rainforest Ecology and Management (Rainforest CRC[16]) – research; and the Cairns and Far North Environment Centre (CAFNEC) – conservation activism.

These organisations were additionally chosen by virtue of their location within the Wet Tropics bioregion, and their specific involvement in activities within and pertaining to the WTWHA from an environmental perspective. Each of the organisations produced documents that were targeted towards and accessible to the public. All the organisations published materials on their individual websites, with these materials varying in nature from annual reports to newsletters and information sheets.

The public, as residents of the region, were considered as a fourth group for comparative purposes, but further deliberation led to their exclusion on the basis that

[16] The Rainforest CRC began operations in 1993, and was Commonwealth Government-funded continuously for two seven-year periods until it ceased operations on June 30, 2006.

there is no cohesive text archive that could be said to represent them. Newspaper coverage was suggested and declined as a suitable resource, due to the hierarchical nature of the editorial process, whereby the news media shapes public opinion. In another example of the social construction of meaning, any coverage of topical environmental issues would very likely be filtered through several stages of gate-keeping before finding public audience (Livingstone & Bennett, 2003). Gatekeeping in the media involves journalists, editors, publishers, and owners, in that they control access to something or someone. However, filters also operate at the other end, through those offering an 'official line' on issues of public import. Newspaper journalists are inclined to seek responses from 'official' representatives, so it is also likely that information would come from one of the three organisations, given their status as environmental representatives in their respective milieus. Admittedly, there is also an editorial process in the preparation of the texts produced by the groups.

Moreover, interaction between the groups was accepted as being inevitable, and group affiliation is not mutually exclusive. Each group ostensibly has its own environmental agenda, but there are also mutually shared goals, in that each group has good intentions towards the WTWHA as reflected in statements of their respective missions and goals:

> To provide for the implementation of Australia's international duty to protect, conserve, present, rehabilitate and transmit to future generations the Wet Tropics of Queensland World Heritage Area, within the meaning of the World Heritage Convention. (Wet Tropics Management Authority, 2002)

> Our vision is to see the rainforests of Australia managed and utilised in a scientifically sound and sustainable manner to yield economic and social benefits to the community while ensuring conservation of the unique cultural and natural features of the rainforest. (Rainforest CRC, n.d.)

> Our mission as an organisation is to ensure the unique and special natural heritage of Far North Queensland is protected. (Cairns and Far North Environment Centre, n.d.)

A direct relationship between the CRC and the WTMA comes from the responsibility of the CRC to provide the scientific basis for WTMA policy development concerning the protection of the WTWHA. The integration of economic and social goals is notable in the CRC vision statement, whereas the other two statements are more aligned in their focus on heritage protection.

Another important consideration is that the word ‘values’ could have more than one meaning for any individual author, so multiple, within-group meanings are also possible, and likely. Moreover, collaborative authorship introduces and integrates the ideas and meaning domains of each author. The nature of group dynamics, with the likely subsumption of individual identities to a group culture or identity, was mitigated to the extent that these group interrelationships exist between all three groups. Differences in uses of the term ‘values’ must also be considered in view of the types of documents produced by each group.

Document Selection

Large corpora are considered essential for the construction of semantic space models that reflect the psychological reality of the mental lexicon (Levy et al., 1998; Lund & Burgess, 1996; McDonald, 2000). With a larger sample, estimates of the population value are more accurate and there is less measurement error. The problem with relatively small samples lies in the stochastic nature of the language process; the number of possible events is always larger than the number of observed events, and many events are rare, depending on the corpus (Dagan, Peireira, & Lee, 1994; Lovelace, 1988).

However, if it is assumed that the selection of words (and their meanings) is determined by their contexts, the choice of a corpus must be driven by the specific contexts of use being studied; in this instance, Wet Tropics ‘values’ as expressed in relation to environmental issues by groups that are differentiated by their environmental perspectives. This choice is supported by the likelihood that the mental representation of a word is influenced by, and in turn influences, the context in which it appears (Schwanenflugel et al., 1988). Thus, a reader encodes more information about a word's contexts of use, and the meanings associated with those contexts, as he or she becomes more familiar with the context (as vocabulary learning, semantic network, schema and social representation theories all suggest).

Of course, it is possible that the concept of VALUES would be accessed through exposure to words that are synonymous with 'values'. This problem can be addressed only through the expectation that terms being used synonymously would be used in similar patterns as the word 'values' (Miller & Charles, 1991). That is, they would appear in the cluster analyses as co-occurrences with the same words as 'values'. A search for those words commonly used as synonyms for 'values' (i.e. attitudes, beliefs, principles), showed that these common synonyms were not used in the document samples. Other synonyms might be more common in environmental discourse, and it was expected that such terms might be revealed through similar patterns of proximal association as for 'values'.

The size of the corpus was necessarily also influenced by the choice of relatively specialised contexts of use. The decision to use a small corpus of purposively sampled documents was driven by the general regularities in language, which apply for smaller samples in much the same way as for larger samples, albeit with less accuracy.

A temporal limit of five years was set for the collection of documents so that all accessed documents were produced and available for the period 1998-2002. The purposive sample of documents pertaining to 'values' in the Wet Tropics World

Heritage Area (WTWHA) consisted of publicly available documents from the WTMA, the Rainforest CRC (henceforth referred to as the CRC) and the CAFNEC containing instances of the letter string VALU. Variations of the letter string, such as VALUE, VALUED, VALUES, VALUATION, EVALUATION and VALUABLE, were thus included.

WTMA documents were accessed from their online library (http://www.wettropics.gov.au/library.html). Of the 51 documents listed on the site, 45 contained instances of the targeted letter string. Documents included annual reports, newsletters, and information sheets together with other material, which formed a comprehensive collection of information pertaining to the Wet Tropics.

CRC documents were accessed from their Publications page (http://www.rainforest-crc.jcu.edu.au/). Accessed documents included the following: research reports (18/35), information sheets (16/45), Rainforest Issues series (2/3), and Forest Matters newsletters (3/3). Numbers in parentheses represent the number of items containing the targeted letter string preceding the total number of the respective type of item. Of the 86 accessible listed documents, 39 contained the targeted letter string, VALU.

CAFNEC documents were not all accessible from their website (http://www.cafnec.org.au/info_resources/ecotone.cfm) at the time of collection, so some were obtained directly from the publisher. Document items consisted of 19 issues (in the five-year time frame) of the quarterly newsletter, *Ecotone*, which includes editorial and feature articles about environmental conservation matters. Some issues also contain book excerpts, advertisements, poetry and short comments about staff and volunteer movement. Of the 19 issues, 18 contained instances of the targeted letter string, all of which were initially selected for analysis.

The documents from all three groups were not exclusively online publications, with many also available in print at other outlets. This is particularly so for *Ecotone*, the CAFNEC newsletter, but WTMA and CRC newsletters were also available in printed form. The CAFNEC document sample nevertheless does stand out, as it consists exclusively of the newsletter, while the other two samples are more diverse. Differences in authorial style and genre place the texts in somewhat different contexts, as does the fact that each of the organisations has its own purpose and target audience. Some level of gate-keeping must be assumed for all of the documents, with individual authorial style and content subsumed to a degree by the organisational 'front'.

Exclusions

Although all sample documents contained at least one instance of the targeted letter string, closer inspection of the documents revealed that not all were suitable for analysis. Four documents from the WTMA sample (two application forms, and two duplicated information sheets) were excluded. One document was excluded from the CRC sample due to all VALUES instances referring to numerical information (i.e. values in a mathematical sense).

The next step was to ensure that all selected documents contained at least one instance of the target word, VALUES. This process resulted in the exclusion of twelve WTMA documents and eight CRC documents. All CAFNEC documents contained at least one instance of VALUES and thus all were retained. To reduce the effects of document level 'burstiness'[17] of VALUES variations, documents containing more than 50 instances of the letter string, VALU, were also excluded.

[17] Katz (1996) described the phenomenon he designated *burstiness* as the close proximity of many occurrences of a particular content word or phrase (within-document burstiness), in contrast with other documents that contain almost no occurrences of the word or phrase (between-document burstiness).

Seven documents from the WTMA sample and two documents from the CRC sample were removed from analysis. These documents were removed due to the likelihood that an overabundance of 'values' instances would overwhelm the other information. Hence, one document focusing heavily on 'values' would act as an outlier and skew the distribution.

A final exclusion process involved individual examination of each VALU instance, and exclusion of any instance featuring in acknowledgements, headings or subheadings, titles, references, box figures and tables. This process meant that some documents no longer contained at least one instance of VALUES, but all documents still contained at least one instance of the letter string VALU. The final instance counts for each of the VALU variations for WTMA, CRC and CAFNEC documents, together with document word counts, are presented in Appendix 1a. Table 3 lists descriptive statistics for the word counts and VALUES instances for documents from each of the organisations.

Table 3

Descriptive Data for Word Counts and Instances of VALUES, in Documents by Group of Origin

Organisation	No. Docs	Document word counts				
		Mean	SD	Min	Max	Total
WTMA	22	304	349	59	1477	6,683
CRC	28	794	855	60	2962	22,241
CAFNEC	18	370	257	74	1031	6,664
Combined Groups	68	523	634	59	2962	35,588
	No. Docs	VALUES counts				
		Mean	SD	Min	Max	Total
WTMA	21	5.19	5.63	1	24	109
CRC	28	5.36	5.55	1	18	150
CAFNEC	16	4.81	3.89	1	16	77
Combined Groups	65	5.17	5.14	1	24	336

The CRC documents together contained the largest word sample, with a count more than three times higher than that for each of the other groups. In contrast, counts for VALUES instances were relatively evenly distributed between the three groups, although the CRC count was the highest, and the CAFNEC documents displayed fewer instances of the target word.

The purposively sampled corpus for the current study consisted of 68 naturally occurring texts chosen as representative of documents produced by each of three groups for public access. Of necessity, this corpus is smaller by several degrees of magnitude than those used in many studies of this nature, but it provides the context in which the meanings of ‘values’ could be distinctive from the meanings in other, more generalised contexts. Additional benefits gained include the unobtrusiveness of the data gathering process, and the avoidance of imposing an arbitrary coding scheme onto the data (Krippendorf, 2004; Mohr, 1998).

The ability to confidently generalise findings from the analysis of this corpus is limited to other such specialised contexts, while ecological validity was gained through the selection of naturally occurring texts. Furthermore, the sample size is comparable to other content analysis studies using a similar approach, for example Marion’s (2001) analysis of 250 online employment advertisements and Stephen’s (1999) analysis of 634 titles of research articles. Nevertheless, such specificity can be considered a problem, with co-occurrence counts reflecting the characteristics of the selected texts rather than true occurrence in a population of such texts (McDonald, 2000). In this case study, consequent to the nature of purposive samples, the population of texts is expected to be representative only of similar environment-oriented texts. The next step in the process was to define the units of analysis.

Unitizing: Text Unit Selection

Text analysis often involves the clustering of ‘text units’, either into stand-alone categories or hierarchies. Text units (single words, lines of text, sentences or paragraphs) are defined before any text is explored and analysed, as they provide the lexical context in which single words are considered, and due consideration was thus given to how these units would be defined.

Paragraphs provide a lot of context surrounding any instance of a word or phrase, and supply the ‘sense’[18] of the meaning through the relationships between words. Although it is possible for several instances of a word or phrase to occur within one paragraph, and sense might thereby be confounded, nonetheless, paragraphs as text units have the greatest potential to provide relevant context without any overlapping meanings. Schatz and Baldwin (1986) used three-sentence paragraphs for a words-in-context test where they assessed the degree to which context helped their subjects’ infer the meaning of unknown words. Bengston and Xu (1995) also limited context selection by including text within 100 words of the phrase ‘national forest’, in their study of forest values. For the current study, in order to select sufficient lexical context to allow for the planned type of analysis while limiting interference from extraneous information, paragraphs were defined under the following conditions.

Defining Context: Pseudo-paragraphs

The 68 document items were prepared for analysis in the following manner. Each sentence containing an instance of the letter string VALU within any of the sample documents was selected along with one sentence to either side, forming a three-sentence pseudo-paragraph. Where additional instances occurred within the

[18] The way in which a word is to be understood; a specific, context-bound reference

next sentence selection, they were included along with the following sentence for each instance, so that some paragraphs consisted of more than three sentences.

The number of paragraphs varied between the groups. The paragraph counts were almost identical for the WTMA (85, M = 3.9, SD = 4.2) and CAFNEC (84, M = 4.7, SD = 2.5) samples, but the count for the CRC sample (225, M = 8.0, SD = 8.4) was much higher, reflecting the larger word count for that group. The differences in variation between the different groups in the number of paragraphs are due to inconsistencies in the focus on 'values' for the different groups and in different documents. For instance, paragraph variation in the CAFNEC sample consisting of quarterly newsletters was relatively low, with a range of 1-9 paragraphs. In contrast, a variable focus on values for the research group suggests that the topic varied in importance across documents. The range of paragraph counts was 1-34, with word counts per paragraph varying according to how often the target letter string occurred. The management group variation was between that of the other two groups (paragraph count range = 1-18), with a paragraph count range double that of the conservation group, but almost half of that for the research group.

Word counts within the individual paragraphs varied greatly across the groups, although the mean word counts for the paragraphs were again very similar for the WTMA (M = 77.6, SD = 36.2) and CAFNEC (M = 78.1, SD = 41.8) samples, while the mean word count for paragraphs was higher for the CRC sample (M = 97.8, SD = 54.0). The CRC documents were wordier, even though this document sub-sample was similar to the WTMA document sub-sample, in that it consisted of reports, information sheets and newsletters. This difference between similar items indicates that the genre of each type of document is not the only factor distinguishing the groups.

Recording: Computer Aided Text Analysis Software

The text analysis was conducted using WordStat (Péladeau, 2003a), which runs from the base product Simstat (Péladeau, 1996). WordStat provides computer-assisted methods of text analysis via statistical and graphical tools for analysing patterns of co-occurrence and visualising these patterns.

Confirmation of the Distribution 'Orderliness'

Of the original occurrence count of 34,747 tokens (words) in the 68 documents, 4,857 were unique types (i.e. words with one or more occurrences). Figure 2 shows a ranking of the sample words in the order of frequency (where a rank of 1 is the highest frequency) plotted on the horizontal axis against the actual frequencies on the vertical axis. The distribution of word frequencies in this sample is consistent with those found in larger samples as described by Zipf (1935) and others (Chen & Leimkuhler, 1989; Ijiri & Simon, 1977; Jorgensen, 1990; McDonald, 2000), where few words occur at very high frequencies and most words occur at very low frequencies.

As occurs in much larger samples, the most frequently occurring of the unique types was THE, with a frequency of 2,352, followed by OF (1,486) and AND (1,363); the frequency for VALUES was 325, ranked at 10 in this sample. On the other end of the scale, 2,381 types occurred at a frequency of one. This orderliness of the sample word distribution is reflected in Figure 2 as a thin line joining the sparsely scattered high frequency words beyond a frequency of around 400, compared with the increasingly dense clustering of low frequency words as the ranking increases beyond 10.

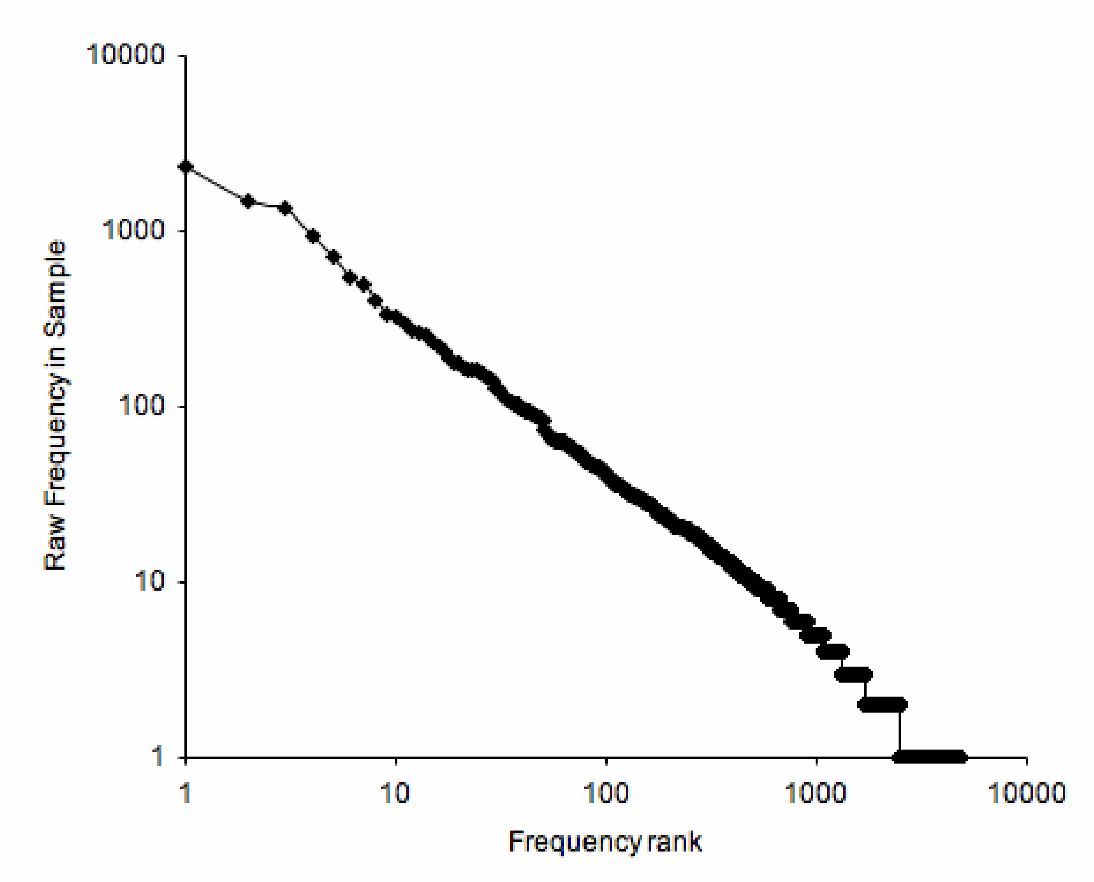

Figure 2. Bilogarithmic plot of word frequency against frequency rankings (4,857 unique types).

Vocabulary Diversity

The commonly used type-token ratio was calculated as an index of the vocabulary diversity for the entire sample, and for each of the group sub-samples. The type-token ratio (TTR) is calculated by dividing the number of unique words, or types (V), by the number of word occurrences, or tokens (T). The TTR for the whole sample was .1398. As this ratio is considered unstable for texts of different lengths, the more stable bilogarithmic type-token ratio (TTR') was also calculated, as .8118. As already noted, the sum of the two ratios typically approximates 1.0, and the sum of the ratios for the current sample is consistent with this finding, with the sum equal to .95. Table 4 shows a comparison of the type-token relationships for the three group sub-samples together with ratios for the whole sample.

Table 4

Type-token Relationships for the Sample Documents and Three Group Sub-samples

Document source[a]	V	T	TTR	TTR'	TTR+ TTR'
WTMA	1,332	6,492	0.21	0.82	1.02
CRC	3,670	21,736	0.17	0.82	0.99
CAFNEC	1,895	6,519	0.29	0.86	1.15
Combined	4,857	34,747	0.14	0.81	0.95

Note. V = types; T = tokens; TTR = type/token ratio, V/T; TTR' = log type/token ratio, logV/logT.

[a] WTMA, n = 22; CRC, n = 28; CAFNEC, n = 18; Combined, n = 68

For each sub-sample, the sum of the two ratios is approximately 1.0 and the TTR' approximates 0.8 (although the CAFNEC TTR' does show some disparity, with a relatively higher TTR'). Differences in document genre, authorship, and targeted audience must be considered again as a potential factor. It appears that the CAFNEC documents feature a larger range of words relative to their frequency of occurrence compared with the other sub-samples. Nevertheless, the study sample largely conforms to the general type-token relationship and this is largely preserved within each of the sub-samples.

Reducing

As this study was concerned primarily with frequency and occurrence relationships between the target word VALUES and other keywords, the text analysis parameters were further limited to relevant material. The WordStat program lists each of the 4,857 unique words in the sample as a keyword[19]. To define units for analyses (not to be confused with the pseudo-paragraph *text units* defined in a previous section), exclusion criteria were employed in the identification of relevant keywords that could be analysed on the basis of occurrences by group, and co-

[19] In text analysis using computerised text searches, a target word can be searched for within context and displayed as a key word in context (KWIC) list. The KWIC list is a concordance tool that displays a selected keyword as it appears in context in each text sample. Each ‘occurrence’ of the selected ‘keyword’ is centrally aligned and ordered either by preceding or following text. Consistent with such terminology, henceforth in this thesis the term ‘keyword’ takes the place of the term ‘type’. Furthermore, as meaning in this study is operationalised as the proximal co-occurrence of content words in naturally occurring context, the term ‘occurrence’ takes the place of ‘token’.

occurrences with other keywords. Any information that was extraneous to finding relevant keywords in proximal co-occurrence was either excluded or modified. For ease of identification, all keywords are identified in text in small capitals.

Function Word and Proper Noun Exclusions

The distribution of words within a text provides one aspect of the contextual landscape. Although Nagy, Herman and Anderson (1985) claimed that naturally occurring texts are not especially context rich, distributional information in texts has been validated as a source of lexical knowledge for syntactical (Redington et al., 1998) and semantic information (Levy & Bullinaria, 2001; Lowe, 2001; Lund & Burgess, 1996; McDonald & Brew, 2004; McDonald & Shillcock, 2001), with the contexts of word use being derived from the distribution of either function or content words in proximal co-occurrence.

Function words are commonly excluded in studies where the focus is predominantly semantic content. Function words are high-usage words that have little or no meaningful content but do have grammatical functions. This class of words includes articles, pronouns, prepositions, quantifiers, conjunctions and auxiliaries (e.g. *the*, *a*, *that*, *of*, *and*, *to, because*).

Content words (nouns, verbs, adjectives, adverbs), in contrast, do have meaningful content. Given that a large proportion of English words occur only rarely (i.e. once in 50,000 words), and that this proportion consists largely of content words, it stands to reason that statistical assumptions made for any corpus of words must take these rare events into account (Dunning, 1993). Whereas function words can be usefully studied as markers of emotional states, social identity and cognitive styles (Pennebaker, Mehl, & Niederhoffer, 2003), it is content words that are mostly used in studies of meaning, and that are the focus for the current study.

The WordStat default exclusion list (555 words, Appendix 1b), also commonly known as a stop list, was employed to exclude function words, including articles, prepositions, quantifiers, conjunctions and pronouns. This procedure left only content words (unique keywords consisting of nouns, verbs, adjectives and adverbs) to be analysed.

Of the content words, place names (e.g. Atherton, Babinda, Barrine, Eacham), personal names (i.e. author names) and botanical names (e.g. *Mimosa pudica*) featuring in the keyword list were manually added to the stop list, as were names of months and acronyms that had no semantic bearing on the texts. Exceptions for place names included the retention of those with occurrence frequencies greater than 10 (e.g. AUSTRALIA f = 79 and QUEENSLAND f = 47). Exceptions for acronyms included the retention of those representing the document source groups: CAFNEC, CRC and WTMA.

Lemmatisation

Keyword variations were collated into one keyword form, either back to the canonical base form or the most frequently occurring form. For instance, ACTIVITIES and ACTIVITY were consolidated as ACTIVITY. This decision was based on findings from word recognition studies demonstrating the predictive superiority of lexeme frequency over surface frequency (Taft, 1991); it is the meanings and not the features that are important. However, not all forms were included in this process.

Some keywords were left unlemmatised due to differences in application between groups, or different contexts of use (Lebart et al., 1998). For instance, ACT was left separate from ACTIVITY, as inspection of each instance in context revealed that ACT mostly referred to a written ordinance as legislation rather than the exertion of energy, as referred to by ACTIVITY. Most of the VALU variations were initially retained for the same reason (i.e. different contexts of use), but EVALUATE, EVALUATED, EVALUATING, EVALUATION and EVALUATIONS were combined as the keyword EVALUATE, and VALUE, VALUED and VALUING were combined as the keyword VALUE. As another example, any instances of PROTECT, PROTECTED and PROTECTING were changed to PROTECTION, the most frequently occurring variation of that word.

The need for individual consideration of each word dictated that this task was performed manually, and it is possible that some omissions in reduction occurred. However, any set of keyword variations that together returned a frequency of 10 or over was consolidated into one keyword. At a later stage, the WordStat stemming algorithm converted plurals to singulars and past tense verbs to present tense. This particular algorithm does not alter parts of speech, and is reasonably conservative, so that some plurals were not converted (e.g. JUDGEMENT and JUDGEMENTS).

Phrase and Idiom Combinations

Co-occurrence is a practical indicator of common idioms and phrases, the recognition of which can enhance the understanding of document meaning (Péladeau, 2003b). While examining keywords in context, it became immediately evident that some were co-occurring frequently with other keywords as phrases. As a third step in the reduction phase, the WordStat phrase finder identified the most commonly occurring phrases, and each of these phrases was combined into one keyword phrase. The phrase search terms included a two-word minimum and a six-word maximum. Table 5 shows those phrases with a frequency greater than 15, which formed new keyword phrases.

Table 5

Phrases Meeting the Criteria of a Two-word Minimum and Six-word Maximum

	Keyword phrases	*f*
1	WET TROPICS	113
2	WTWHA[a]	61
3	WORLD HERITAGE	57
4	WORLD HERITAGE VALUES	53
5	CULTURAL VALUES	41
6	NATURAL VALUES	34
7	BIODIVERSITY VALUES	33
8	WORLD HERITAGE AREA	29
9	CONSERVATION VALUE	24
10	ABORIGINAL PEOPLE	23
11	NATURAL AND CULTURAL VALUES	23
12	CAPE YORK[b]	22
13	HERITAGE VALUES	21
14	NORTH QUEENSLAND	20
15	WET TROPICS MANAGEMENT	16
16	CONSERVATION VALUES	16

Note. *f* = frequency

[a] Wet Tropics World Heritage Area

[b] Six instances where CAPE occurred alone were changed to include YORK to be consistent with the referent, Cape York

Each of the individual keywords was also retained wherever it occurred without being part of the phrase. However, the CAPE YORK and NORTH QUEENSLAND combinations accounted for most of the count for at least one of the phrase words. As another example, the combination of WET and TROPICS (*f* = 113) left 17 occurrences of the keyword WET (*f* = 130), but only three occurrences of TROPICS (*f* = 116). A point of note in the phrase frequencies is the difference between the three groups in the combination of premodifiers with VALUES. Whereas WTMA and CAFNEC used HERITAGE VALUES, NATURAL VALUES and CULTURAL VALUES with some frequency, the CRC was alone in the use of BIODIVERSITY VALUES, and less frequent in the use of CULTURAL VALUES, than the other groups.

Part of Speech and Word Sense Exclusions

As a fourth step in the reduction process, part of speech and word senses were taken into account. The focal point of this study was the keyword VALUES in its plural noun form in the real-world context of the Wet Tropics environment. Using the KWIC list, occurrences of VALUES were explored for noun or verb parts of speech in the original lexical context. This exploration identified that all occurrences of VALUES were in the form of common plural noun with the exception of two occurrences in present-tense verb form, which were excluded. Furthermore, VALUES as a plural noun has several senses, or ways to be understood. Table 6 contains inclusion and exclusion examples for the keyword VALUES in context.

Table 6
Examples of Included and Excluded VALUES Occurrences

Sense	Example sentence
Common noun plural (Included)	Block F has the highest conservation VALUES of all the blocks within the Swamp.
Verb (Excluded)	Today, society VALUES both economic stability and environmental health.
Scale/quantity (Excluded)	The rank VALUES for question 2-4 are based on the immediacy of perceived impacts.

In the example given for the sense of scale/quantity, where the VALUES in question are numerical ranks on a measurement scale, the keyword VALUES co-occurs with the keyword IMPACTS. Such a co-occurrence would be treated in analyses in the same way as for a statement such as "IMPACTS on the area's VALUES were severe", even though the meanings in the two statements, and the interrelationships between the keywords, are very different. Occurrences in this instrument reading sense as numerical quantities can thus be considered as 'noise', and nine of the plural noun VALUES occurrences were excluded due to this reference to numerical quantities, which is a clearly distinct application and not of direct interest in this study.

In total, eleven occurrences were excluded from the original VALUES frequency count of 336, and keyword phrase amalgamations (e.g. NATURAL + VALUES, CULTURAL + VALUES) reduced this further, to 106 instances where VALUES occurred without being part of a common phrase. The final count of unique keywords after all exclusion procedures was 2,512 (reduced from 4,857), and the aggregate sample occurrence count was reduced to 16,901 (from 34,747). Table 7 summarizes the distribution of keywords for each of the groups compared with the sample as a whole.

Table 7

Keyword and Occurrence Counts for the Sample and Three Sub-samples

Source	Document count	Keywords		Occurrences	
		Count	Percentage of total[a]	Count	Percentage of total
WTMA	22	778	31%	3,073	18%
CRC	28	1,942	77%	10,801	64%
CAFNEC	18	1,143	45%	3,027	18%
Combined	68	2,512	100%	16,901	100.0%

[a] Keyword percentages for the three groups do not sum to 100, as most keywords were not unique to one group.

The CRC documents contained more than three quarters of the 2,512 unique keywords while the WTMA sub-sample had the lowest keyword count, with those documents containing less than a third of the total unique keywords being represented. The CRC sub-sample also featured the highest proportion of keyword occurrences, which does not seem entirely attributable to the higher document count for that sub-sample (only six more than the WTMA sub-sample) and is perhaps indicative of some burstiness within one or more of the CRC documents. As noted earlier, the word count for the CRC sub-sample was more than three times that for the other two sub-samples, and the CRC mean number of paragraphs per document was also higher. The WTMA and CAFNEC occurrence proportions, mean word counts, and mean paragraph counts, on the other hand, were similar to each other.

If the word count difference came from the type of document alone, this is an unusual finding, as the WTMA and CRC sub-samples both included research reports, information sheets and newsletters. The CAFNEC sub-sample, in contrast, consisted solely of newsletters. It is possible that the WTMA, as a government agency, must be more succinct in its publications, to frame communications suitable for a public audience. The CRC, as a research organisation, also targets a public audience, but largely targets agencies such as the WTMA, who rely on their research information.

As the documents formed a purposive sample of texts representing the written communication of the three groups, the burstiness of the CRC documents is considered as being representative of research rhetoric, which is perhaps by nature more wordy than that required for communicating management-related information and volunteer activism information to the public. The CRC documents contained almost twice the mean number of instances of the target letter string, VALU, compared with the other two sub-samples. The selection of pseudo-paragraphs surrounding each instance of the letter string also helps to explain the higher word count for the CRC sub-sample. Longer sentences are another possibility.

Incidentally, even at this stage, most of the sub-samples conformed to the characteristic type-token identity, with the sum of the TTR and TTR' approximating 1.0. Only the CAFNEC sub-sample did not conform: TTR + TTR' = 1.3, with a TTR' closer to 0.9 than the typically reported 0.8.

Frequency Threshold

Keyword frequency information was required for the first statistical analysis to explore differences between the three groups in the words occurring in connection with VALUES, but the reduction exercise described thus far still left too large a number of keywords for any constructive low-dimensional representations, either as a correspondence map or tree cluster diagrams. Furthermore, the selection of only the most frequently occurring keywords increases the accuracy and power of analyses (Lebart et al., 1998). The setting of a frequency threshold provided a final step to further reduce the size of the keyword list for analysis, and to ensure that words occurring only rarely in this sample were excluded. Figure 3 shows that case and keyword frequency thresholds of 10 occurrences eliminate some higher-frequency keywords that occur in relatively few cases, and similarly eliminates a large number of low-frequency keywords.

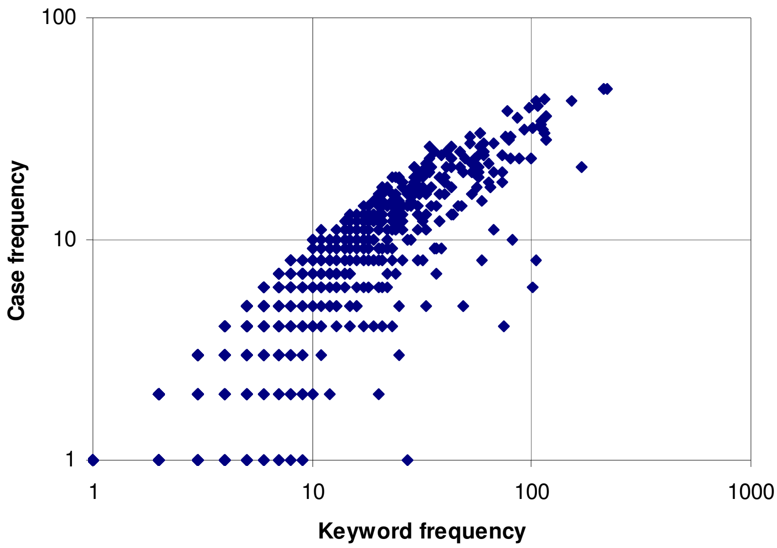

Figure 3. Bilogarithmic scatter plot of keyword and case frequencies for 2,512 keywords in 68 cases.

Nevertheless, as the point of the planned correspondence analysis and its corresponding two-dimensional representation is its descriptive power, a balance between reduction and retention was found with a case frequency threshold set to 15 and a keyword frequency threshold set to 25. This meant that keywords fit the criteria only if they had at least 25 occurrences, and appeared in at least 15 documents. The final 100 keywords are listed in decreasing order of total frequency in Table 8.

Table 8

Keyword and Case Frequencies for 100 Keywords by Group using the Criteria of Keyword Frequency >24 and Case Frequency >14

Keyword	1	2	3	T	C	Keyword	1	2	3	T	C	Keyword	1	2	3	T	C
MANAGEMENT	57	134	31	222	48	SIGNIFICANT	14	36	10	60	25	YEAR	3	21	11	35	21
AREA	72	78	63	213	48	WATER	9	45	6	60	25	EXIST	7	21	6	34	26
SPECIES	5	161	4	170	21	CONTROL	3	55	1	59	15	LONG	7	16	11	34	23
ENVIRONMENT	15	109	29	153	42	COMMUNITY	7	32	19	58	30	NATURAL VALUES	7	10	17	34	20
RAINFOREST	25	86	5	116	28	IMPORTANT	15	38	5	58	26	INCREASE	2	22	9	33	21
REGION	17	78	21	116	36	GOVERNMENT	25	18	14	57	24	LARGE	1	26	6	33	16
LAND	42	43	30	115	43	HABITAT	8	47	2	57	20	UNDERTAKE	7	19	7	33	20
PLAN	32	68	15	115	30	WORLD HERITAGE	42	12	3	57	19	VALUABLE	5	18	10	33	22
WETTROPICS	40	71	2	113	31	WTMA	35	20	2	57	21	RESOURCE	1	20	11	32	19
PROTECTION	27	27	57	111	34	THREAT	6	42	8	56	17	VEGETATION	4	21	7	32	17
IMPACT	35	67	8	110	33	REQUIRE	13	38	4	55	23	LOCAL	4	21	6	31	17
VALUES	26	54	26	106	40	INFORMATION	11	39	3	53	22	NUMBER	4	24	3	31	19
NATURAL	31	49	24	104	42	PROGRAM	1	44	8	53	16	PEOPLE	12	8	11	31	20
DEVELOP	11	70	21	102	32	W H VALUES[a]	41	8	4	53	20	QUALITY	6	23	2	31	16
EVALUATE	7	86	6	99	23	ECOLOGICAL	7	34	11	52	27	REPORT	3	20	8	31	16
PROVIDE	27	58	12	97	39	ECONOMIC	5	33	14	52	29	BENEFIT	4	20	6	30	19
INCLUDE	27	49	17	93	31	PROCESS	12	28	10	50	23	BIOLOGICAL	5	22	2	29	16
FOREST	9	75	4	88	23	SITE	6	35	8	49	20	FUTURE	2	20	7	29	21
VALUE	8	54	25	87	35	EFFECT	5	37	5	47	25	HERITAGE	13	4	12	29	17
LIST	37	42	2	81	23	QUEENSLAND	10	25	12	47	21	STATE	10	13	6	29	17
HIGH	7	55	18	80	29	ACTION	8	25	10	43	17	TERM	8	14	7	29	19
AUSTRALIA	14	52	13	79	28	ISSUE	6	26	11	43	21	UNDERSTAND	7	16	6	29	18
CONSERVATION	29	24	25	78	38	LANDSCAPE	11	23	9	43	23	W H AREA[c]	13	14	2	29	21
POTENTIAL	17	56	3	76	29	RECOGNISED	9	26	8	43	26	AFFECT	8	18	2	28	17
ASSESSMENT	17	46	10	73	24	C VALUES[b]	16	21	4	41	21	CHANGE	1	22	5	28	15
CULTURAL	32	25	16	73	20	ESTABLISH	6	29	6	41	25	BASE	2	23	2	27	16
PROJECT	7	61	5	73	18	IDENTIFY	3	32	5	40	18	ADDITION	7	15	4	26	18
PLANT	10	57	0	67	20	INVOLVE	8	29	3	40	19	ENSURE	11	6	9	26	17
RESEARCH	3	59	5	67	27	RELATE	6	24	10	40	16	NATIONAL	3	15	8	26	18
SYSTEM	0	53	12	65	17	MAKE	5	20	14	39	24	RESULT	5	19	2	26	18
BIODIVERSITY	2	58	4	64	18	PRESENT	5	28	5	38	19	CONTRIBUTE	7	15	3	25	15
NATIVE	6	41	17	64	22	STUDY	2	32	4	38	16	MAJOR	3	19	3	25	19
ACTIVITY	42	14	5	61	27	WORK	6	18	12	36	25						
WTWHA	12	47	2	61	24	SOCIAL	11	16	8	35	17						

Note. 1 = WTMA; 2 = CRC; 3 = CAFNEC; T = Total; C = Case; [a] WORLD HERITAGE VALUES; [b] CULTURAL VALUES; [c] WORLD HERITAGE AREA

As well as retaining the VALU forms EVALUATE, VALUABLE, VALUE and VALUES, the keyword phrases WORLD HERITAGE VALUES, CULTURAL VALUES, and NATURAL VALUES feature in this keyword selection. BIODIVERSITY VALUES did not meet the frequency threshold. The highest number of cases for any keyword is 48 (MANAGEMENT and AREA).

Correspondence Analysis and Results

To explore relationships between the three groups and their keyword usage, a correspondence analysis was performed on the frequency data. It was expected that each group's general focus would be represented in the selection of keywords. That is, it was expected that the WTMA keywords would reflect a government agency environmental management focus, the CRC keywords a scientific research focus, and the CAFNEC keywords a 'green' activism-for-conservation focus.

The keyword and group associations for the 100 keywords are indicated by the numerical values in Table 9, with keyword items listed in alphabetical order. Eigenvalues, representing the variances along the axes, were $\lambda_1 = 0.147$ for the horizontal axis (the column dimension) and $\lambda_2 = 0.079$ for the vertical axis (the row dimension); the total variance of the points configuration was 23%. The percentages of variance explained corresponding to the eigenvalues were 65.1 % for the column axis (representing the groups) and 34.9 % for the row axis (representing the keywords). A test for independence using the chi-square formula[20] (Lebart et al., 1998) indicated a significant relationship between keywords and groups; χ^2 (198, n = 6000) = 1380, $p < .05$, with distinctly different keyword profiles for the three groups.

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[20] The chi-square formula is $\chi^2 = kt$, where t equals the product of *trace t* - the sum of the eigenvalues - and k equals the total frequency count for the 100 keywords.

Table 9

WordStat Correspondence Analysis Statistics for Three Subgroups of the Independent Variable (WTMA, CRC, CAFNEC) and 100 Keywords

Item	Axis 1	Axis 2	Item	Axis 1	Axis 2
Variable coordinates			Keyword coordinates		
WTMA	1.61	1.00	MAKE	0.17	-1.84
CRC	-0.76	0.23	MANAGEMENT	0.14	0.34
CAFNEC	0.69	-2.12	NATIONAL	-0.11	-1.45
Keyword coordinates			NATIVE	-0.40	-1.16
ACTION	0.05	-0.63	NATURAL	0.74	-0.31
ACTIVITY	2.59	2.01	NATURAL VALUES	1.18	-2.81
ADDITION	0.27	0.26	NUMBER	-0.82	0.35
AFFECT	0.06	0.99	PEOPLE	1.76	-1.10
AREA	1.23	-0.74	PLAN	0.23	0.48
ASSESSMENT	-0.02	0.30	PLANT	-1.06	1.21
AUSTRALIA	-0.26	-0.09	POTENTIAL	-0.45	1.09
BASE	-1.24	0.39	PRESENT	-0.67	0.06
BENEFIT	-0.40	-0.50	PROCESS	0.26	-0.21
BIODIVERSITY	-1.55	0.37	PROGRAM	-1.29	-0.41
BIOLOGICAL	-0.65	0.70	PROJECT	-1.13	0.49
CHANGE	-1.09	-0.59	PROTECTION	1.46	-2.82
COMMUNITY	0.00	-1.60	PROVIDE	0.21	0.53
CONSERVATION	1.53	-0.85	QUALITY	-0.54	0.79
CONTRIBUTE	0.20	0.57	QUEENSLAND	0.30	-0.75
CONTROL	-1.60	0.80	RAINFOREST	-0.49	1.03
CULTURAL	1.56	0.18	RECOGNISED	0.02	-0.18
CULTURAL VALUES	0.80	1.06	REGION	-0.39	-0.31
DEVELOP	-0.54	-0.62	RELATE	-0.11	-0.87
ECOLOGICAL	-0.35	-0.60	REPORT	-0.41	-1.09
ECONOMIC	-0.37	-1.18	REQUIRE	-0.24	0.84
EFFECT	-0.92	0.21	RESEARCH	-1.42	0.30
ENSURE	1.94	-0.93	RESOURCE	-0.49	-1.98
ENVIRONMENT	-0.66	-0.51	RESULT	-0.50	0.69
ESTABLISH	-0.52	-0.02	SIGNIFICANT	0.09	0.05
EVALUATE	-1.32	0.49	SITE	-0.61	-0.23
EXIST	-0.04	-0.11	SOCIAL	0.83	-0.24
FOREST	-1.18	0.70	SPECIES	-1.71	0.69
FUTURE	-0.64	-1.02	STATE	0.93	0.02
GOVERNMENT	1.66	-0.04	STUDY	-1.26	0.07
HABITAT	-0.98	0.89	SYSTEM	-1.28	-0.74
HERITAGE	2.36	-1.42	TERM	0.64	-0.46
HIGH	-0.59	-0.84	THREAT	-0.78	-0.10
IDENTIFY	-1.05	-0.04	UNDERSTAND	0.29	-0.26
IMPACT	0.26	1.07	UNDERTAKE	0.13	-0.39
IMPORTANT	-0.06	0.79	VALUABLE	0.10	-1.31
INCLUDE	0.51	0.07	VALUE	-0.33	-1.35
INCREASE	-0.58	-1.31	VALUES	0.46	-0.57
INFORMATION	-0.48	0.90	VEGETATION	-0.38	-0.68
INVOLVE	-0.46	0.73	WATER	-0.68	0.38
ISSUE	-0.15	-0.95	WET TROPICS	0.28	1.63
LAND	1.26	-0.37	WORK	0.31	-1.52
LANDSCAPE	0.39	-0.24	WORLD HERITAGE	2.78	2.39
LARGE	-1.11	-0.63	WORLD HERITAGE AREA	1.05	1.46
LIST	0.94	1.85	WORLD HERITAGE VALUES	3.09	2.30
LOCAL	-0.45	-0.46	WTMA	1.95	2.20
LONG	0.52	-1.33	WTWHA	-0.64	1.07
MAJOR	-0.79	0.13	YEAR	-0.26	-1.59

Note: These keyword coordinates can be used as a guide to locating and identifying the keyword items in Figure 4.

Locations of row and column points within a two-dimensional space are consistent with the tabled associations. Figure 4 is a correspondence map of the space, representing the column and row coordinate units. Axis lines, as the origin, indicate the profile for the entire sample; deviation from the origin indicates differentiated keyword occurrence between the three groups. Columns, along the horizontal axis, represent the keyword profiles for each of the three groups as compared with the distribution for the entire sample of keywords. Proximity to the vertical axis indicates similarity to the keyword profile for the total sample. Those groups plotted near each other share similar profiles of word usage, while distance from the origin indicates a more distinctly individual profile. In this sample, the CRC and CAFNEC profiles are relatively closer to the profile for the total sample (i.e. closer to the vertical axis line) than is the WTMA profile, which is more distinctly different.

The WTMA keyword count was lower (33% of the total, and only 18% of occurrences) than for the other two groups, but it appears that at least part of their keyword profile is also the most distinctive, in that it is not shared with the other groups. The similarity of the CRC sub-sample to the total sample is understandable given the large percentage of keywords (77%) and occurrences (64%) appearing in those documents. The CAFNEC sub-sample, however, contained a reasonable percentage of keywords (46%) relative to a much smaller percentage of occurrences (18%). The difference in spatial locations between the CAFNEC and CRC sub-samples comes from the transition relationships that link the CAFNEC and CRC coordinates in the column space to the row profiles, which illustrate similarities and differences in keyword occurrences for the groups.

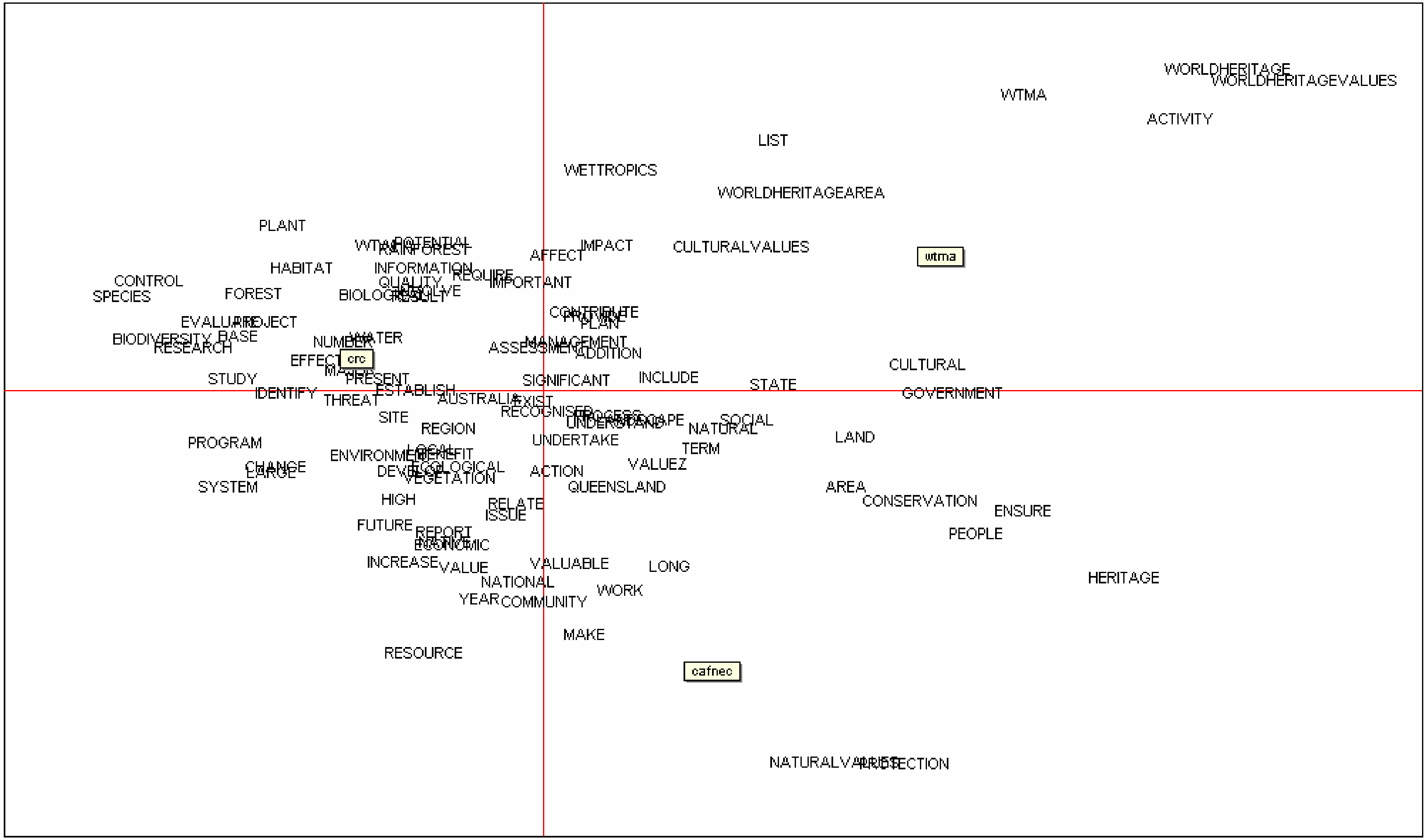

Figure 4. Two-dimensional correspondence map for three subgroups of the independent variable (WTMA, CRC, CAFNEC) and 100 keywords, using a case frequency threshold of 15 and a keyword frequency threshold of 25. (‘values’ was recoded to ‘valuez’ to avoid word stemming from plural to singular)

Row points, on the vertical axis, represent keyword profiles; any two keywords with identical or similar profiles are plotted in, or near, the same vertical position. For instance, NATURAL VALUES and PROTECTION, at the very bottom of the correspondence map, share a similar row profile. The keywords plotted furthest from the centre are those most singularly associated with the group closest to those words. NATURAL VALUES and PROTECTION are more singularly associated with CAFNEC than the other two groups, in that their occurrences are more frequent in that sub-sample of documents than in the WTMA or CRC documents. Keywords clustered near the central point share distributions more evenly among all three groups.

Those keywords sitting along the horizontal axis line - IDENTIFY, ESTABLISH and GOVERNMENT - have profiles similar to the profile for all keywords in the sample, and yet the transition relationships linking these points in the row space to points in the column space reflect the differences in group association. GOVERNMENT, for instance, is more aligned with the WTMA profile than with the CRC profile, which could be expected given that the WTMA is a government agency. In contrast, IDENTIFY and ESTABLISH are more closely aligned with the CRC profile, and reflect the CRC research focus.

As it should be, given its importance in the text selection process, the keyword VALUES is a part of the central cluster of words that are proximal to both the row and the column axes. Although the keyword VALUES is of central interest to this study, the galaxy of words surrounding this keyword reveals similarities and differences in vocabulary between the three groups, which were expected to be indicative of some differences in the applications and meanings of the target word, VALUES.

Discussion

Correspondences provide evidence that, although the groups do share a vocabulary, there are also some between-group differences for those keywords occurring in association with VALUES. Omissions also provide some insight into the nature of the shared vocabulary. Of note is the lack of any keywords with strong negative connotations. Keywords such as THREAT, IMPACT, AFFECT and EFFECT are all words with the potential to indicate negative consequences, but there is no clear indication of such reference from this type of analysis. The cluster analyses described later in this chapter provide more information about words that co-occur with these and other keywords, which gives more insight into this type of thematic relationship.

As a generalised interpretation of a correspondence map, keywords further removed from the origin have more singular distributions for the group they are plotted closest to. Correspondence map keyword profiles show similarities between the WTMA and the CAFNEC sub-samples on the horizontal axis, with a clear distinction between these two groups and the CRC sub-sample, located on the far left side opposite to the other two groups. On the vertical axis, however, the CRC shares a profile with the WTMA in the upper quadrants, with the CAFNEC located in the lower right side quadrant. Each of the groups has its own distinctive keyword profile in addition to the set of keywords shared by other groups, and these are now discussed.

Group Keyword Profiles

The keyword phrases WORLD HERITAGE and WORLD HERITAGE VALUES, along with ACTIVITY, WTMA, LIST, WORLD HERITAGE AREA and CULTURAL VALUES are characteristic of the WTMA profile. The inclusion of WORLD HERITAGE VALUES and CULTURAL VALUES in different locations suggests that the two values ‘types’ have different external object referents, although there are no direct concrete-referent keywords to suggest what these might be.

In contrast to the very abstract WTMA profile, keywords aligned more strongly with the CRC profile include PLANT, HABITAT, FOREST, CONTROL, SPECIES, EVALUATE, PROJECT, BASE, BIODIVERSITY and RESEARCH. While no 'values' types appeared in the CRC profile under the existing threshold criteria, BIODIVERSITY VALUES featured as a keyword phrase exclusively for the CRC, and it is physical environmental referents that predominate in the CRC vocabulary. This aligns with the expectation that CRC keywords would reflect the CRC focus on research within the Wet Tropics environment. A plausible explanation for a more concrete vocabulary is the scientific tendency towards operationism, addressing the need for observable behaviours, characteristics, or events.

Keywords that are more clearly characteristic of the CAFNEC profile include NATURAL VALUES, PROTECTION, HERITAGE, PEOPLE, ENSURE and CONSERVATION. These keywords together reflect the identity of CAFNEC as a community-based organisation whose interests include environmental conservation and protection through activism. The 'natural values' referred to by this group do appear to have environmental object referents, in that the group's interest is in conservation of the environment. Nevertheless, the inclusion of PEOPLE and HERITAGE in the keyword profile suggests that it is not the environment, per se, that is of sole importance to this group. The idea of stewardship emerges from the keyword collection, with the ideas of defending against loss, and the wise use of natural resources, found in PROTECTION and CONSERVATION. HERITAGE, as practices, attributes or material possessions passed from ancestors and on to future generations, is another keyword that enforces this theme. Stewardship in such a sense is akin to that described in

Smith's (2001) summary of ethnographic research concerning Australian Aboriginal people's perspectives on property. There is a condition of trust that people will care for the land now and for future generations. Kluckhohn and Strodtbeck's (1961) suggestion that relationships between humans and the natural world are the bedrock of culture and cultural differences, and also at the core of what 'values' are, has resonance here also.

Shared Vocabulary

These characteristic group profiles show differences in application, but the cluster of keywords central to both axes show a vocabulary overlap. That is, the groups do employ a similar vocabulary when discussing 'values' in the plural noun form, and this vocabulary is not encompassing of generalised referents to 'values' as attitudes, beliefs, or principles. However, this vocabulary goes only a small way to answering the question of what the 'values' are, as the keywords are largely abstract terms rather than itemised features or attributes of the environment, or of people. The CRC sub-sample does contain keyword nouns[21] with strictly concrete, external referents such as FOREST, RAINFOREST, PLANT, WATER and VEGETATION, and this probably reflects the scientific focus on the biophysical environment and associated biological and ecological processes. Less concrete referents include SPECIES, BIODIVERSITY and RESOURCE, but these keywords still connect 'values' to the external world rather than in the hearts or minds of people.

The CAFNEC sub-sample characteristic keyword noun referents are more abstract; for instance, CONSERVATION, HERITAGE and PROTECTION, along with NATURAL VALUES, LAND and PEOPLE are the more concrete keywords for this group. What is not clear from this type of analysis is, if natural values are to be protected, if

[21] The previously explained process of lemmatization was taken into consideration for the discussion of noun and verb keywords. It is the general difference in use that is important.

this includes people as protected or as protectors. A close search using the KWIC list, with PROTECTION as the target keyword, suggests that the CAFNEC considers people predominantly as protectors, whereas the WTMA discusses protection as one of its management duties. In contrast, the CRC considers people among various environmental threats.

The CRC view appears to be shared by the community of the Wet Tropics bioregion at large. A community survey of perceived threats to the WTWHA (Bentrupperbäumer & Reser, 2006) reported that humans were perceived as the second most serious threat, after a combination of feral animals, plants and pests. Of course, feral species are the result of human activity, and 98% of replies were about human-caused impacts and threats, compared with 2% relating to natural hazards and disasters.

The perspective evidenced in the CAFNEC and WTMA documents is possibly due to a shared identification with concerned people wanting to ‘do their bit’ to protect the environment. This is particularly likely for CAFNEC, with their focus on environmental advocacy and activism, but is also likely to a lesser degree for the WTMA, with their focus on managing the WTWHA for the benefit of all people.

Similar to the CAFNEC documents, the WTMA sub-sample contains abstract *noun* referents, including WORLD HERITAGE, WORLD HERITAGE VALUES and ACTIVITY, along with CULTURAL VALUES, and the less-abstract LIST and WET TROPICS. Apart from reflecting the WTMA focus on managing the Wet Tropics World Heritage Area, stemming from its World Heritage listing, this keyword profile is not helpful in defining ‘values’ as understood by this group.

Examination of the keyword *verbs* reveals that the majority are in the shared vocabulary of all three groups, while some are characteristic of the CRC sub-sample.

For instance, keyword verbs characteristic of the CRC sub-sample profile include CONTROL, EVALUATE, RESEARCH (as expected given this group's research focus), STUDY (clearly related to research), IDENTIFY, PRESENT, ESTABLISH, INVOLVE and REQUIRE. In fact, all the keyword verbs in the CRC profile are arguably research-related. The CAFNEC sub-sample has ENSURE, MAKE and WORK in its characteristic keyword profile, and the WTMA sub-sample has no keyword verbs fitting the frequency threshold criteria.

Although the CRC and CAFNEC profiles did conform to the expectations that they were focussed respectively on research and conservation (these featured as keywords strongly aligned with the respective groups), the WTMA profile did not conform to the expectation of a focus on management. The keyword MANAGEMENT in fact sits within the central galaxy of keywords, indicating shared use by all three groups, albeit more particularly the CRC and WTMA. No other keywords in the WTMA profile indicated anything related specifically to management. However, in a correspondence map produced using less stringent thresholds[22] (i.e. case and keyword frequencies set to 10, as in Figure 5), the keywords REGULATE (arguably management-related), AGREEMENT, ABORIGINAL and ABORIGINAL PEOPLE featured as distinctive of the WTMA profile.

[22] The correspondence map using the less stringent thresholds was created first, and rejected in favour of the map forming the topic for the bulk of this discussion. The original map was included retrospectively to better illustrate the nature of the total sample, and the relative density of the CRC sub-sample of keywords.

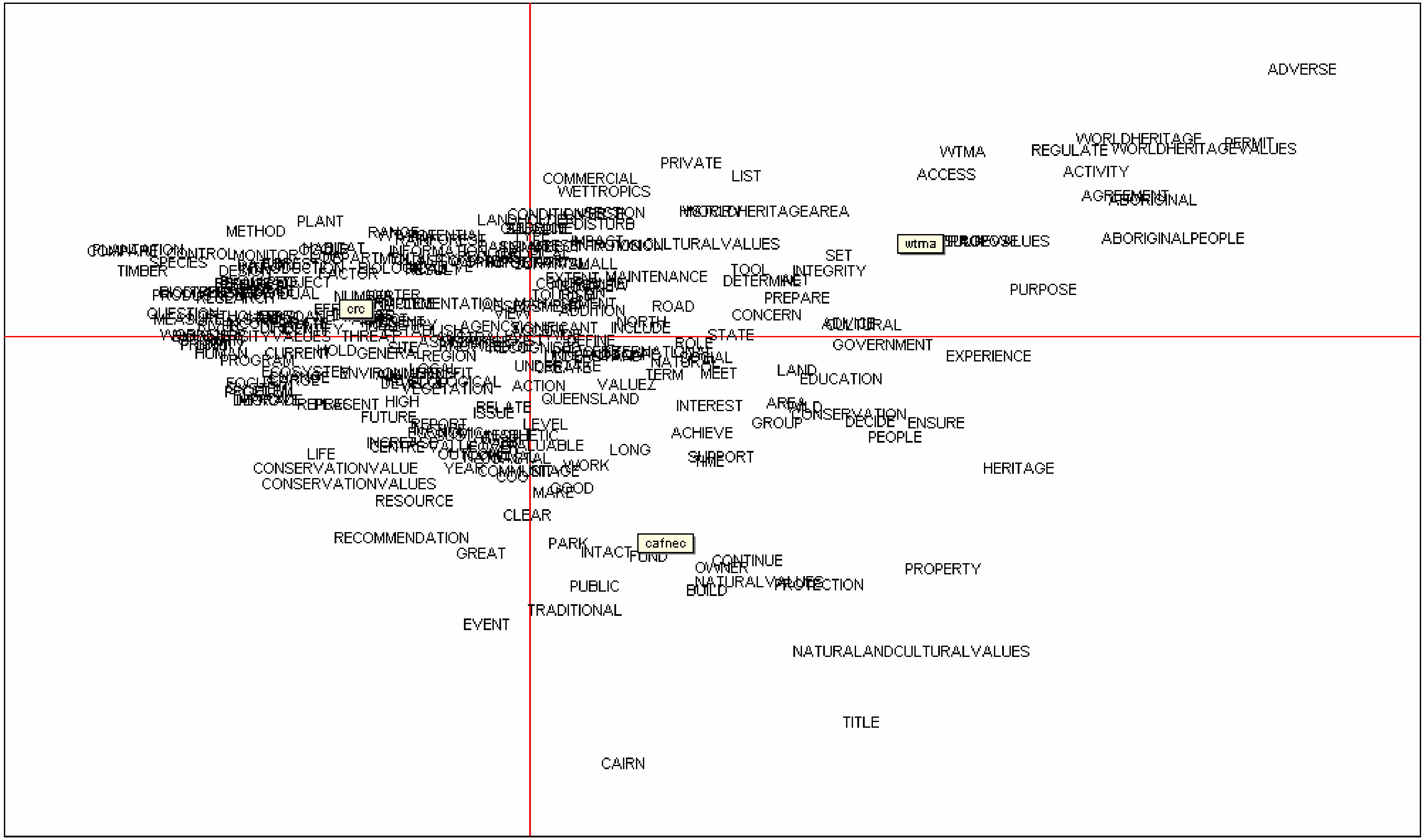

Figure 5. Two-dimensional correspondence map for three subgroups of the independent variable (WTMA, CRC, CAFNEC) and 246 keywords, using case and keyword frequency thresholds of 10. (Note that ‘Cairns’, the name of a town in the Wet Tropics region, appears as ‘cairn’ as a result of the word stemming procedure)

Some of the keywords most distinctly associated with the CAFNEC profile represented in Figure 5, that were cut off under the more stringent frequency thresholds (Figure 4), are PROPERTY, NATURAL AND CULTURAL VALUES, and TITLE (referring to the Native Title Act, which recognises and protects the rights and interests of Indigenous Australians and Torres Strait Islanders according to traditional customs). These keywords reinforce the integrated nature of the CAFNEC keyword profile, with people and nature given dual consideration. Although CONSERVATION VALUE and CONSERVATION VALUES appear to feature in the CRC column profile in Figure 5, they are actually drawn away from the origin by the transition relationships that situate them more closely with the CAFNEC profile.

Applying the more liberal thresholds also enhances the keyword density in the CRC sub-sample. Compare the keywords around the CRC on the upper left side of Figures 4 and 5. The burstiness phenomenon identified in the CRC documents meant that the majority of the keywords are associated most strongly with that group.

The relative keyword density of the CRC documents shown in Figure 5 is noteworthy for its helpfulness in describing the nature of the sample. The benefit from showing the denser map lies purely in this descriptive power, as the overlapping of keywords on the map adds to the complexity of any interpretation instead of enhancing any understanding of ‘values’. The more stringent keyword and case frequency thresholds of 25 and 15 respectively, while resulting in fewer keywords, provided a more informative correspondence map (Figure 4) on which individual keywords could be distinguished, particularly in the CRC section of the map.

Document Examples

The important role of interpretation in making sense of statistical outcomes was foreshadowed earlier. Keywords employed by the groups remain abstract lists of words if they are divorced from their contexts. A closer reading of the individual documents (i.e. in their original context) revealed the following differences between the groups. The research-oriented group, the CRC, appears to adopt an operational language in discussing environmental values. The other two groups, in contrast, are apparently less clear in their writing, and thus more referentially indeterminate in their applications of 'values'. Such use appears to be driven by the group agendas to some extent. Contrast the scientific workplace milieu and its culture of precision with the workplace milieu of the environmental campaigners, where emotive rhetoric is more commonplace and accepted. Even though scientists share the public reverence for the natural environment (Vining, 1992; Vining & Tyler, 1999), it is not reflected in the scientific writing studied in this text sample. Similarly, as a management agency, WTMA is constrained in the extent to which individual managers are able to express reverence for the natural world. It is more within the characteristics of the CAFNEC, the community volunteer organisation, that emotive expression can be expected.

Amongst the differences, there was also evidence of a shared vocabulary, and the management, research, and conservation groups clearly share the goals of protecting and conserving environmental features, albeit for slightly different ends. Values appear to be largely associated with natural resources for all three groups, but indications of an affective component integrated with the biophysical features suggests that human evaluation is an overarching consideration for many of the various senses of values.

For example, there is a connotation of preference in many understandings of values, as seen in the CAFNEC emphasis on ‘natural values’. CAFNECs *Ecotone* newsletters discuss a range of environmental campaigns the organisation is involved with, or that have features relevant to their group culture as environmental protectors. On a broad scale, the group recognises the benefits of natural areas being associated with economic worth because the outcome is preservation of the ‘natural values’. This theme is exemplified in the quotations, both from co-ordinator’s reports, but four years apart [all italics within the quotations are added here for emphasis]:

> In an economic system where an old growth forest is *valued* only for the *value* of its timber, and not for its *values* as a habitat or its contribution to the water cycle, or even its *value* as a place to rejuvenate the spirits, there is little incentive for the market place to protect these rapidly dwindling triumphs of evolution. (Rainbird, March, 2004, p. 3 2004)

> This fundamental obstacle will continue to hinder progress towards greater levels [of] environmental protection. There is an urgent need amongst the broader conservation movement to rationalise this situation and begin recognising and assessing *natural values* and protected areas for their economic benefit to the community and the regional economy. This in no way means allowing the idea of multiple resource abuse in combination with pockets of conservation, but providing an *economic value* on the high level conservation and management of entire landscapes, both terrestrial and marine. In Far North Queensland there is already immense local and regional economic benefit from protecting *natural values* and resources. If used properly, this is potentially a very powerful tool to extend and improve protection of *natural values*. (Boer, October, 2000, p. 2 2000)

Economic value and *natural values* appear to be separate concepts for the CAFNEC, and natural values appear to be those inherent in the biophysical landscape and its natural processes.

Harré, Brockmeier, and Mühlhäusler (1999) noted that there are at least four possible distinctions in the Greenspeak use of ‘nature’ and ‘natural’: natural/artificial; organic/inorganic; rural/urban; and wilderness/peopled. Most such distinctions are potentially implicated in the phrase ‘natural values’, as it is difficult to find what it is in the Wet Tropics context of the text sample that could be ruled out except for the organic/inorganic distinction. As the natural values are to be protected, 'natural' takes on a positive connotation, and one interpretation is that natural values do not include the negative connotations that rest in the words 'artificial' (alien, or imposed by humans), 'urban' (unnatural, so valued less) or 'peopled' (the idea that the existence of people creates an artificial environment). PEOPLE is another CAFNEC keyword, as is HERITAGE, which suggests an eye to the future. It is thus likely that the wilderness/peopled distinction of 'natural' has relevance in the Wet Tropics context, with a preference for the conservation of uninhabited areas that are relatively free of human interference within the WTWHA in order to preserve the rural/urban contrast.

The desire to preserve and protect landscapes for their own sake, as well as for their role in regulating the quality of human habitation, highlights the integrated focus on people and their environment for the CAFNEC group. The CAFNEC emphasis on the people-environment interaction implies an affective component within the meanings of 'values'. The importance of cultural connections with the environment for Indigenous people, and a respect for that relationship, perhaps forms an analogy for how other locals hold the environment in high esteem, as a culturally shared landscape connected with a sense of place. Nevertheless, the CAFNEC also appears to appreciate the need for economic consideration of natural resources as a means for protecting the resources for more intrinsic reasons. They are strategic in their exploitation of the economic sense of meaning by which 'values' can be understood, in order to further their primary agendas of environmental conservation and protection. It is plausible that some members of the CAFNEC strategically align themselves with the Indigenous cause and attempts to gain Native Title, thus consciously exploiting the different meanings of values in order to further their own causes. Consider the following example:

> The whole system is a refuge for threatened species. On the northern New South Wales section of the Paroo overflow lakes, including Peery Lake, valuable stone resources made the area an important focus of aboriginal life for many thousands of years. Known aboriginal sites in the area have revealed bone middens, quarries and specialized stone tool workshops. This agreement is of huge significance to the protection of wild and natural rivers all over Australia. The recognition that the Paroo received to protect its high conservation value should now also be implemented across the remaining wild and natural rivers of Queensland and Australia now. We urgently need to protect the remaining wild rivers from the degrading processes of land clearing and dam building and move into the future of sustainable water management in Australia. (Cordner, September, 2003, p. 8)

Here is a calculated reference to a precedent for environmental protection due to Indigenous connections with an area. Concrete evidence of human ‘existence’ and use of natural resources (i.e. bone middens, quarries, stone tool workshops) has not in this case interfered with the notion of the area in question as ‘wild’ and ‘natural’. In contrast is the idea of human ‘interference’ leading to land and water degradation, intimating that under such conditions the land will neither be wild nor natural. While the CAFNEC makes use of the natural/artificial distinction, the dichotomy is itself clearly an artificial one, as every part of the natural environment arguably bears some connection with human existence (Harré et al., 1999). It appears that at least some members of the CAFNEC recognise the benefits of strategically framing their environmental messages to align themselves with the dominant and respected socioeconomic discourse of the scientific community. Such strategic re-framing notwithstanding, “while many environmentalists are scientists, and the concerns of many environmentalists are rooted in science, the concerns of environmentalists (and others for that matter) tend to be multi-faceted – and not limited to scientific issues” (Tindall, 2001, p. 64).

The broader discourse (i.e. external to this study) relating to cultural heritage values is anyway mired by the interchangeable use of ‘values’ with ‘assets’ and ‘preferences’, as in Rolfe and Windle’s (2003) study using a stated preference technique to estimate non-use ‘values’ for protecting cultural heritage sites. For instance, Rolfe and Windle noted a total of 2,724 identified places containing ‘Aboriginal heritage values’ (i.e. rock art, rock and stone artefacts, etc.), and yet discussed differences between the general and Aboriginal communities as ‘negative values’ or ‘positive values’ (expressed as preferences for either environmental or cultural heritage attributes). Rolfe and Windle’s study is important in showing that the general population (in Rockhampton and Brisbane) is concerned more about environmental issues (specifically attributes such as healthy vegetation in the floodplain, waterway health, and unallocated water i.e. not allocated to irrigation) than about protecting Aboriginal cultural heritage, whereas the Rockhampton Indigenous community were more concerned for cultural heritage than the water-related attributes. However, if the Rolfe and Windle study is, indeed, “the only published attempt to estimate non-use values of indigenous cultural heritage protection in Australia and possibly the world” (Venn & Quiggin, 2007, p. 336), it is unfortunate that it makes the meaning of ‘values’ even fuzzier.

In some contrast to the CAFNEC discourse, the CRC stands somewhat apart with their pragmatic focus on the economics of the environment, and their interest in trees as crops and for industry, as well as the need for the protection and conservation of trees in their wild state. CRC documents, stemming from research conducted within tropical rainforest areas and on land adjacent to these areas, acknowledge traditional and current plantation practices among the many topics they cover. The changing economic dynamic from traditional timber production to tourism and cultural considerations features in one example. The profitability versus productivity dilemma is discussed in workshop proceedings, with attention to public willingness to plant timber species for the protection, conservation and maintenance of natural areas. The following quotation is an example of this theme:

> During the past two centuries there have been large shifts in attitudes to Australian rainforest timbers and their source forests: from felling native forests towards growing plantations; from viewing forests and plantations as mainly providers of timber to viewing them as sources of multiple benefits (timber, biodiversity, carbon sequestration, catchment protection, others); and from timber plantations being developed mainly by government on public land towards those established by private citizens or companies on freehold land. Intact rainforests, which were once viewed as either a source of timber or a source of fertile land for agriculture, are now widely recognised for their *environmental and social values* [italics added]; as places of beauty and grandeur that are especially rich in species of flora and fauna, and which play a role in local and global climate regulation. (Erskine & Catterall, 2004, p. 9)

The example is one instance where attitudes are taken into consideration; note that *environmental and social values* are integrated in a description that includes aesthetic characteristics (beauty and grandeur) and biophysical characteristics (flora and fauna, and climatological processes). In the World Heritage inscription context, aesthetic characteristics are integral to the outstanding universal attributes of the WTWHA, and this is one of the potentially problematic features of such discourse.

‘Aesthetics’, like ‘values’, is another ambiguous topic in environmental discourse (Botkin, 2001; Daniel, 2001; Lee, 1994; Tindall, 2001), for it has both physical and psychological origins. Beauty, as a psychosocial construct relating to human response and appreciation, is also directly related to biophysical attributes. As for landscape beauty, it is an increasingly accepted premise that beauty equates with ‘unmarred by human activity’ (Botkin, 2001), referred to in this quotation as ‘intact rainforests’. In this sense, beauty is not so much tied to visual stimuli but to an ideal, which is an implicit link to human values as underlying preferences (Tindall, 2001).

‘A world of beauty’ – an item in Schwartz’s *Universalism* value type – also reflects the aesthetic issue. Although Schwartz did not directly suggest, and nothing in the stated intentions of his studies implies, any emphasis on environmental issues, or of the environment as central to the universal needs, requisites, and requirements of humans, his *Universalism* type was described as an “understanding, appreciation, tolerance, and protection for the welfare of all people and for nature” (1994, p. 22). Other *Universalism* items include ‘protecting the environment’ and ‘unity with nature’, which indicates at least some acknowledgement of the importance of the human connection to nature.

The CRC, as a scientific research organisation, understandably restricts their publications to scientific issues, even though many scientists are also environmentalists. Public credibility of environmental issues is desirable, which is another reason for framing such issues in scientific terms (Tindall, 2001). The CRC focus on scientific research is evident in the following quotation:

> However, plantations that are designed and managed to optimise economic returns from timber sales may have a limited ability to provide the habitat structure and resources needed by many of the flora and fauna species that are characteristic of intact rainforest. How much contribution can timber plantations really make to sustainable regional biodiversity? To answer this question requires scientific research based on methods that allow quantitative measurement of *biodiversity values* [italics added], used to compare measured biodiversity outcomes across a spectrum of different plantation styles. (Erskine & Catterall, 2004, p. 9)

The quotation again highlights the many confusions surrounding just what these expressions do mean, and indicates that a more suitable term than ‘values’ might be applicable. In this instance, the quantification of the ‘biodiversity values’ is the focus of the research. The problem with such quantification was raised earlier, in the discussion of an undue reliance on operationism, and a belief that words, or the constructs they represent, are things. The ‘values’ are not in this instance assigned economic worth, as is sometimes attempted as a quantification in human socioeconomic or ecosystem services terms. Instead, biodiversity values here appear to be perceived as integral to the preservation of flora and fauna, which suggests reference to the biophysical environment. Whether the flora and fauna are economically valuable, or their inherent value is acknowledged, is not clear. Aspects of values that some would argue are universally important and not quantifiably measured are precluded in this type of use, where the actual referents are probably attributes or properties of the biophysical environment – the flora and fauna – and the processes involved in their continued presence within the ecosystem. Of course, what adds to further confusion is that ‘biodiversity’ is a relatively new term, coined as recently as 1985 (Faith, 2007). Like ‘values’, biodiversity is another ill-defined word that is expected to carry a complex semantic load as an emotive buzzword (Callicott et al., 1999) that some take to mean ‘everything’ (Faith). The dominant ‘voice’ of the CRC as a scientific organisation articulates a socioeconomic mindset that is possibly driven to some extent by the need for economically measurable outcomes to justify government funding of the CRC. The socioeconomic emphasis facilitates notions of ‘value’ as economic worth or contingent valuation, so that the connection between values and biophysical attributes becomes measurable as biota inventories or instrument readouts. However, the CRC, too, recognise the importance of Indigenous culture, and ‘cultural values’:

> Rainforest Bama, private landholders and local governments also play roles in the management and presentation of World Heritage values. There are more than 16 Aboriginal traditional owner groups with ongoing traditional connections to land in and near the Wet Tropics. These places, usually referred to as 'story places' (natural features such as mountains, rivers, waterfalls, swimming holes, trees) are parts of the Wet Tropics landscape that are important to Rainforest Bama as they symbolise features that came into existence during the ancestral creation period (sometimes called the 'Dreaming' or the 'Dreamtime') (WTMA: 2000). These places have powerful meaning and

> properties to traditional owners and hence these cultural values need to be managed and protected. (Ignjic, December, 2001, pp. 4-5)

Interestingly, and somewhat ironically, for traditionally-oriented Indigenous communities there is arguably little meaningful distinction between the ‘natural’ and the ‘human’ environment, and the larger environment is understood and related to as a living, breathing sentient being and system (e.g. Reser, 1992, 1993; Rose, 1996). Hence the matter of where values reside becomes particularly intriguing (e.g. Reser & Bentrupperbäumer, 2005). However, it is not only Indigenous people who talk about cultural values. When ‘cultural’ is used as an adjective of ‘values’, particularly in the context of cultural World Heritage values, the invoked and elicited domains of meaning and reference change appreciably in a Western cultural context. Indeed, the term ‘cultural heritage values’ clearly and logically also encompasses the values and sentiments of generations of non-Indigenous residents and cultures.

Some of these considerations clearly go beyond the scope of the present thesis, but are without question very important matters, and of particular relevance to effective protected area management in Australia. It is therefore worth briefly exploring various senses of ‘cultural’ and ‘cultural values’ through the quotations of the organizations. To explore the meanings implied by the uses of the keywords CULTURAL and CULTURAL VALUES in the relevant texts, it is necessary to distinguish between several senses, as Harré et al. (1999) did with ‘natural’. Uses of ‘cultural’ in the Wet Tropics context suggest distinctions such as cultural/natural; civilized/uncouth; artistic/scientific; or intellectual/philistine. The contrast between ‘cultural’ and ‘natural’ is related to the idea of nature as unpeopled wilderness, and there is potential for conflict between natural and cultural priorities:

> Proper management of cultural values does not necessarily conflict with management of the natural values, but management of the latter without

> consideration of the former can, and has, resulted in the destruction or degradation of the cultural values. (Pannell & Horsfall, March, 2002)

A distinction of 'cultural' as the difference between the civilized and the uncouth reverses the affective polarity, with civilization positively associated with the idea of people in control, in contrast with the negativity implied in the crudeness or rawness of the untamed, or uncouth. It is less likely that the artistic/scientific or intellectual/philistine distinctions are relevant in the Wet Tropics context, at least in those texts studied. The importance of 'cultural values' in many of the texts is linked with the WTMA's role as managers of the area, and their interests in maintaining links with the Indigenous owners.

Another dimension comes from the Indigenous owners, who seek to maintain their connection with the Wet Tropics through sharing knowledge and taking an active role in the management of their interests:

> The consultations undertaken for this project confirmed that Rainforest Bama valued tourism for economic and cultural purposes. Tourism operations can provide businesses, employment and training opportunities for Aboriginal people as well as cultural transmission and education and enable traditional owners to fulfil their land and cultural resource management responsibilities… It also enables Aboriginal people to manage country and transmit stories and cultural knowledge on to future generations. The relationship of Rainforest Bama to their land comprises ecological, social and cultural values. Whilst the Wet Tropics were home for Rainforest Bama for thousands of years before, access to country since colonisation and dispossession has often been limited. (Ignjic, December, 2001, pp. 8-9)

As for the meanings of 'values' for the WTMA, they are probably more restricted than for the other two organisations, with references predominantly tied to World Heritage listing of the Area for its outstanding universal significance. Many of the WTMA documents are intended as guidelines and strategies for their management practices; they list and describe World Heritage-relevant 'values'. The documents also outline co-operative management strategies involving Rainforest

Aboriginal peoples, and some of the newsletters are produced by, or in conjunction with the Rainforest Bama (people), one of the Wet Tropics stakeholder groups. The quotation (from *Interim Protocols for Aboriginal Participation in Management of the Wet Tropics World Heritage Area*) is included as an example of the type of discourse regarding WTMA interaction with Indigenous Australians and their involvement in management activities:

> Ensure that Aboriginal people participating in a project have a clear upfront understanding of what the project is about including the broader context and planning framework of the project.
>
> Where consultants are engaged to carry out impact assessment discuss this aspect with the relevant group and give consideration to involving Aboriginal people in the selection and management of the consultants, particularly where *cultural values* [italics added] are involved. (Wet Tropics Management Authority, 1998).

Other WTMA documents are more generally informative in nature, as in their series of Information Sheets:

> Landholders with ordinary freehold title within the Wet Tropics World Heritage Area are provided with special exemptions under the Plan. It is the intention of the Wet Tropics Management Authority to work together with landholders in the Area to help conserve its *values* [italics added]. The Authority wishes to minimise any disruption to the activities of landholders in implementing the Plan, and to provide all necessary support and advice to assist landholders where a permit is required. (Wet Tropics Management Authority, n.d.)

This is one more example of problematic language use, where ‘values’ appear to be a part of, or characteristic of, the WTWHA, rather than an idea in the minds of people.

The WTMA are more restricted to legislative language in their management of the WTWHA as a resource, and in the administration of restrictions and permissions for activities within the Area. As stewards of the WTWHA, they are bound by government legislation. Nevertheless, the WTMA must also work in management partnerships with the various stakeholders, in particular the Indigenous landowners, and are morally bound to consider their cultural connections to the land. While talking about cultural 'values', the WTMA also introduces the concept of 'living cultural landscapes', which arguably provides a superior representation of what is being protected to that suggested by 'cultural values'. An emphasis on 'cultural heritage' is further suitably referential to Indigenous people's long-standing, ancestral connections to the region.

Connotative meanings of 'values' in many cases conceivably stem from consideration of the WTWHA as a 'natural resource'. This idea goes hand in hand with the notion of stewardship (Harré et al., 1999), which involves the management of nature as well as the management and maintenance of Indigenous ties to the land. Indeed, MANAGEMENT, CONTRIBUTE and ASSESSMENT are keywords common to all three groups, but particularly to the research and management groups. Each of the example quotations is but one part of the general discourse of the respective group, but they correspond with the themes of customary practice emerging from the correspondence analysis and do not stand alone in this representation; they merely exemplify the group themes.

Additional support for the thematic differences of the various discourses in the sample was provided from cluster analysis, which is commonly used in conjunction with correspondence analysis. While the latter illustrates the distributional 'space' of the keywords, cluster analysis, which measures proximal co-occurrences of keywords, better illustrates relationships between keywords through their strength of association.

Cluster Analysis and Results

Frequency of occurrence in the text indicates only one facet of the habitual applications of VALUES and associated concepts for this set of keywords. To further explore the application of the keyword VALUES, together with related concepts within and between the groups, a relational analysis was conducted, this time using proximity as a distance (and association) measure (Aldenderfer & Blashfield, 1984). The clustering technique was employed to search for structures inherent in the text without imposing structure according to pre-conceived expectations (Greenacre, 1984). Hierarchical cluster analysis on all keywords and groups produced dendrograms, which are hierarchical tree graphs that illustrate how clusters of keywords are associated with each other or, alternatively, how independent they are from each other.

Cluster analysis is merely heuristic in nature, and different measures (along with other parameters) will result in different solutions (Aldenderfer & Blashfield, 1984). Levy, Bullinaria and Patel (1998) found Euclidean distance and cosine measures of semantic distance (in semantic categorisation) to be inferior to city block, Kullback-Leibler and Hellinger measures. However, there are several precedents for the selection of Euclidean distance as a similarity measure, and it is widely employed in studies of semantic and psychological space (Heady & Lucas, 2006; Huckle, 1995; Lund & Burgess, 1996; Lund, Burgess, & Atchley, 1995; Lund, Burgess, & Audet, 1996; Tversky & Hutchinson, 1986). For the current study, two different similarity measures were employed in cluster analyses: Jaccard's association coefficient and cosine theta, a normalised Euclidean distance measure (Péladeau, 2003b). The two measures were chosen as appropriate for use with a small corpus, in that the resulting clusters would indeed reflect some manner of the psychological ‘reality’ within the texts. Thematic consistency and coherence were used as guides to the interpretation of this reality.

Window Size to Measure Co-occurrence

Whatever the measure of similarity, a window size must be specified to properly define co-occurrence. A ‘window’ is specified as a set number of words either side of a target word. The window is moved across the document to find words that co-occur with the target word within the specified limits. For the current analysis, meaning was operationalised as the relationships between words, as their co-occurrence in a defined window of words.

A window can be any width; expanded to an entire document as for Latent Semantic Analysis (Landauer, Foltz, & Laham, 1998), or reduced to one or two words either side of a target word (Redington et al., 1998). Whatever the window width, co-occurrence is measured as the number of words occurring between the pair of words that are said to co-occur. For a window of one word (i.e. one word either preceding or following a target word), there would be no other words between the pair under consideration, which is informative for studies of syntax. Lund, Burgess and Audet (1996) and McDonald (2000), in studying semantic space, chose a window size of 10 words; that is, five words before and after each keyword. Levy, Bullinaria and Patel (1998) suggested that for some measures of semantic distance (e.g. Kullback-Leibler or Hellinger) the optimum window size for models of semantic space is 14 words (seven words each side of the keyword). In contrast, Huckle (1995), using a Euclidean distance metric, found no clear differences in dendrograms produced in cluster analyses using window sizes of one, five, and 25 words either side of a target word.

Taking Huckle's findings into consideration, in addition to the size of the corpus and the distance measure being used, for the current study the window size was set at a text unit (i.e. a pseudo-paragraph) to retain as much context as possible, while minimizing the intrusion of irrelevant information. All co-occurrences were thus considered as part of the naturally occurring values-related context in which they were selected.

A keyword co-occurrence matrix was formed for each group. Each matrix was analysed using the two different measures chosen as indices of similarity. Jaccard's coefficient omits joint absences and weights co-occurrences and singular occurrences equally, while cosine theta measures the cosine of the angle between two vectors. Indices for both measures range from zero to one, with one indicating a higher level of similarity, as frequent proximity. The difference between solutions derived using the two measures comes from the difference in how each is calculated. Jaccard's coefficient uses mere frequency of occurrence while cosine theta also uses frequency of occurrence, but additionally takes into account relative keyword frequency.

Resetting Frequency Thresholds

The criteria employed to limit keyword and case frequencies to create an easily legible correspondence map were not suitable for cluster analysis. The retention of keywords featuring in 15 or more cases (documents) was too restrictive once the group data were separated, especially given that the CAFNEC sub-sample consisted of only 18 cases. To accommodate for differences in sub-sample sizes, an individual case threshold for each group was set to approximately one quarter of the case count for that group. Thus, case thresholds for each group respectively were WTMA, 5 (from 22); CRC, 7 (from 28); and CAFNEC, 4 (from 18). The keyword frequency threshold of 25 was also reset to a minimum of 15 for each sub-sample. This returned individual group keyword counts of 31 for WTMA, 136 for CRC, and 24 for CAFNEC.

Hierarchical Clustering

Using these individual group frequencies, structure exploration was conducted using cluster analysis to identify clusters of keywords with interrelated co-occurrence patterns. Clustering was calculated with an average linkage clustering technique. This technique averages keyword similarities (inter-object proximities), and joins keywords as a cluster whenever a given level of similarity is reached. While clusters do not overlap, they are nested, and larger, less similar clusters subsume each of the early-agglomerated clusters. Each iteration of the clustering process brings together those clusters that are most similar (i.e. the keywords in one cluster co-occur with some frequency with those from another cluster). Further clusters are formed and combined in hierarchical fashion until all keywords are encompassed in one overarching cluster (for a more detailed explanation of cluster analysis see Aldenderfer & Blashfield, 1984).

How Many Clusters? Stopping Rules

Although various stopping rules can be used to indicate optimal cluster solutions, there is still no widely accepted formal test of clustering tendency[23]. Indeed, most stopping rules are not widely understood, produce different solutions depending on the clustering method, and are still, at best, only heuristic in nature. Moreover, as the content analyses described herein were exploratory in nature, there were no external criteria available for validation of the cluster solutions. The 'best' number of clusters for each hierarchical tree in this study was established by locating obvious 'jumps' in the cluster formations that could indicate relatively discrete

[23] See Aldenderfer and Blashfield (1984), Mojena (1977), and Tibshirani, Walther and Hastie (2001) for examples of a range of proposed methods for predicting clusters.

clusters. Using this method, nodes formed earlier, generally with a value higher than 0.4 (i.e. closer to 1.0), were retained within these larger clusters, while any nodes formed later, with similarity values closer to zero, were left independent. This decision was guided by the general coherence and thematic consistency observed under these conditions.

Hierarchical Tree Graphs: Dendrograms

With the window size set to pseudo-paragraphs to represent lexical context, dendrograms were produced for co-occurring keywords for each sub-sample. Dendrograms are presented in pairs for ease of comparison to each other for informativeness of the similarity measures. For each pair, the clusters produced using the association measure, Jaccard's coefficient, are presented first, followed by clusters produced using the distance measure, cosine theta.

Reading the Clusters

Cluster solutions are shown with keywords on the vertical axis and cluster formation on the horizontal axis (Péladeau, 2003b). Similarity index scores closest to 1.0 indicate that keywords tend to appear together, and these are clustered earlier. Keywords tending not to appear together in paragraphs are clustered later, and have similarity index scores closer to zero. The order of keywords is not important for interpreting the dendrograms; clusters are analogous to kinetic *Calder mobiles*[24], wherein object clusters are free to rotate around each other. Cluster formations remain the same while individual object positions can vary.

WTMA Dendrograms and Cluster Solutions

The first pair of dendrograms is for 31 keywords from the WTMA sub-sample. Figure 6 is the dendrogram produced using Jaccard's coefficient. Figure 7 is the

[24] Named for their creator, Alexander Calder (1898-1976), an American artist and sculptor.

dendrogram produced using cosine theta. Discussions are more detailed for cosine theta cluster solutions, as they proved to be more informative about similarity and semantic themes.

For the cluster solutions returned using Jaccard's coefficient, there were few similarity scores greater than a loosely defined threshold of 0.4, with most clustering occurring closer to the zero side of the scale, thus indicating a lack of similarity (as proximal co-occurrence) between keywords.

The five clusters that met the similarity (S) threshold were the keyword pairings, LIST-HERITAGE (S > 0.6), ACTIVITY-IMPACT (S > 0.4), ABORIGINAL-CULTURAL (S > 0.4), GOVERNMENT-RAINFOREST (S > 0.4), and ADVERSE-POTENTIAL (S > 0.4). The dendrogram produced using cosine theta, on the other hand, returned several nodes with similarity scores higher than 0.6, as presented in Figure 7, and cluster themes are more easily distinguishable. The benefit from the integration of relative frequency into the cosine theta equation offers insights beyond mere word co-occurrences. For clusters derived using the cosine theta similarity measure, similarity scores were commonly higher than 0.4, with eight agglomerations with scores of 0.6 or higher.

These early agglomerations consist largely of keyword pairs that are indicative of WTMA vocabulary characteristics: ACTIVITY-PERMIT, LIST-VALUES, IMPACT-PLAN, AREA-CULTURAL VALUES, LAND-WORLD HERITAGE VALUES, and ABORIGINAL-ASSESSMENT. It is noteworthy that the keyword pairings from the distance measure are completely different from the pairings from the association coefficient, and yet the two solutions are thematically similar.

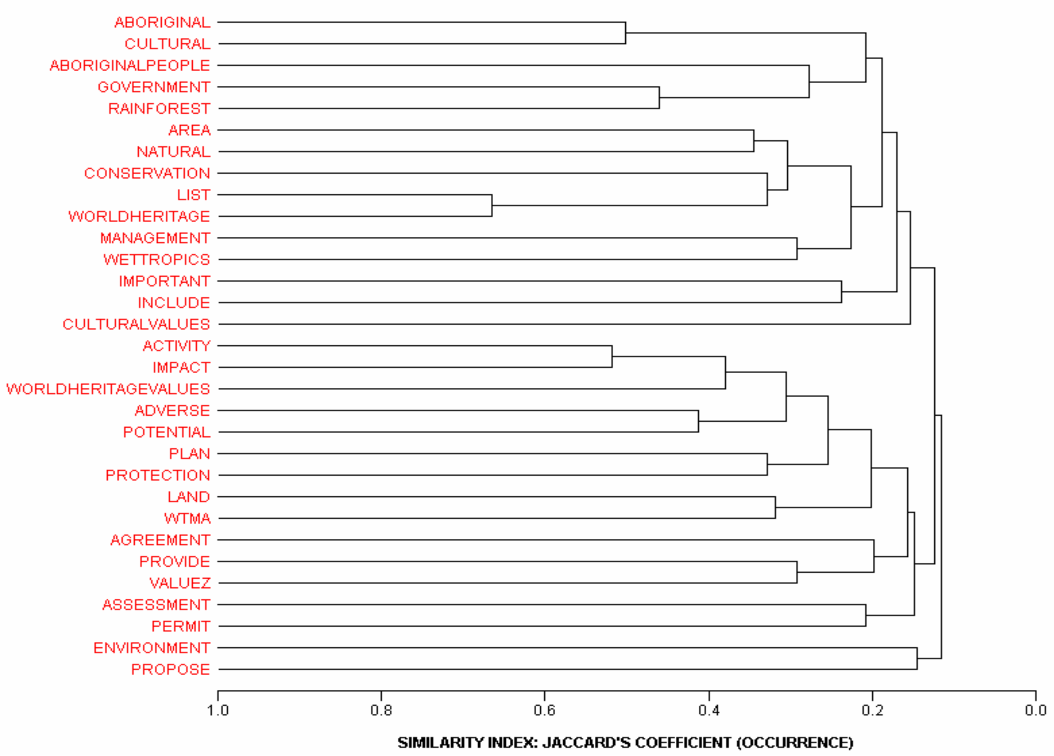

Figure 6. Keyword dendrogram for 31 keywords from the WTMA sub-sample: Jaccard’s coefficient.

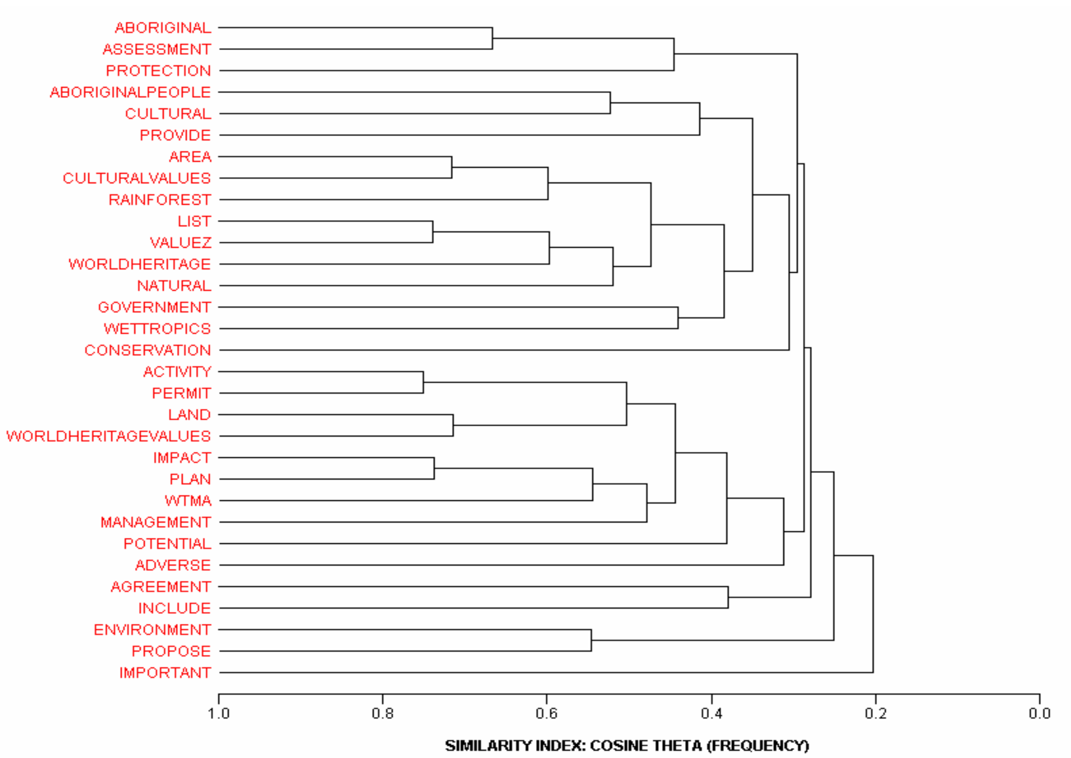

Figure 7. Keyword dendrogram for 31 keywords from the WTMA sub-sample: cosine theta.

Statistics for these pairings are given in Table 10, which also shows the dendrogram's five clusters, incorporating all 31 keywords. Note that in all cluster tables, any 'node' is the pairing of at least two 'objects', and objects are either keywords or nodes.

Table 10

WTMA: Statistics for Five Clusters Derived Using Cosine Theta

Cluster	Node	Object 1	Object 2	Similarity scores
1	6	ABORIGINAL	ASSESSMENT	0.67
	16	Node 6	PROTECTION	0.44
2	11	ABORIGINAL PEOPLE	CULTURAL	0.52
	19	Node 11	PROVIDE	0.41
	4	AREA	CULTURAL VALUES	0.72
	7	Node 4	RAINFOREST	0.60
	2	LIST	VALUES	0.74
	8	Node 2	WORLD HERITAGE	0.60
	12	Node 8	NATURAL	0.52
	15	Node 7	Node 12	0.47
	18	GOVERNMENT	WET TROPICS	0.44
	20	Node 15	Node 18	0.31
	23	Node 19	Node 20	0.35
3	1	ACTIVITY	PERMIT	0.75
	5	LAND	WORLD HERITAGE VALUES	0.72
	3	IMPACT	PLAN	0.74
	10	Node 3	WTMA	0.54
	14	Node 10	MANAGEMENT	0.48
	13	Node 1	Node 5	0.50
	17	Node 13	Node 14	0.44
	21	Node 17	POTENTIAL	0.38
4	9	ENVIRONMENT	PROPOSE	0.55
5	22	AGREEMENT	INCLUDE	0.38

Note. A node is the pairing of at least two objects, and objects are either keywords or nodes.

Reading from the top of the dendrogram beginning with node 6 is the first cluster of three keywords: ABORIGINAL-ASSESSMENT and PROTECTION. The second cluster is a larger amalgamation of twelve keywords in four sub-clusters, with the first sub-cluster (ABORIGINAL PEOPLE-CULTURAL and PROVIDE) linked only loosely to the next three at a later agglomeration. The four sub-clusters together form a very loose and abstract VALUES theme, with RAINFOREST and ABORIGINAL PEOPLE the only concrete referents. The keywords VALUES and CULTURAL VALUES are included in this theme, together with CULTURAL and NATURAL, and perhaps this is an indication that the WTMA discussions of ‘values’ include both interpersonal (culture) and environmental (nature) meaning distinctions of the word.

The WTWHA received its World Heritage listing status due to the existence of a range of natural characteristics that have come to be largely designated as ‘values’*;* thus, values in the sense of the LIST-VALUES pairing at node 2 appears to be a referent of natural resources and biophysical attributes. The agglomeration of this node with WORLD HERITAGE further suggests those characteristics for which the WTWHA has come to be renowned. The pairing of AREA with CULTURAL VALUES is further clustered with RAINFOREST, which suggests an environmental referent, although it could also refer to the inseparability of nature and culture for the Indigenous Australians who still have traditional ties to the rainforest areas within the Wet Tropics region.

The third cluster is another larger amalgamation, this time with nine keywords in two sub-clusters: ACTIVITY-PERMIT and LAND-WORLD HERITAGE VALUES in one, and IMPACT-PLAN, WTMA and MANAGEMENT in another. POTENTIAL is included in the cluster only as a later agglomeration. Many activities within the WTWHA governed by the WTMA require permits, so it is natural that the ACTIVITY-PERMIT pairing would occur, and this is one portion of the WTMA management objective. At node 5, the pairing of LAND with WORLD HERITAGE VALUES provides a further natural resource perspective on ‘values’, with a physical environmental referent.

The fourth and fifth clusters are the pairings of AGREEMENT-INCLUDE and ENVIRONMENT-PROPOSE. These last pairings are joined with other clusters only at later iterations, at a very low level of similarity. ENVIRONMENT was not a high-frequency keyword for the WTMA group (f = 15), with the frequency for PROPOSE slightly higher (f = 20), so the relatively high similarity rating for the pairing suggests that, while they occur often together, they are not commonly linked thematically to other groupings in the WTMA vocabulary. The keywords CONSERVATION, ADVERSE and IMPORTANT were agglomerated individually, at low similarity levels, and so were not considered thematically significant within the WTMA dendrogram.

CRC Dendrograms and Cluster Solutions

The second pair of dendrograms is for 136 keywords from the CRC sub-sample. Figure 8 is the dendrogram produced using Jaccard's coefficient, and Figure 9 is the dendrogram produced using cosine theta. Each of the CRC dendrograms is shown in full, and identification of individual keywords is relatively difficult. It is best to view these Figures only for comparison of the clustering patterns; individual keywords and cluster scores for the cosine theta solution are detailed later in tables.

There were no clusters with similarity scores greater than 0.4 for the Jaccard's coefficient solution. This coefficient was again inferior to cosine theta as a measure of similarity, as coherently discrete clusters were difficult to distinguish. The inability to determine thematic patterns using this measure highlights the benefits afforded by the cosine theta's consideration of relative keyword frequency.

In contrast, for the cosine theta solution there were 71 nodes with scores higher than 0.4; of these, 24 were early-agglomeration nodes with similarity scores higher than 0.6. Three of the early pairings have very high similarity scores (i.e. >0.8), indicating very frequent co-occurrence of the keywords: CRC-MANAGEMENT, ESTABLISH-TIMBER, and CULTURAL VALUES-REGION.

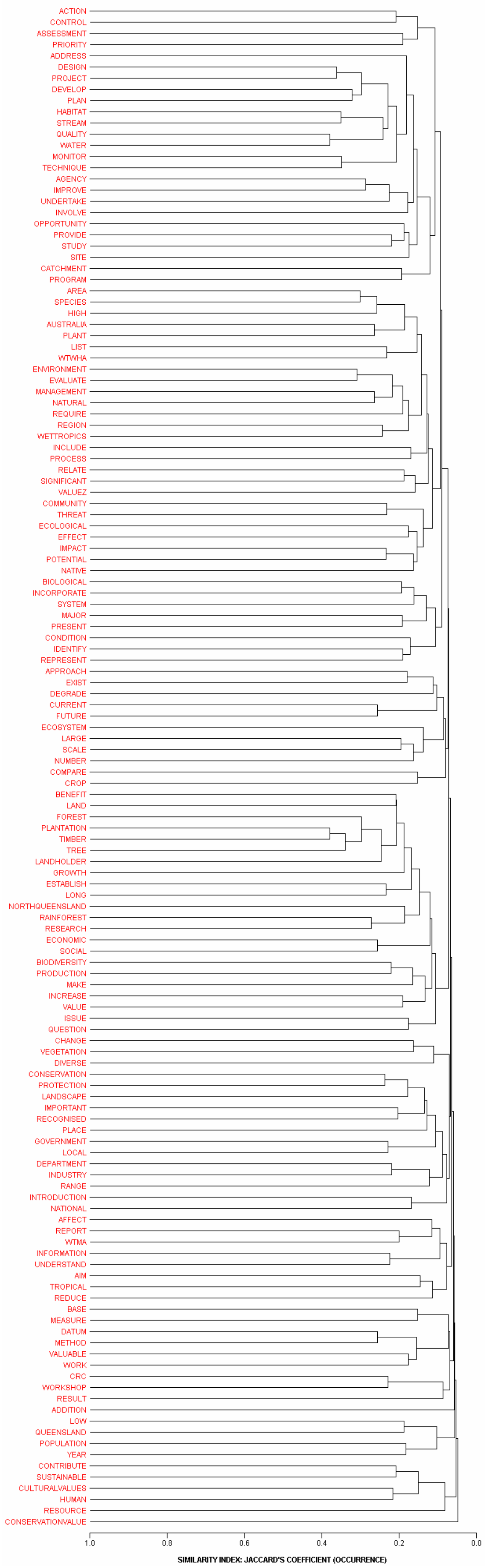

Figure 8. Keyword dendrogram for 136 keywords from the CRC sub-sample: Jaccard's coefficient.

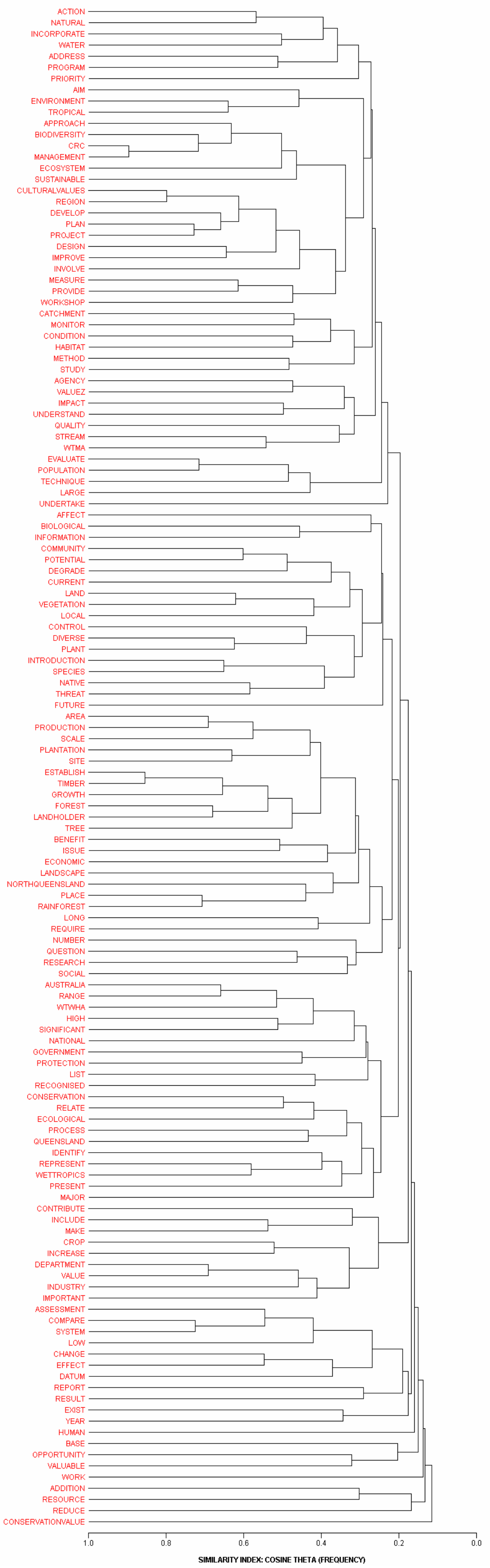

Figure 9. Keyword dendrogram for 136 keywords from the CRC sub-sample: cosine theta.

The strong similarity value for the CRC-MANAGEMENT node reflects the organisation's mission statement to support the management of the tropical rainforests and its stated objective to create a management framework for the conservation of rainforest regions. It is, however, in contrast to the major activity of the organisation: research.

Eleven discrete clusters are apparent in the dendrogram. The first, a seven-keyword cluster, has no obvious theme, although ACTION, ADDRESS and PRIORITY suggest a proactive agenda. A RESEARCH theme is apparent in the next three clusters, beginning with the FOCUS of the CRC research in the second cluster (CRC, MANAGEMENT, APPROACH, SUSTAINABLE, ECOSYSTEM, BIODIVERSITY). The third cluster features keywords that suggest an OPERATIONISM theme: DEVELOP, PLAN, PROJECT, DESIGN, IMPROVE, INVOLVE, MEASURE, PROVIDE and WORKSHOP. The fourth cluster echoes this theme (MONITOR, METHOD, STUDY).

Cluster number five has a less obvious theme, and it is this cluster that contains the keyword VALUES. It is interesting that WTMA as a keyword is also linked in this cluster, VALUES as understood by the CRC researchers feeds into the WTMA rhetoric. Table 11 lists statistics for the first five clusters.

The sixth cluster (statistics reported in Table 12) has three related themes: TIME (POTENTIAL, CURRENT, INTRODUCTION, FUTURE), DAMAGE (AFFECT, DEGRADE, THREAT), and FLORA AND FAUNA (BIOLOGICAL, LAND, VEGETATION, LOCAL, PLANT, SPECIES, NATIVE), which are together suggestive of concerns about degradation of the environment over time.

Table 11

CRC: Statistics for Clusters 1-5 (of 11) Derived Using Cosine Theta

Cluster	Node	Object 1	Object 2	Similarity scores
1	28	ACTION	NATURAL	0.57
	38	ADDRESS	PROGRAM	0.51
	40	INCORPORATE	WATER	0.50
	73	Node 28	Node 40	0.39
	81	Node 73	Node 38	0.35
	99	Node 81	PRIORITY	0.30
2	18	APPROACH	Node 6	0.63
	6	BIODIVERSITY	Node 1	0.72
	1	CRC	MANAGEMENT	0.90
	41	Node 18	ECOSYSTEM	0.50
	52	Node 41	SUSTAINABLE	0.46
3	3	CULTURAL VALUES	REGION	0.80
	23	Node 3	Node 13	0.61
	13	DEVELOP	Node 4	0.66
	4	PLAN	PROJECT	0.73
	16	DESIGN	IMPROVE	0.65
	35	Node 23	Node 16	0.52
	56	Node 35	INVOLVE	0.45
	22	MEASURE	PROVIDE	0.62
	49	Node 22	WORKSHOP	0.47
	80	Node 56	Node 49	0.36
4	51	CATCHMENT	MONITOR	0.47
	76	Node 51	Node 50	0.37
	50	CONDITION	HABITAT	0.47
	95	Node 76	Node 46	0.31
	46	METHOD	STUDY	0.48
5	48	AGENCY	VALUES	0.47
	43	IMPACT	UNDERSTAND	0.50
	82	QUALITY	Node 31	0.35
	31	STREAM	WTMA	0.54
	85	Node 48	Node 43	0.34
	94	Node 85	Node 82	0.31

Note. A node is the pairing of at least two objects, and objects are either keywords or nodes.

Table 12

CRC: Statistics for Cluster 6 (of 11) Derived Using Cosine Theta

Cluster	Node	Object 1	Object 2	Similarity scores
	109	AFFECT	Node 57	0.27
	57	BIOLOGICAL	INFORMATION	0.45
	24	COMMUNITY	POTENTIAL	0.60
	44	Node 24	DEGRADE	0.49
	77	Node 44	CURRENT	0.37
	21	LAND	VEGETATION	0.62
	67	Node 21	LOCAL	0.42
	90	Node 77	Node 67	0.32
6	60	CONTROL	Node 20	0.44
	20	DIVERSE	PLANT	0.62
	15	INTRODUCTION	SPECIES	0.65
	25	NATIVE	THREAT	0.58
	74	Node 15	Node 25	0.39
	96	Node 60	Node 74	0.31
	103	Node 90	Node 96	0.29
	118	Node 109	Node 103	0.24
	120	Node 118	FUTURE	0.23

Note. A node is the pairing of at least two objects, and objects are either keywords or nodes.

This theme is evocative of Kluckhohn and Strodtbeck's (1961) temporal value orientation together with the 'human-nature' relationship, with hints of the present and future linking the dominance or subordination of humans and nature. In a more spatial orientation, cluster seven (statistics reported in Table 13) combines the themes of LOCATION (AREA, SITE, NORTH QUEENSLAND, PLACE) and ENVIRONMENTAL ATTRIBUTES (PRODUCTION, PLANTATION, TIMBER, GROWTH, FOREST, LANDHOLDER, TREE, LANDSCAPE, RAINFOREST).

Statistics for clusters 8-11 are presented in Table 14. The eighth cluster consists of only four words (NUMBER, QUESTION, RESEARCH, SOCIAL), and these are linked, but not obviously thematically related, to cluster seven. Cluster nine has two sub-themes, LEVEL OF INTEREST (AUSTRALIA, WTWHA, NATIONAL, GOVERNMENT, QUEENSLAND, WET TROPICS) and REASON FOR INTEREST (PROTECTION, LIST, RECOGNISED, CONSERVATION, IDENTIFY, REPRESENT, PRESENT).

Table 13

CRC: Statistics for Cluster 7 (of 11) Derived Using Cosine Theta

Cluster	Node	Object 1	Object 2	Similarity scores
	10	AREA	PRODUCTION	0.69
	27	Node 10	SCALE	0.58
	19	PLANTATION	SITE	0.63
	2	ESTABLISH	TIMBER	0.86
	14	Node 2	GROWTH	0.66
	11	FOREST	LANDHOLDER	0.68
	32	Node 14	Node 11	0.54
	47	Node 32	TREE	0.47
7	71	Node 63	Node 47	0.40
	39	BENEFIT	ISSUE	0.51
	75	Node 39	ECONOMIC	0.38
	79	LANDSCAPE	Node 59	0.37
	59	NORTH QUEENSLAND	Node 8	0.44
	8	PLACE	RAINFOREST	0.71
	70	LONG	REQUIRE	0.41
	100	Node 97	Node 79	0.30
	108	Node 100	Node 70	0.27

Note. A node is the pairing of at least two objects, and objects are either keywords or nodes.

Cluster ten includes several verbs (CONTRIBUTE, INCLUDE, MAKE, INCREASE, VALUE, IMPORTANT), and these, together with CROP and INDUSTRY reflect economic growth, so the theme is labelled ECONOMICS. The eleventh and final discrete cluster has OUTCOMES as its theme, as represented by seven of the 11 keywords (ASSESSMENT, COMPARE, CHANGE, EFFECT, DATUM, REPORT, RESULT).

Nineteen keywords were unassigned to major clusters, even though some were linked at relatively high levels of similarity. For instance the pairing of EVALUATION-POPULATION has a similarity score of 0.72, and for ENVIRONMENT-TROPICAL the similarity score is 0.64. However, even though these pairings might seem intuitively representative in themselves, it is likely that the frequency of these word co-occurrences is an artefact of document burstiness for these words. For the eleven keywords listed at the bottom of the dendrogram, similarity scores are relatively low, and pairings are linked together at later stages of the agglomeration process. Thus, these keywords do not fit together as a discrete cluster and nor do they have a general theme.

Table 14

CRC: Statistics for Clusters 8-11 Derived Using Cosine Theta

Cluster	Node	Object 1	Object 2	Similarity scores
8	98	NUMBER	Node 88	0.30
	53	QUESTION	RESEARCH	0.46
	88	Node 53	SOCIAL	0.33
9	12	AUSTRALIA	RANGE	0.66
	36	Node 12	WTWHA	0.51
	37	HIGH	SIGNIFICANT	0.51
	65	Node 36	Node 37	0.42
	93	Node 65	NATIONAL	0.31
	58	GOVERNMENT	PROTECTION	0.45
	68	LIST	RECOGNISED	0.41
	106	Node 93	Node 58	0.28
	107	Node 106	Node 68	0.27
	42	CONSERVATION	RELATE	0.50
	66	Node 42	ECOLOGICAL	0.42
	61	PROCESS	QUEENSLAND	0.43
	87	Node 66	Node 61	0.33
	72	IDENTIFY	Node 26	0.39
	26	REPRESENT	WET TROPICS	0.58
	83	Node 72	PRESENT	0.34
	102	Node 87	Node 83	0.29
	113	Node 102	MAJOR	0.26
	116	Node 107	Node 113	0.24
10	92	CONTRIBUTE	Node 33	0.32
	33	INCLUDE	MAKE	0.54
	34	CROP	INCREASE	0.52
	9	DEPARTMENT	VALUE	0.69
	54	Node 9	INDUSTRY	0.46
	69	Node 54	IMPORTANT	0.41
	89	Node 34	Node 69	0.32
	115	Node 92	Node 89	0.25
11	30	ASSESSMENT	Node 5	0.55
	5	COMPARE	SYSTEM	0.73
	64	Node 30	LOW	0.42
	29	CHANGE	EFFECT	0.55
	78	Node 29	DATUM	0.37
	105	REPORT	RESULT	0.29
	112	Node 64	Node 78	0.26
	126	Node 112	Node 105	0.18

Note. A node is the pairing of at least two objects, and objects are either keywords or nodes.

The overarching picture of the habitual application of the keyword VALUES and its surrounding co-occurrents for the CRC represents research operations and their outcomes. Although the picture is built up from the sub-sample of documents made available on the CRC website at the time of collection, and would have been subjected to some degree of gate-keeping, it must be remembered that the documents represent the public 'front' of the CRC research outcomes.

CAFNEC Dendrograms and Cluster Solutions

The third pair of dendrograms is for 24 keywords from the CAFNEC sub-sample. Figure 10 is the dendrogram produced using Jaccard's coefficient, and Figure 11 is the dendrogram produced using cosine theta. The inclusion of PROTECTION and CONSERVATION with VALUES for the Jaccard's solution in Figure 10 is another intuitively apt clustering, but it does not reveal anything about what the 'values' being conserved and protected might be. Another apt partition in this dendrogram produced using the association measure is the clustering together of CULTURAL, INDIGENOUS, NATIVE, TITLE and TRADITIONAL, suggestive of an ABORIGINAL ISSUES theme.

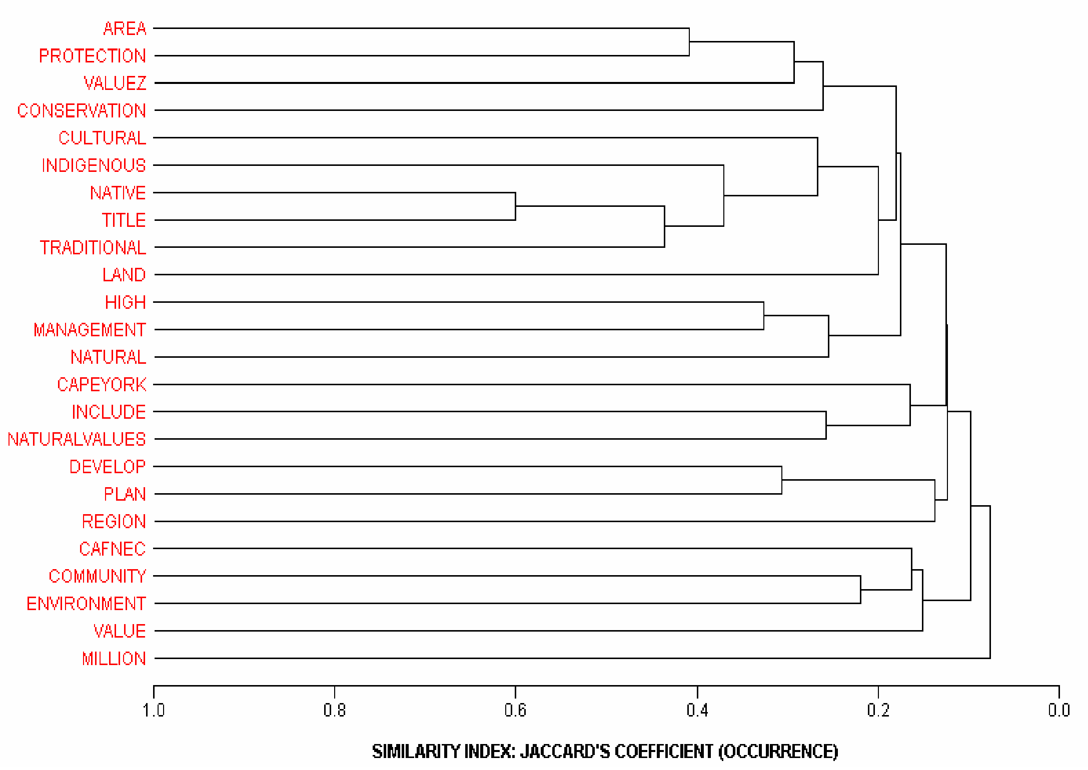

Figure 10. Keyword dendrograms for 24 co-occurring keywords in CAFNEC text: Jaccard's coefficient.

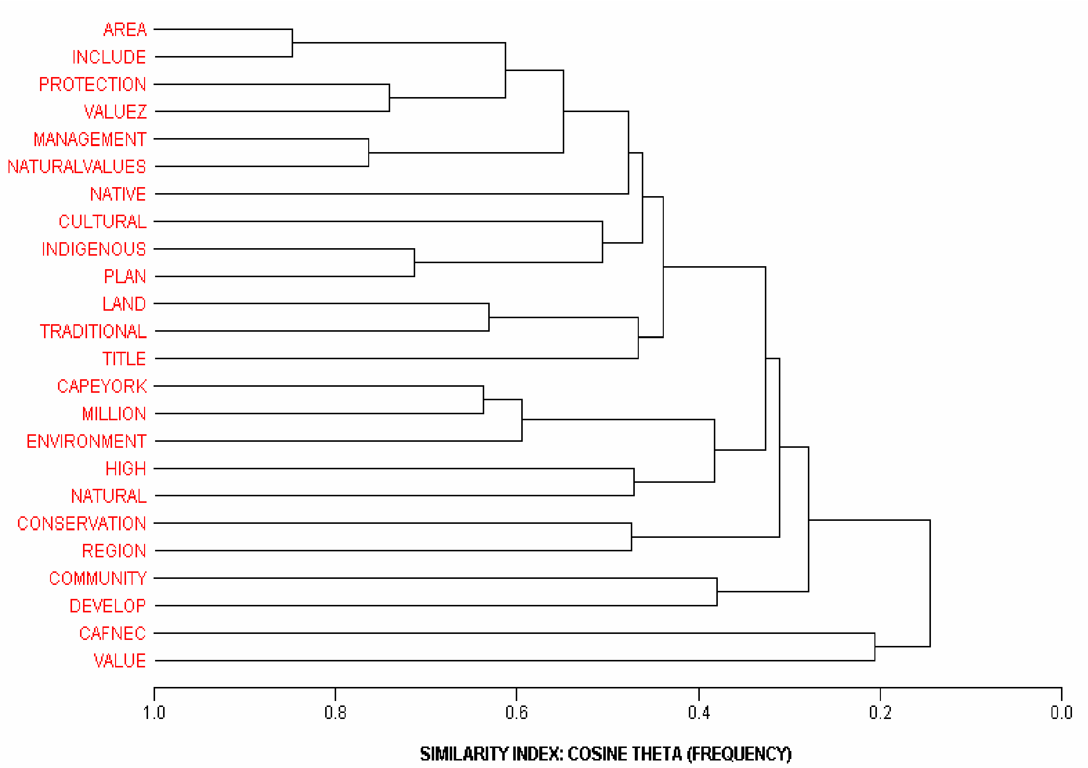

Figure 11. Keyword dendrograms for 24 co-occurring keywords in CAFNEC text: cosine theta.

In comparison, there are two main clusters and two keyword pairings evident in the cosine theta solution. Table 15 lists the similarity statistics for the node and cluster solutions for this group.

Table 15

CAFNEC: Statistics for Four Clusters Derived Using Cosine Theta

Cluster	Node	Object 1	Object 2	Similarity scores
1	1	AREA	INCLUDE	0.85
	2	MANAGEMENT	NATURALVALUES	0.77
	3	PROTECTION	VALUES	0.74
	4	INDIGENOUS	PLAN	0.72
	6	LAND	TRADITIONAL	0.63
	7	Node 1	Node 3	0.61
	9	Node 7	Node 2	0.55
	10	CULTURAL	Node 4	0.50
	11	Node 9	NATIVE	0.48
	14	Node 6	TITLE	0.46
	15	Node 11	Node 10	0.46
	16	Node 15	Node 14	0.44
2	5	CAPE YORK	MILLION	0.64
	8	Node 5	ENVIRONMENT	0.59
	13	HIGH	NATURAL	0.47
3	12	CONSERVATION	REGION	0.47
4	18	COMMUNITY	DEVELOP	0.38

Note. A node is the pairing of at least two objects, and objects are either keywords or nodes.

The first cluster, consisting of 13 keywords beginning at the top of the dendrogram, features a theme focus on ABORIGINAL ISSUES that is less specific yet more comprehensive than the cluster of the same theme in the Jaccard's solution. Within the main cluster, five of the sub-clusters are keyword pairings with similarity scores greater than 0.6: AREA-INCLUDE, PROTECTION-VALUES, MANAGEMENT-NATURAL VALUES, INDIGENOUS-PLAN, and LAND-TRADITIONAL. The CAFNEC shares the keyword MANAGEMENT in its vocabulary with the WTMA and the CRC, but the WTMA application of this word is more encompassing of the organisation as a whole than the specific links indicated here. However, the CAFNEC pairing of MANAGEMENT-NATURAL VALUES and subsequent linking of this pairing with PROTECTION-VALUES indicates a referentially ambiguous notion of 'values' that is nevertheless likely to be indicative of natural resources, as it is unlikely that anyone would suggest trying to manage or protect individually held values of an intrapsychic character.

The second cluster consists of five keywords: CAPE YORK-MILLION, ENVIRONMENT, and HIGH-NATURAL. There is no intuitively apparent theme behind this cluster, but it indicates the importance of the natural environment in the Cape York area. CAPE YORK, MILLION and HIGH are relatively low frequency keywords (<25 in this sample), so the associations here are likely due to exclusivity in their co-occurrences. A closer KWIC-list inspection of the keyword MILLION revealed that reference is largely to dollars and thus repeats the CAFNEC acknowledgement that economic considerations are important for the protection of natural, environmental attributes, or 'values'.

The third and fourth clusters are keyword pairings: CONSERVATION-REGION and COMMUNITY-DEVELOP. These are indicative of the nature of the organisation's role in activism towards conservation within the local region. The keywords CAFNEC and VALUE were joined as a late pairing, and are only loosely connected to all the other keywords as a final agglomeration. This signifies a definite distinction between 'value' and 'values' for this organisation, with VALUES and NATURAL VALUES featuring in the ABORIGINAL ISSUES themed cluster.

Case Clusters

A cluster analysis of the 68 document cases from all three groups revealed three discrete clusters; one of these consists of 13 WTMA documents (59% of the sub-sample) and another consists of 18 CRC documents (64% of the sub-sample), but there was also a cluster consisting of 21 documents (33% of the entire sample) from all three groups. It is likely that these 21 documents contain the bulk of those keywords that are shared by all three groups. A further 16 cases (25% of the entire sample) were not clustered discretely but were instead late agglomerations and thus share very little similarity with other documents. Aside from any differences in group agendas, the discrete clustering of WTMA and CRC documents indicate that differences in how the keyword VALUES is used are as much an artefact of document attributes as of the groups who produced them. It is noteworthy that the CAFNEC documents did not form a discrete cluster, which suggests that this group adopts a scientific authorial style similar to the other groups. A desire for public credibility would further such a likelihood, and it must be remembered that many CAFNEC members are scientists as well as environmentalists.

Discussion: Comparative Performance of the Similarity Measures

Similarity scores derived using Jaccard's coefficient were predominantly less than 0.4, and most clustering occurred closer to the zero side of the scale, indicating a lack of similarity (as proximal co-occurrence) between keywords. The cosine theta measure was superior, not only in that similarity values were higher, but also because the clusters were more thematically consistent and readily discernible. Nevertheless, cluster solutions derived using the cosine measure were not always easily discernable, and other interpretations are of course possible. The lack of any strong, conceptually clarifying representations of 'values' emerging from the data does not mean that there are none; some methodological issues could have restricted the emergence of such representations.

Sample Size

The small sample of documents limited the potential for the emergence of intuitively semantic clusters. While the methodology described is certainly valid, with ample precedent in the literature, the limitations of the sample size for the current study conceivably restricted the emergence of any true psychological reality pertaining to the conceptual representation of 'values' within the texts. Themes were more easily discernable in the CRC dendrograms because of the relative wealth of distributional information available in the CRC texts, and this is directly attributable to the larger quantity of available texts and the more wordy nature of that sub-sample compared with those from the WTMA and the CAFNEC.

Window Size

Window size could have been a mitigating factor in the low similarity (association) scores obtained using Jaccard's coefficient. Different window sizes are more suitable for certain measures than for others. Pseudo-paragraphs mostly consisted of only three sentences but, occasionally, further instances of the targeted letter string, VALU, determined that extra sentences were selected into the paragraph, thus extending the window along with the paragraph. This extra noise created by the large window could have interfered with the solutions derived from both measures, but the higher similarity (distance) scores in the cosine theta solutions suggest that interference was less for that measure than for the Jaccard's coefficient (association). Again, the consideration of the relative frequency of each keyword in the cosine theta measure could have been beneficial here.

Word Stemming

The lemmatisation process whereby word form variations were combined into one form is another commonly used technique in this type of research (Lebart et al., 1998). Word stem frequencies (more so than surface frequencies[25]) are an important factor in word recognition and word priming studies (Taft, 1991), and the combination of variations into one form is not problematic in corpus studies using larger samples. However, word sense distinctions are sometimes retained in corpus analysis studies, as noun and verb forms can provide different meanings to words around them, as can adjectives and adverbs (Lebart et al., 1998; Pennebaker et al.,

[25] Baayen, Dijkstra and Schreuder (1997) did find a surface frequency effect for plural nouns in Dutch, but this was likely due to the ambiguity of the plural suffix *–en*, which is also used as a verbal ending.

2003). This distinction was considered as a factor in the current study, and the decision to combine word form variations into the one lemmatised word form was made on the basis of the sparseness of the available data. Many words that would have not met the frequency threshold were included once combined into a composite form.

Going Further

Multidimensional scaling (MDS) is often employed in conjunction with clustering techniques, with the same proximity matrix being used for both techniques. Two- and three-dimensional mapping of data is possible using MDS, but has not been reported here, as the visual presentations do not provide any further insights into the structure of the data.

Although the content analyses described have raised further questions, results can at least be exploited for direction now that some characteristics of habitual application and function have been clarified. With all the many applications of and meanings assigned to ‘values’ according to context and agenda, it has at times appeared as though this many-faceted word would never be completely understood. The broader issue of whether meaning can be gainfully measured in a small corpus according to habitual, applied function, and within intergroup contexts, has come to appear more approachable and manageable with these further insights into the behaviour of language.

The multiple objectives of this research included the documentation of meanings and uses of the term and expression ‘values’ relating to the natural environment of the Wet Tropics World Heritage Area region, its management and its conservation. This documentation revealed little evidence of meaning slippage between the three groups, with most of the co-occurrence relationships showing that the word ‘values’ is used together with a similar selection of words among all three groups. It is likely that the groups are adhering as much as possible to denotative applications of values, with emotive language notable only in its absence. The nature of the sampled texts very likely influenced results, and it is also likely that at least some of the difference between the group vocabularies was an artefact of this. Finding naturally occurring texts that are equivalent in writing style, content, and intent while still reflecting lexical practice idiosyncratic to each group would be difficult, if not impossible, and especially so in the already limited context.

The correspondence analysis, as expressed in the correspondence maps, provided some clarity regarding group idiosyncrasies for the application of those keywords occurring in conjunction with ‘values’. The dimensions of customary use revealed by this process provide a base from which to articulate and to further explore the differences and similarities in the use of the word ‘values’ by the three groups. Nevertheless, a thorough understanding of specialised uses is not complete without a comparison with generalised uses.

5. Comparing Localised and General Contexts

The idea or phonic substance that a sign contains is of less importance than the other signs that surround it. Proof of this is that the value of a term may be modified without either its meaning or its sound being affected, solely because a neighbouring term has been modified.[26]

Introduction

One of the goals of this thesis was to explore the lexical applications of 'values' in a specific, naturally occurring context. This exploration was described in the form of a text analysis of documents pertaining to 'environmental values' in the real-world context of the Wet Tropics bioregion. The applications described in Chapter 4 are arguably distinct from generalised uses, and this chapter now explores the more general lexical applications of 'values' in a large corpus. The small size of the document sample examined in the text analysis was a consequence of the necessarily distinctive nature of the sample. Searches within a larger corpus (the British National Corpus) for occurrences of the keyword VALUES and its co-occurrences with a selection of other keywords were conducted to provide a more generalised overview of usage (albeit in the British idiom) in the natural and applied sciences, and in the social sciences, in comparison with the distinctive Wet Tropics context already examined.

The Corpus

The 100 million-word British National Corpus (BNC) (Oxford University Computing Services, 2006a) has a spoken sub-corpus of approximately 10 million

[26] Saussure (1983, pp. 111-119) acknowledged the important role of context in comprehending a sign in its entirety within a system of differences.

words. The written sub-corpus contains 3,209 texts, amounting to approximately 90 million words, consisting of imaginative and informative texts. In contrast to the five-year time period for the purposive sample of texts examined in the text analyses already described, all BNC texts originated in the period 1960-1994.

BNC Online Version

The BNC Online version was accessed via the special purpose SGML-Aware Retrieval Application (SARA) Client software (Oxford University Computing Services, 2006b). The BNC Online is an electronically accessible version of the full BNC, and consists of a collection of texts that have been classified using the UK's Copac[27] service (Burnard, 2000). BNC texts are also part-of-speech tagged using the constituent likelihood automatic word-tagging system (CLAWS) (Burnard, 2000). The relevant CLAWS code was applied in searches for VALUES in the required part of speech: that is, as a plural common noun, NN2.

Method: Creating Sub-corpora

Copac classifications were employed to make sub-corpora relevant to the current research purposes. Texts from the informative (as opposed to imaginative) classifications, incorporating academic and non-academic texts, including newspapers, were selected. Texts in the BNC imaginative domain (wridom1) include creative literary works of fiction and drama, and were thus not deemed suitable for a comparative sub-corpus search for the current purposes.

Texts from within the written domain in the natural and pure sciences (wridom2) and applied science (wridom3) were together compared with texts from the social science classification (wridom4), for frequency of the keyword VALUES as a plural common noun, and for various collocations. The natural and pure sciences

[27] Copac (available at the URL http://copac.ac.uk) provides free access to the merged online catalogues of major UK and Irish university research libraries, plus the British Library and the National Library of Scotland

(146 texts) and applied science (370 texts) BNC classifications were combined as a *Science* sub-corpus of 516 texts for comparison with a *Social* sub-corpus using the social science classification (527 texts).

Co-occurrence searches for the words most commonly occurring with VALUES in the text analysis already described revealed the specialised applications in those documents, and those results formed the basis for comparison with the more generalised natural and social science documents from the BNC.

Results

Keyword Frequencies

The BNC count for occurrences of VALUES as four types[28], or parts of speech, was 7,568 occurrences in 1,307 texts (almost 41% of all BNC texts). In comparison, the count for occurrences of VALUES (NN2) , the form retained for the text analyses already described, is 7,207 instances (95% of the total) in 1,254 texts (96% of all texts in which VALUES occurs), showing that this is by far the most commonly used part-of-speech form for the word. Table 16 shows comparative frequencies for VALUES occurrences (tokens) in four part-of-speech forms for the two sub-corpora.

Table 16

Comparative Frequencies (f) of VALUES Occurrences in Four Forms for Science and Social Sub-corpora

Forms		Sub-corpus			
		Science		Social	
		Token *f*	Text *f*	Token *f*	Text *f*
NN2	Plural common noun	2304	191	1785	258
VVZ	The –s form of lexical verbs	15	15	19	18
NN2/VVZ	Ambiguous but preference for noun	96	38	37	33
VVZ/NN2	Ambiguous but preference for verb	19	13	10	10
	Totals	2434	516	1851	527

[28] In the BNC, values is listed as four types, including NN2, plural common noun; VVZ, the –s form of a lexical verb; and two forms that are ambiguous between noun and verb with preference either way: NN2/VVZ, and VVZ/NN2.

VALUES in the form of plural common noun provided the majority of occurrences in the search of the selected BNC sub-corpora. The token frequency was relatively higher for *Science* than for *Social* (2,304 vs. 1,785), but the text frequency was relatively lower (191 vs. 258), indicating some document burstiness for VALUES in the *Science* texts. Examination of the VALUES tokens in context revealed that by far the majority of instances in both sub-corpora referred to VALUES in the mathematical sense as a numerical quantity, or in an economic sense as monetary worth. The occurrence of VALUES in an environmental context was relatively rare in both of the sub-corpora. In the *Science* sub-corpus, for instance, only six of the 191 texts contained such a context.

Co-occurrences

Prior to searching for the co-occurrence of target words occurring in close proximity to VALUES, a further text exclusion limitation was set using the (alltim3) classification (Burnard, 2000) to maintain temporal similarity between the samples. Only the most recently acquired BNC texts were selected for searches, in this case those published between the years 1985-1993. Limiting searches to the later time period reduced the number of texts in the *Science* sub-corpus from 516 to 459, and in the *Social* sub-corpus from 527 to 401.

This exclusion reduced the number of VALUES occurrences in the *Social* sub-corpus from 1,785 in 258 texts to 1,417 in 222 texts, but made no difference to frequencies in the *Science* sub-corpus, with the VALUES count remaining at 2,304 in 191 texts. This means there were no occurrences of the keyword VALUES in the BNC natural and pure sciences, or applied science classifications, in any texts published prior to 1985. Although this is incidentally interesting, further knowledge about the nature of BNC texts in those classifications in the earlier time period would be needed in order to gainfully speculate on why it might be so.

In order to reveal differences between *Science* and *Social* applications, collocation searches of the BNC for those words found to commonly co-occur with VALUES in the Wet Tropics text analysis took the form of a series of queries in corpus query language. These searches located VALUES as a common noun plural (NN2) followed or preceded by each target word (in each instance the collocate search word) within a window of 20 words either side of VALUES.

This 40-word window is smaller than the average pseudo-paragraph length for the context units searched in the 'Wet Tropics' text analyses already described (CRC, M = 97.8, SD = 54.0; WTMA, M = 77.6, SD = 36.2; CAFNEC, M = 78.1, SD = 41.8). The construction of pseudo-paragraphs, as for the text analyses, was not possible for the BNC. Furthermore, the search procedure did not require a similarity coefficient as applied in cluster analyses comparing the association and distance measures, for which an appropriate window size is more critical. The 40-word window was considered sufficient to reveal the co-occurrence information necessary to distinguish generalised applications of the keyword VALUES from the selective applications in the specialised, environmentally relevant context of the Wet Tropics.

As the aim of this exercise was to compare specialised, environmentally relevant applications with generalised applications, four target words associated with values in generalised senses were considered along with a selection of 18 target words identified as frequent collocates of VALUES in the environmental context. As a further comparison, collocation searches extended to the target words BELIEFS, MORAL, PERSONAL and SOCIAL, to determine whether these more general referents occur together with VALUES more in social science texts than in natural, applied science and pure science texts.

To enable direct comparisons between the *Science* and *Social* subcorpora co-occurrence frequencies, and the keyword frequencies in the text analysis corpus

(*Environment*), a total co-occurrence frequency was calculated for each by summing the target word co-occurrences. A percentage of each total co-occurrence frequency was then calculated for each target word. The bar graph in Figure 12 shows comparative percentages of each target word's co-occurrence with VALUES for the two BNC sub-corpora and the text analysis corpus.

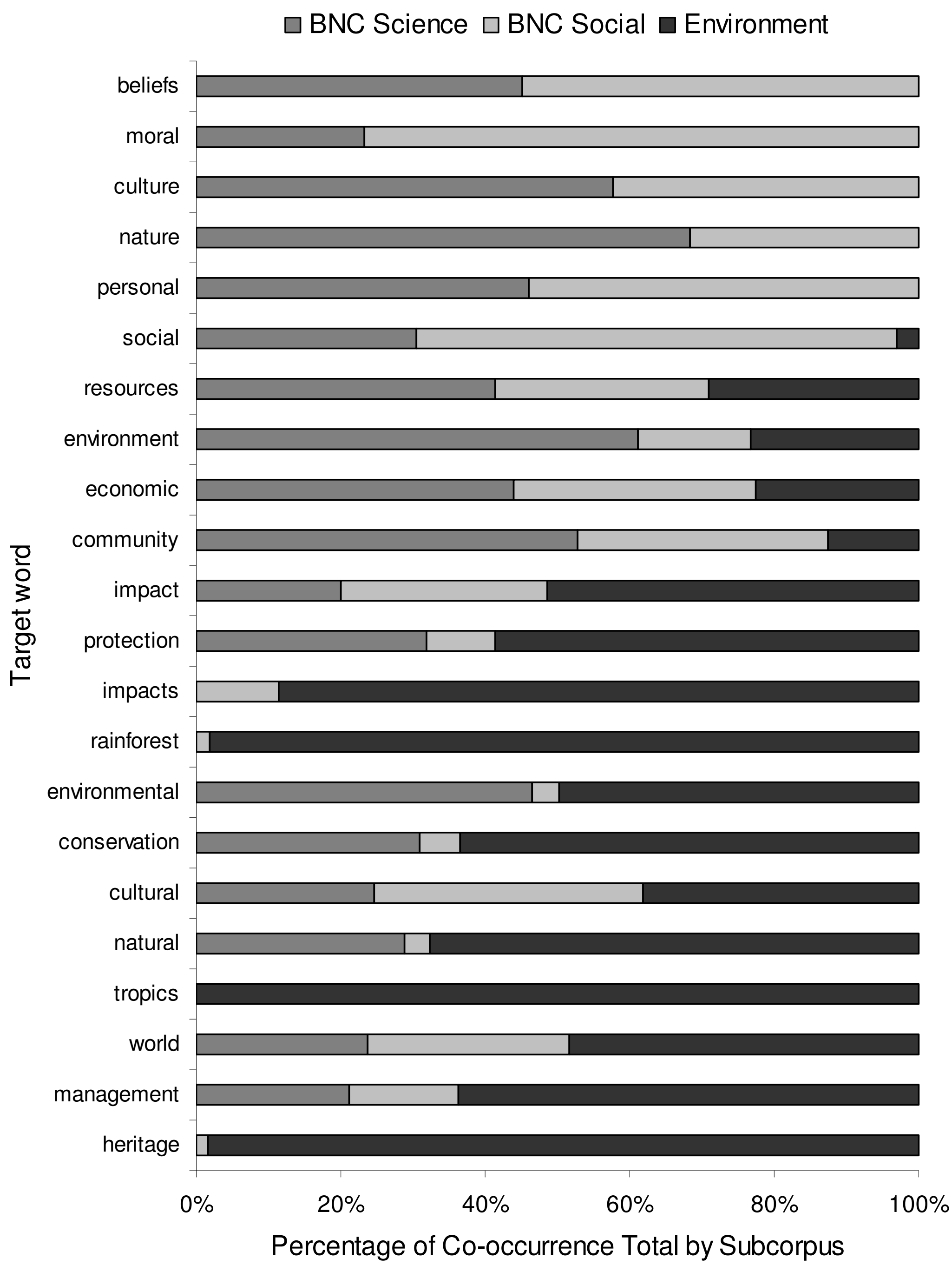

Figure 12. Comparative percentages of co-occurrence between 'values' and 22 target words in two BNC sub-corpora against an Environment category.

The *Social* sub-corpus contained a greater number of co-occurrences than the *Science* sub-corpus for the majority of the target words, because there were fewer texts containing VALUES in the *Science* sub-corpus. The percentages used for more direct comparisons clearly show the differences between the target words in the BNC sub-corpora and the *Environment* keywords in their co-occurrence patterns with VALUES. The first five target words reading from the top of the Figure (PERSONAL, NATURE, CULTURE, MORAL, BELIEFS) did not feature at all in the *Environment* corpus, even prior to the stemming procedure. Four of the target words (SOCIAL, BELIEFS, MORAL, PERSONAL) were included under the assumption that they were more relevant to social science meanings and contexts of VALUES than to those of the natural, applied and pure sciences, and the first three of these were indeed the most frequent collocates with VALUES in the *Social* set of 22 target words. All four occurred more frequently with VALUES in the *Social* sub-corpus than in *Science*.

The target words CULTURAL and COMMUNITY are also arguably more associated with social science-oriented than pure science-oriented contexts, and these words also co-occurred with VALUES at relatively high frequencies. Co-occurrence frequencies for all target words are relatively low in the *Science* sub-corpus compared with the *Social* sub-corpus. Those target words that co-occurred with VALUES at the lowest frequencies in the BNC (ENVIRONMENT, IMPACT, RESOURCES, ENVIRONMENTAL, CONSERVATION, NATURAL, PROTECTION, IMPACTS, HERITAGE, RAINFOREST, TROPICS) were those most specifically associated with the context purposively sampled for the Wet Tropics text analysis. Indeed, four of these words (IMPACTS, RAINFOREST, TROPICS, HERITAGE) did not feature at all in either the *Science* or *Social* texts. Figure 12 shows word items in the ‘environment’ category, within the *Environment* corpus, represented by the lower 12 items, whereas word items co-occurring with ‘values’ in the BNC sub-corpora are the 10 items listed from the top.

Values Subsets

As a further comparison between the BNC sub-corpora, a selection of VALUES instances in context (as for a KWIC list) was downloaded from the *Science* and *Social* sets. The selection of these subsets of VALUES instances was conducted by searching for VALUES as a plural common noun (NN2) and downloading one instance, in context, from each text: 191 from the *Science* sub-corpus and 222 from the *Social* sub-corpus. The selections were then classified according to the following contexts of use: environmental/cultural, economics, numerical/parameter measurements, social/people, and unknown/unclear. These categories are represented in Figure 13 as percentages of the total number of instances of VALUES in each of the sub-corpora.

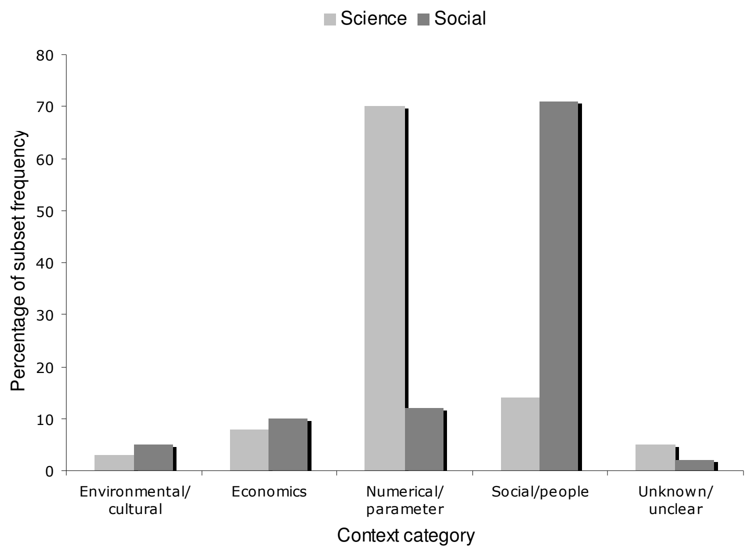

Figure 13. Comparative percentages of 'values' instances according to context category for two BNC sub-corpora.

As expected, the frequencies for the numerical/parameter measurement category are higher for the *Science* subset (70% of instances compared with 12%), and the social/people category frequencies are higher for the *Social* subset (71% of instances compared with 14%). A similar high frequency of numerical/parameter measurement instances was observed in some of the documents examined in the Wet

Tropics text analysis. At least one of those documents was excluded due to the high frequency of VALUE and VALUES instances in the mathematical or statistical sense. There was no similar observation for social/people categories in the Wet Tropics text analysis, with most of those texts containing VALUES instances from the environmental/cultural category.

The environmental/cultural category frequencies are relatively low for both subsets (only 3% and 5% respectively), and this indicates that the application of the word VALUES, and consequently the 'environmental values' concept, in environmental contexts is not widespread or generalised, at least in those texts represented in the BNC. Economic references also have only minimal representation in the texts (8% for *Science*, 10% for *Social*), whereas unknown or unclear references to values constituted another small category (5% for *Science*, 2% for *Social*).

Such differences in use could be problematic for the communication of information pertaining to 'environmental values' between specialists and the public if different meaning domains are being accessed. Some might argue that not all of the texts in the text analysis corpus could be considered 'public' reading, but much of the sampled literature is ultimately aimed towards public understanding of the Wet Tropics World Heritage Area, its management, and its conservation. Of course, this picture could change given a different subset of instances, because other texts could contain multiple occurrences of VALUES in various contexts depending on document-level burstiness, as described by Katz (1996). Nevertheless, the co-occurrence frequencies in Figure 12 and the VALUES frequencies in context categories in Figure 13 indicate that the natural, applied and pure sciences and social science domains of common practice are different, and these BNC informative domains differ from the specific focus on environmental values in the Wet Tropics documents. This further supports the widespread argument that the discussion of environmental values in the Wet Tropics needs clarification for wider audience comprehension.

Further Subcorpora Comparisons

The differences thus far described stem largely from the predominant applications of use and meaning domains within the different scientific disciplines. It might reasonably be supposed that the language of the everyday has been ignored. The nature of the written word is such that it represents a more formal, considered idiom than that expressed informally in conversations or social gatherings, and there are other written domains within the BNC that are not focussed on science.

The BNC texts in the *Science* and *Social* sub-corpora come from various informative sources, including academic and non-academic journals, magazines and newspapers. The searches described thus cover a broad range of applications, and are not confined to one specialist group. Nevertheless, as a further comparison, searches were extended to the other informative categories including World Affairs (wridom5), Commerce and Finance (wridom 6), Arts (wridom 7), Belief and Thought (wridom 8), and Leisure (wridom9), to access even more broad perspectives of use.

The informative written domain categories 5 and 6 together formed a third sub-corpus (*World Finance*, 716 texts), and the written domain categories 7, 8 and 9 together formed a fourth sub-corpus of comparable size (*Culture*, 745 texts). These sub-corpora were again limited to publications from the period 1985-1993, which was searched using the same procedure to identify VALUES with target word collocations. The bar graph in Figure 14 is a comparative display of co-occurrence percentages for the *World Finance* and *Culture* BNC sub-corpora against the *Environment* keywords.

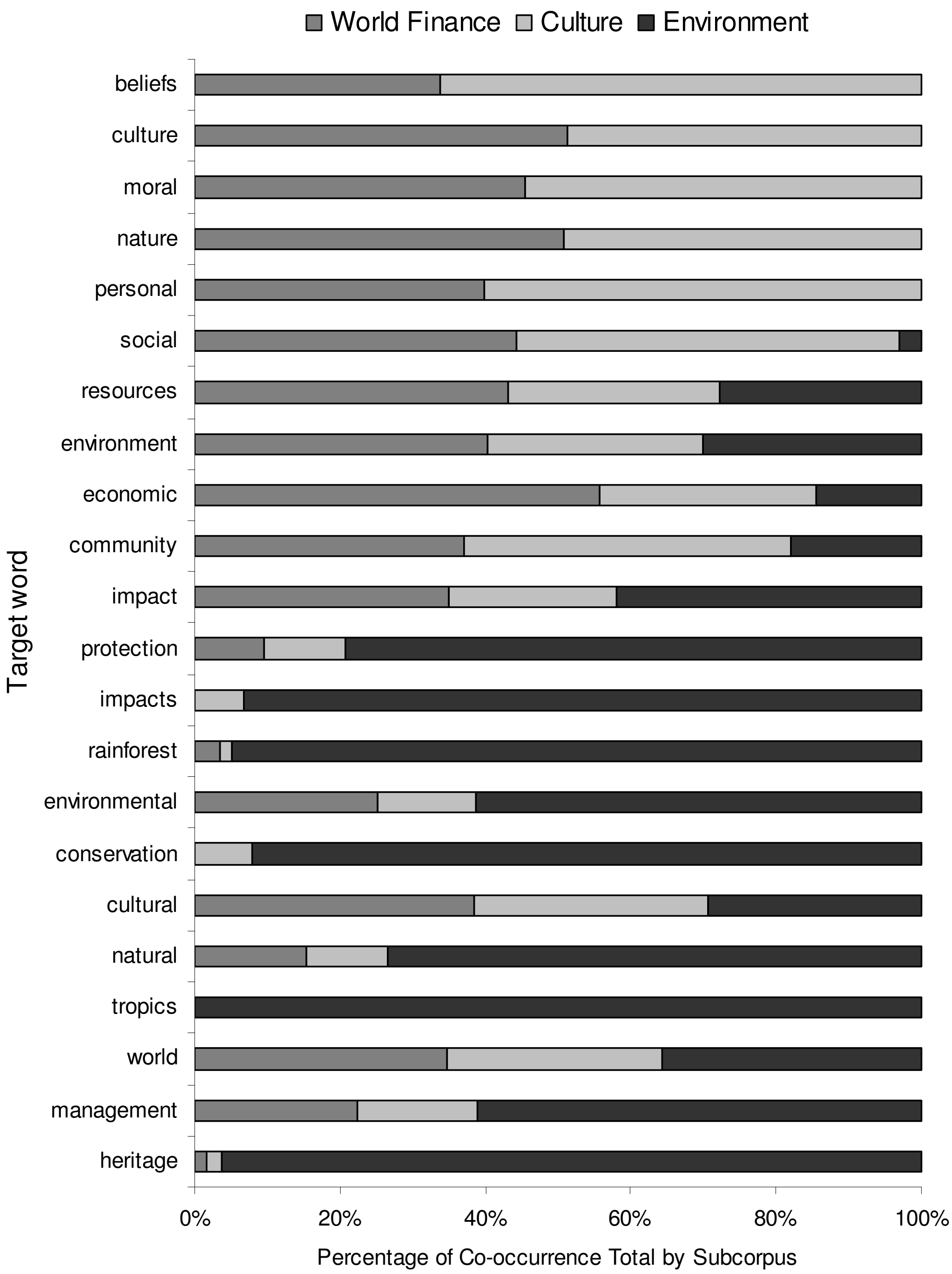

Figure 14. Comparative percentages of co-occurrence between the word 'values' and 22 target words in the *World Finance* and *Culture* BNC sub-corpora against an *Environment* category.

Of the 22 target words, as for the subcorpora in Figure 12, it was again those considered to be most strongly associated with people, or with social connotations, that feature with the highest frequency in the *World Finance* and *Culture* informative domains. The keywords with the stronger environmental associations feature as relative rarities in co-occurrence with the keyword VALUES in all four of the BNC domains, and the informative domains form a distribution that is readily discernible from that of the *Environment* keywords of Wet Tropics discourse.

Discussion

Although the target word VALUES features to some degree in almost 41% of the BNC texts, discussions of ‘values’ in connection with the environment are not common in general use, and it is possible that relatively specialised applications and attendant specialised meanings are feeding the current misunderstandings and miscommunications about ‘environmental values’. It appears possible that the predominant uses of ‘values’, together with attendant meanings of values as a word referent associated with beliefs, occurs in all of the BNC informative domains, and these presumably overlap with popular culture use. It is possible that the concept, VALUES, might be inferred without the use of the word ‘values’ as a direct referent. Although this could certainly be occurring, the aim of the study was to compare the *Environment* corpus with a generalized corpus for those words co-occurring with ‘values’. The keywords BELIEFS, MORAL, PERSONAL and SOCIAL were included as generalized referents to the values concept in the expectation that they would collocate more frequently in the social sciences texts, due to their reference to the social sciences concept of values.

Contrary to Putnam’s (1975) confidence in the universality of the division of linguistic labour, the ‘structured cooperation’ required for the widespread understanding of the values concept as applied to environmental discourse is not evident in the informative domains of discourse. Indications are that the criteria associated with the term ‘values’, at least pertaining to the environment, are known only to a subset of people. As detailed in Chapter 3, the role of background knowledge in the development of meanings was expected to influence the ways in which the word ‘values’ is used in discussions and has come to be understood by those with specialised interests in researching, managing and protecting environmental values.

For instance, keyword similarities as found in the cluster analysis performed as part of the Wet Tropics text analysis could be employed as the basis for a normative assessment of word associations (in an *environmental* vocabulary), as advocated by Deese (1969). Similarity as measured by the frequency of proximal co-occurrence also has applications for experimental studies using the priming paradigm (Lund et al., 1996), word association experiments as conducted by Spence and Owens (1990), and the lexical decision paradigm (Bullinaria & Huckle, 1997).

McDonald and Shillcock (2001) explored the relationships between various lexical or semantic variables and distributional information in text, and showed that distributional information such as word frequency and word co-occurrence can be used to predict lexical processing effort as measured by the lexical decision task. Taking their findings into consideration, it was expected that the co-occurrences between words in the environmental vocabulary studied via text analysis could be used as the basis of a similar study. Words from the environmental vocabulary would conceivably facilitate responses for those whose background knowledge would familiarise them with such a vocabulary.

6: Lexical Facilitation of Meaning: The Role of Background Knowledge

The concept of meaning describes a relation between some more or less arbitrary symbols, interrelated with each other in a complex and partially structured way, and human experience. The relationship depends on a third term: human cognition.[29]

Introduction

The research described thus far included correspondence and cluster analyses of naturally occurring text, which identified a selection of keywords used in the context surrounding the target keyword VALUES. It was noted that persons who of necessity access a word, or concept, more than others, develop extensive familiarity with the word in a particular context through awareness of its relationships with surrounding words, through direct or indirect reference. Familiarity from acquired background knowledge together with frequent exposure to a word facilitates stronger associations and faster access to the word's concept properties than those for whom the word is unfamiliar or newly acquired (Collins & Quillian, 1969; Steyvers & Tenenbaum, 2005).

The environment-oriented applications and meanings of 'values' appear to be specific to people such as environmental scientists, natural resource managers, and conservationists, who all maintain a current knowledge and awareness of environmental issues. Such meanings and uses are discernible from generalised meanings and uses relating to social matters and beliefs. The text analysis suggests a few differences between the three environmental groups (not many), but nothing

[29] James Deese (1969, pp. 40-41) drew on psychological semantic theories to form his views on the nature of the interactions between language and reality.

about the uses of 'values' in the general population. The public read and hear about environmental matters but are mostly not involved in writing about it, so another way to look for differences was required. One way might be to compare a behavioural measure of knowledge about these concepts – the lexical decision task. This use of a behavioural measure also allows the question of whether there are behavioural consequences to the language use differences.

Given the role of background knowledge in the development of meaning (Anderson et al., 1977; Sjogren & Timpson, 1979), those who use a specialised vocabulary might need to apply less lexical effort compared to a group who uses those words less often. It would seem to be a reasonable assumption that environmentally aware people will develop stronger associations with an environmental meaning domain for 'values', whereas those not so environmentally aware will be slower to access specialised, and thus relatively unfamiliar, meaning domains. It must be understood that familiarity does not equate to valuing; people with competing values systems might be equally familiar with an environmental vocabulary without agreeing on nuances of meaning. Rather than discriminating between value systems, the experimental task was deployed to explore the effect of specific background knowledge on lexical knowledge.

For the current study, a lexical decision task was conducted to test whether a set of Wet Tropics *environment* words were more relevant, and thus more immediately recognisable, for participants who were more familiar with the Wet Tropics values literature (in a sense, experts) than for participants who were relatively naïve to the literature.

The Lexical Decision Task

The lexical decision task is often used as an index of semantic and associative memory processes and mechanisms (e.g. Gardiner, Ramponi, & Richardson-

Klavehn, 1999; Meyer & Schvaneveldt, 1976; Toth, 1996). Taft (1991) provides a review of reliable findings from studies using lexical decisions, including the frequency effect (faster responses to high frequency words compared to low frequency words) and the lexical status effect (faster responses when classifying letter strings as words compared with nonwords). The reliability of these effects has led to the broader applicability of the lexical decision task. For example, Joordens and Becker (1997) proposed a learning account of priming that predicts long-term semantic priming for lexical decisions that rely on semantic information as opposed to those relying on surface cues.

On the role of background knowledge, Gernsbacher (1984) discussed a range of inconsistent findings concerning *lexical familiarity* as opposed to *experiential familiarity*. Lexical familiarity concerns printed frequency, usually measured in counts per million in large corpora; the higher a word's printed or spoken frequency, the higher its lexical familiarity. Experiential familiarity, on the other hand, concerns subjective, individually determined word familiarity that is purportedly dependent on how often an individual has encountered a word, and is arguably more sensitive as a measure of actual frequency of encounters.

For the purposes of this study, it was expected that a set of keywords drawn from the text analysis represent to some extent an indirect index of an environmental vocabulary. It was expected that people who are engaged in environment-related work or study would be more familiar with such a vocabulary.

The topic of familiarity is contentious, and Taft (1991) argued against the practice of matching items on subjective familiarity, noting the likelihood that raters could perceive their ability to access a word quickly as their familiarity with the word. In such cases, subjective familiarity is equivalent to access time, so that words matched on subjective familiarity would naturally elicit no difference in response times. Nevertheless, McDonald (2000) reported a relationship between subjective familiarity and lexical decision response latency differences, even when controlling for pairs of words closely matched for corpus frequency.

Apart from familiarity with common words, or those that are more personally significant, an alternative explanation for differential facilitation in lexical decisions is *context availability* (Schwanenflugel & Shoben, 1983), which is determined by the amount of information that is available either from the text or from the reader's world knowledge. Schwanenflugel, Harnishfeger and Stowe (1988) performed a series of experiments to test their hypothesis that context availability, rather than familiarity or other factors, is responsible for some lexical decision effects. They showed that faster response times for concrete stimuli compared to abstract stimuli were due to the relative ease of retrieving related contextual information derived from either the stimulus environment or from participants' *prior knowledge*, as measured through rated context availability. When word stimuli are embedded in a context, either from surrounding text or from one's prior knowledge, participants' responses are faster than for words that are relatively isolated from any context.

One way to test for how prior knowledge affects lexical access is to draw words from a particular domain and then compare experts in that domain with relative novices. In the case of the environmental values literature, those who regularly read about, write about and think about 'values' in a Wet Tropics context should be relatively more experientially familiar with a set of environment-related words than any of the commonly used large-corpus frequency counts might suggest. A comparable sample of non-experts on the other hand, is likely to have had some experience with this language simply as a function of living in the WTWHA and the television and newspaper coverage of these issues. Hence the difference between experts and more naïve subjects will not be from familiarity with the material per se, but in the way that knowledge is applied and acted upon.

It would be all but impossible to test for such differences with a sample of general high-frequency words. High-frequency 'environment' words should be equally recognisable to both groups, given the nature of frequency effects. Therefore, group differences were sought using a set of 'environment' words that were of low frequency in a large corpus.

One of the problems with low frequency words is that no corpus can possibly contain all the words (Lovelace, 1988) or combinations of words (Dagan et al., 1994) within a language, and it can be misleading to rely on any one corpus, at least for word frequencies. The general recommendation is to increase sample size (that is, use a larger corpus) to stabilize the relative frequencies of low-frequency words. Lovelace (1988) highlighted the need for care in selecting low-frequency words from small samples, particularly when dispersion is not taken into account. For example, in using the Kucera and Francis (1967) word norms for language frequencies of a selection of words, Lovelace found that 104 of the words had frequency counts of zero, even though some of the words were arguably common (e.g. CUCUMBER, LETTUCE, TOASTER).

For a set of environment-related words that are low frequency (and unfamiliar) in a generalised sense, slowed lexical decision responses might be expected. However, because they are familiar in a localised sense, prior knowledge could facilitate ease of access to related contextual information, making responses faster for an *Expert* group compared with a *Naïve* group. Based on findings concerning facilitation either from experiential familiarity or context availability, it was hypothesised that an Expert group would respond faster than a Naïve group to a set of localised high-frequency environment words (high familiarity but low frequency in general) than to a set of frequency-matched control words.

Method

Design

The experiment was a 2 x 2 x 2 factorial design with Group (Expert and Naive) as the between-subjects independent variable, and Source (keyword sample condition and control) and Sample Frequency (high or low frequency in the keyword sample) as within-subjects independent variables. Speed and accuracy were the dependent variables, as measured by lexical decision response times and error rates.

Participants

Participants were a group of people experienced and engaged in thinking, reading and writing about the environment in a Wet Tropics context, and a control group who were relatively naïve on that topic. The Expert group consisted of 24 staff and advanced students (i.e. postgraduates, 3rd & 4th year students) from the JCU Schools of Tropical Biology, Earth Sciences, or Tropical Environment Studies and Geography, and active conservationists. The mean age of this group was 48 years (SD = 13.58)[30]. The Naïve group consisted of 40 first-year students recruited from the JCU School of Psychology participant pool. The mean age of the naïve group was 27.64 years (SD = 10.66). A *t*-test revealed that the difference in age between the older Expert group and the younger Naïve group was significant, $t_{(1, 58)} = 6.40$, $p < .001$ (CI: mean difference 20.36 years ± 6.37 years). The mean age for the entire sample was 34.77 years (SD = 15.22).

[30] Age data were missing for one participant in the Expert group and seven participants in the Naïve group. In such instances where there is missing data, the insertion of group means is less conservative than using the overall mean, and less liberal than relying on an estimate based on prior knowledge (Tabachnick & Fidell, 2001), which in this case was irrelevant. The respective group mean age was thus inserted where data were missing.

Naïve group participants received partial course credit for participating and the Expert group received no reward. All participants had normal or corrected to normal vision.

Apparatus

Stimuli were presented and responses recorded using E-Prime experimental software (Psychology Software Tools, 2005), running on an Acer TravelMate 230 laptop computer, which was time-tested to ensure millisecond precision. Responses were collected via a PST Serial Response Box (Psychology Software Tools, n.d.).

Stimulus Items

Stimuli consisted of 100 words, together with 100 pronounceable nonwords as fillers. 'Environment' words were drawn from the keyword sample from the text analysis study, and they ranged in length from four to 12 letters.

Environment target words were closely matched to paired control words based on general frequency. To control for some of the potential sampling errors inherent in frequency counts, particularly for low-frequency words, three corpora[31] were consulted for frequency information, and items were considered to match as long as there was agreement between any two of the three. Final matches were conducted using CELEX-written frequencies.

In the text analysis keyword sample, half of the environment words were low frequency ($f = 1$) and the other half were high frequency ($19 < f < 99$). However, the 50 environment words and 50 control words were all low frequency in the population of words in general, with lexeme frequencies ranging from one to 14 occurrences per million in the CELEX written word count. This restriction meant that some words of higher frequency within the keyword sample were not selected, as their frequencies

[31] Lexeme frequencies from the British National Corpus, the Sydney Morning Herald and the CELEX-written database were found using N-Watch (Davis, 2005).

within the larger corpora exceeded 14 occurrences per million. Table 17 lists examples of word items selected for each of the four conditions.

Table 17

Examples of Word Stimulus Items by Source and Keyword Sample Frequency

Keyword sample *f*	Source		CELEX-W *f*
	Environment	Control	
High	tourism	drought	5
	heritage	legitimate	11
Low	pastoral	gorgeous	5
	submit	endure	11

Note. *f* = frequency, CELEX-W = CELEX-written database

Nonwords were drawn from the ARC Nonwords database (Rastle, Harrington, & Coltheart, 2002), or were derived by substituting two letters of a real word (e.g. VAL*ID*ATE became VAL*AG*ATE). Nonwords had orthographically existing onsets and bodies containing only legal bigrams, and ranged in length from four to twelve letters. A list of all stimuli is provided in Appendix 2a.

Procedure

Participants were provided with a printed outline of the procedure, which was also explained verbally, to ensure that they understood the task requirements. The 200 stimuli were presented in two 100-trial blocks, each consisting of 25 environment words, 25 control words, and 50 nonwords. Stimuli were presented in lowercase white letters, in Arial, size 24 font on a black background. The block presentation order was randomised across participants, with a rest break between each block. An instruction screen (encouraging participants to respond as quickly and accurately as possible) and eight practice trials preceded each experimental block. On the completion of the practice trials the experimenter checked that the participants were comfortable with the task. If so they proceeded to the experimental trials.

Each experimental trial consisted of a centrally presented fixation point displayed for 500ms followed by a stimulus item, which remained in view for 1000ms or until the participant responded by pressing a button marked W for word items or N for nonword items. An ISI of 500ms began once a response was detected or the stimulus timed out. The order of trials was randomised for each participant.

Results

Prior to analyses, the data were cleaned to remove participants and items with spuriously long response times. Data from three participants from the Expert group and one participant from the Naïve group were removed from analyses due to slow mean response times (slower than 900 milliseconds). In addition, four word items for which the mean response times were slower than 900 milliseconds were removed (in this case corresponding items from all conditions were removed). Reported analyses are thus for the 21 Expert participants and 39 Naïve participants whose response times met the inclusion criteria, and for 21 items in each of the four conditions.

Any remaining data points greater than 2.5 SD from the mean were considered outliers and were trimmed to that level (Tabachnick & Fidell, 2001) for words and nonwords respectively. The aggregate error rate for the word condition was 5.96 %, and for the nonword condition it was 9.86 %. The mean response time for the word condition was 706ms (SD = 201) and for the nonword condition it was 771ms (SD = 216), consistent with the commonly observed lexical status effect (Taft, 1991).

Descriptive statistics for participants' response times and error rates are shown in Table 18, with data grouped by independent variables. Corresponding details of response times and errors across items are provided in Appendix 2b.

Table 18

Mean Response Times in Milliseconds and Mean Percentage Error Rates as a Function of Group, Source and Sample Frequency across Participants

Group	Means	Source			
		Environment words		Control words	
		High freq	Low freq	High freq	Low freq
Expert	RT	696 (91)	716 (65)	735 (86)	728 (92)
	Errors	2.8 (4.7)	2.6 (3.4)	4.0 (5.9)	3.1 (2.9)
Naïve	RT	639 (85)	659 (83)	658 (82)	646 (93)
	Errors	3.6 (5.1)	7.9 (6.9)	6.1 (7.8)	4.6 (5.4)

Note: Items in brackets are standard deviations

A percentage error rate of 4.76% equates with one error in 21 items.

Analyses of variance were conducted on response time and error data with alpha set to .05. Significance tests for assumptions of normality and homogeneity showed no serious violations in the response time data. Skewness and kurtosis statistics calculated using the *z*-test with a conservative alpha of .001 are presented in Appendix 2c. Response time data for the naïve participants in the low frequency control word condition showed a slight positive skew, but the analysis of variance technique is considered robust to moderate normality violations (Howell, 2002; Pallant, 2005). There is reportedly more concern about violations of the assumption of homogeneity (Keppel, 1991), but this assumption was not seriously violated in the data.

For the error data, skewness and kurtosis statistics indicate some normality violations, but this is not unusual given the small number of errors made. Only five of the 60 participants made more than four errors in any of the four conditions, and most participants made only one or no errors in each condition. Additionally, there were no more than six errors made for the 21 target words in each condition. A frequency table of errors across participants and items for each of the four conditions is provided in Appendix 2d.

As recommended by Clark (1973) to enable generalisation across participants and items, analyses were conducted averaging across both participants (F_P) and items (F_I). ANOVA tables for all analyses are provided in Appendix 2e. Confidence intervals for all effects reported in the next section are calculated at 95% around the mean difference and scaled in dependent variable units. Effect sizes for significant effects are reported using partial eta-squared (η_p^2) as an index of the strength of association. It should be noted that caution should be used in interpreting the partial eta-squared statistic in multifactorial designs, as outcomes are artificially inflated due to the partialling out of variance produced by other factors, and thus the sums of the outcomes are not additive (Hullett & Levine, 2003; Levine & Hullett, 2002; Olejnik & Algina, 2003; Pierce, Block, & Aguinis, 2004). In any case the 95% CI around the difference gives a clearly interpretable indication of the magnitude of any effects on response times or errors.

ANOVA Analyses of Response Times and Errors

In the response time data, there was a significant main effect for group, $F_{P\ (1,\ 58)} = 9.47$, $p = .003$, $MSE = 26513$, $\eta_p^2 = .14$ (CI: 68 ± 44), $F_{I\ (1,\ 40)} = 57.71$, $p < .001$, $MSE = 3333$, $\eta_p^2 = .59$ (CI: 68 ± 18), with faster response times for the Naïve group (M = 651, SE = 13) than the Expert group (M = 719, SE = 18). An analysis of variance on participants' error data also showed a main effect for Group, with the Naïve group's error rate (M = 5.6%, SE = .70) significantly higher than that of the Expert group (M = 3.13%, SE = .10), $F_{P\ (1,\ 58)} = 4.24$, $p = .044$, $MSE = 76$, $\eta_p^2 = .07$ (CI: 2.4 ± 2), $F_{I\ (1,\ 40)} = 99.96$, $p < .001$, $MSE = 34$, $\eta_p^2 = .71$ (CI: 9 ± 2).

There was also a significant main effect for Source in reaction times, responses were faster to environment words (M = 678, SE = 11) than to control words (M = 692, SE = 12), and this effect was significant both for participants, $F_{P\ (1,\ 58)} = 10.18$, $p = .002$, $MSE = 1097$, $\eta_p^2 = .15$ (CI: 14 ± 9), and for items,

$F_{I\ (1,\ 40)} = 6.38$, $p = .016$, $MSE = 1262$, $\eta_p^2 = .14$ (CI: 14 ± 11). There was no corresponding significant effect in the error data, $F_{P\ (1,\ 58)} = .219$, $p = .642$, $MSE = 13$ (CI: 0.2 ± 1), $F_{I\ (1,\ 40)} = .10$, $p = .754$, $MSE = 19$ (CI: 0.2 ± 1).

There was no significant difference between responses to high sample-frequency and low sample-frequency words either for response times, $F_{P\ (1,\ 58)} = 2.11$, $p = .152$, $MSE = 624$ (CI: 5 ± 7), $F_{I\ (1,\ 40)} = .744$, $p = .393$, $MSE = 2646$ (CI: 7 ± 16), or errors, $F_{P\ (1,\ 58)} = 0.48$, $p = .483$, $MSE = 22$ (CI: 0.5 ± 1), $F_{I\ (1,\ 40)} = .27$, $p < .608$, $MSE = 26$ (CI: 0.4 ± 2).

There was a significant interaction between Sample Frequency and Source for response times, $F_{P\ (1,\ 58)} = 12.17$, $p = .001$, $MSE = 973$, $\eta_p^2 = .17$ (CI: 15 ± 8), $F_{I\ (1,\ 40)} = 6.11$, $p = .018$, $MSE = 1708$, $\eta_p^2 = .02$ (CI: 16 ± 13), and for errors, $F_{P\ (1,\ 58)} = 6.37$, $p < .014$, $MSE = 22$, $\eta_p^2 = .10$ (CI: 1.6 ± 1), $F_{I\ (1,\ 40)} = 4.46$, $p = .041$, $MSE = 26$, $\eta_p^2 = .10$ (CI: 1.7 ± 2). As illustrated in Figure 15, response times were faster for environment words than for control words in the high sample-frequency condition, but there was no difference between environment and control words of low sample-frequency.

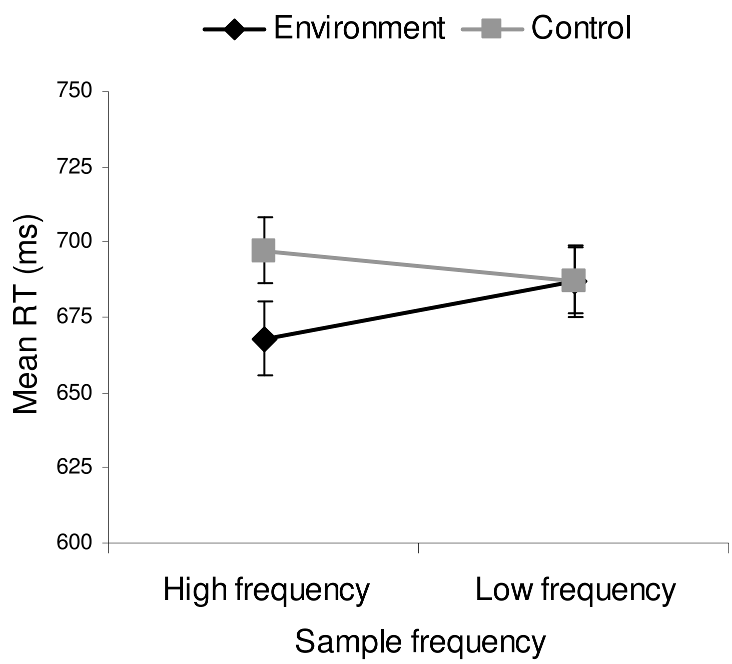

Figure 15. Disordinal interaction in response times between word source and sample frequency, with error bars showing standard error.

There was no significant interaction between Sample Frequency and Group, either for response times, $F_{P\ (1,\ 58)} = .127$, $p = .723$, $MSE = 624$ (CI: 2 ± 14), $F_{I\ (1,\ 40)} = .020$, $p = .889$, $MSE = 2646$ (CI: 2 ± 32), or errors, $F_{P\ (1,\ 58)} = 2.45$, $p =.123$, $MSE = 22$ (CI: 2.0 ± 3), $F_{I\ (1,\ 40)} = 1.63$, $p = .209$, $MSE = 26$ (CI: 2.0 ± 3).

The interaction effect for mean response times between the Groups according to whether items were environment or control words (Source) was significant, $F_{P\ (1,\ 58)} = 5.86$, $p = .019$, $MSE = 1{,}097$, $\eta_p^2 = .09$ (CI: 22 ± 18), $F_{I\ (1,\ 40)} = 5.37$, $p = .026$, $MSE = 1262$, $\eta_p^2 = .12$ (CI: 25 ± 22). Figure 16 shows that there was no difference between responses to environment and control words for the Naïve participants, but Expert participants responded faster to environment words than to control words. This interaction was not significant in the error data, $F_{P\ (1,\ 58)} = 1.49$, $p = .227$, $MSE = 13$ (CI: 1.2 ± 2), $F_{I\ (1,\ 40)} = .833$, $p = .367$, $MSE = 19$ (CI: 1.2 ± 3).

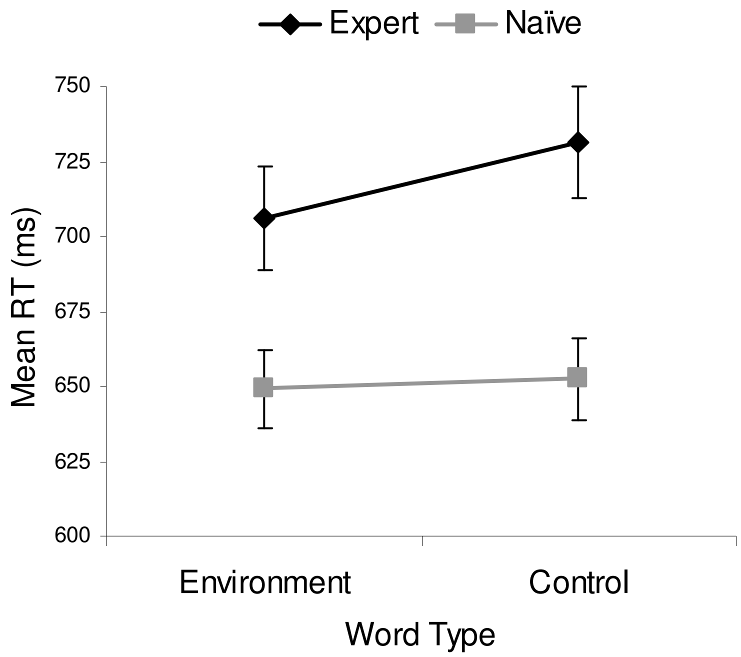

Figure 16. Ordinal interaction in response times between group and word source, with error bars showing standard error.

The three-way interaction between Group, Sample Frequency and Source was not significant for response times, $F_{P\ (1,\ 58)} = .12$, $p = .73$, $MSE = 973$ (CI: 3 ± 17), $F_{I\ (1,\ 40)} = .06$, $p = .80$, $MSE = 1708$ (CI: 3 ± 26) or for errors, $F_{P\ (1,\ 58)} = 3.89$, $p =.053$, $MSE = 22$ (CI: 2.6 ± 3), $F_{I\ (1,\ 40)} = 2.76$, $p = .105$, $MSE = 26$ (CI: 2.6 ± 3).

To summarise the observed effects, Expert participants recognised environment words faster than control words, as expected, but word source did not affect Naïve participants' responses. Additionally, participants recognised high sample-frequency environment words faster than low sample-frequency words or control words. The frequency effect was also observed in lower error rates for high sample-frequency environment words than those of low sample frequency. Participants thus recognised high sample-frequency words both quickly and accurately.

The group main effects were unexpected and the finding that the naïve group was responding faster but with more errors than the expert group is a concern, as it suggests that there may have been a speed accuracy trade-off. That is, it is possible that the experts may have adopted a more conservative response strategy compared to the naïve subjects. Why this might have occurred is unclear, but it should be noted that the Expert group was, on average, around twenty years older than the Naïve group. An alternative explanation is that age simply slows responses times (Balota & Duchek, 1988; Madden, 1992), and this slowing in itself affords greater accuracy as it allows time for additional linguistic processes to contribute information to the decision process (Ratcliff, Thapar, Gomez, & McKoon, 2004).

The possibility that the significant difference in age was a factor in the obtained pattern of results was explored by adding age as a covariate to the analysis.

Age as a Covariate

To control for the potential confound of age, analyses of covariance were conducted on participants' response times and error data using age as a covariate (mean sample age = 34.77 years). Complete ANCOVA statistics including a table of adjusted means are provided in Appendix 2f.

Despite controlling for age in the analysis, the Expert group response times were still significantly slower than those of the Naïve group, $F_{(1, 1, 57)} = 6.12$, $p = .016$, $MSE = 26956$, $\eta_p^2 = .10$, but there was no longer a significant difference for errors, $F_{(1, 1, 57)} = 1.69$, $p = .198$, $MSE = 75$. Similarly, the previously observed significant main effect for environment words versus control words was also still evident for response times, $F_{(1, 1, 57)} = 4.93$, $p = .030$, $MSE = 1084$, $\eta_p^2 = .08$, but not for errors, $F_{(1, 1, 57)} = .098$, $p = .755$, $MSE = 14$.

In the already reported ANOVAs, significant interactions were noted for environment and control words by Group and by Frequency. With the effects of age controlled for, the Source by Group interaction was still significant for response times, $F_{(1, 1, 57)} = 7.31$, $p = .009$, $MSE = 1084$, $\eta_p^2 = .11$, but not for errors,

$F_{(1, 1, 57)}$ = 1.09, p = .302, MSE = 14. The Source by Frequency interaction was no longer significant either for response times, $F_{(1, 1, 57)}$ = .156, p =.695, MSE = 982 or for errors, $F_{(1, 1, 57)}$ = . 878, p = .353, MSE = 23.

Discussion

The significant effects in the ANOVAs and ANCOVA were mostly small to moderate (> .06 < .72) following a conservative use of Cohen's (1988) guidelines for interpreting effect sizes (small = .10, medium = .25, large = .40). The partial eta-squared index indicated that each of the significant interactions accounted for between 7% and 17% of the variance from the relevant factors.

The ANCOVA results suggest that some of the observed effects are governed by differences within the groups other than age. It is possible that age did contribute to differences in error rates, but other factors such as experience and accumulated background or vocabulary knowledge in the Expert group are more likely to have contributed to facilitation of their lexical decision responses to environment words. For example, it is possible that facilitation from Experts' background knowledge of environment words was a factor in the interaction between the participant groups and the word types.

Alternatively, significantly faster responses for the Naïve group, with concomitantly higher error rates in comparison to the slower response times and lower error rates for the Expert group, could indicate that each group was using qualitatively different response criteria. A plausible explanation for the use of different response styles is the older mean age of the Expert group compared to the Naïve group. As the older group consisted largely of academics and postgraduate students and the naïve group consisted largely of university students in their first year of study, the age difference is understandable. Age does play some part in lexical decision at the response stage, with a general observation of slower responses from older participants (Balota & Duchek, 1988; Madden, 1992), In the current study, the higher error rate combined with faster reaction times at first suggested a speed-accuracy trade off, with Expert participants adopting a cautious strategy in favour of accuracy and Naïve participants adopting a relatively reckless strategy in favour of speed. However, this explanation appears implausible, as error rates were reasonably low, and any error rate differences disappeared once age was controlled for.

Another possibility is that reliance on an acquired semantic dimension for the Expert group through their experience and familiarity with word items could have slowed down their responses due to employment of deeper processing strategies involving semantic activation. In contrast, the faster response times for the Naïve group might possibly have arisen due to their unfamiliarity with word items, leading to a reliance of those participants on surface cues, which require minimal processing but are somewhat more error prone. It has also been argued that slow response times facilitate extra semantic processing such that when response times are intentionally slowed (e.g. by setting a response cue), additional processing takes place and that this can influence the observed effects (Gardiner et al., 1999; Toth, 1996). Thus, slow response times due to age can produce additional processing. The ANCOVA results controlling for age discount such occurrence in this instance.

Also worth consideration is a difference between the two groups in the expectancy set for the experimental situation and task. The more educated and specialised respondent group of ‘experts’ might, in some ways, be more susceptible to research demand characteristics and biases. The influence of background knowledge and experience is not limited to word use and meaning. The expert group, as scientists and advanced students of science, might have had very different expectations of the task than the naïve group, consisting largely of first-year university students. Although such biases might be possible, it is nevertheless impossible to say what they might mean for the reported data.

What the exercise has shown is that groups differing in exposure and use of these environmental word items process them differently. It has also demonstrated that the lexical decision task can be used to look at group differences in language exposure. Habitual use of and exposure to this environmental vocabulary in a Wet Tropics context appears to make some of these words readily accessible to those who are exposed to that context. To be certain that the effect is not merely differences between the groups other than those suggested here, it would be necessary to repeat the task with another group of participants from outside the region.

The studies reported thus far were concerned with characteristics of an environmental vocabulary, concentrating on keywords identified through the analysis of naturally occurring text samples. It was earlier noted that analysis of texts removes the demand characteristics of the research, as the texts already exist. The lexical characteristics of the target word 'values' and its thematic relationships with a surrounding galaxy of words have now been described. In order to explore and describe the nature of 'values' as a conceptual system, other procedures are more suitable. Concept mapping was earlier foreshadowed as being suited to such an undertaking, and a mapping procedure is described in the next chapter.

7. Mapping the Dimensions of 'Values': Meanings in a Conceptual Values System

The psychological structure of meaning is a set of relations between (1) some aspects of a particular language, (2) ideas in the minds of people who use the language, and (3) objects and events in the perceptual-physical world. Common sense epistemology leads us to expect some orderly relation between the perceived world and ideas in the head, and these ideas correspond to some aspect of language.[32]

Introduction

The social sciences 'values' literature already reviewed suggested that generalised applications and associated meanings of 'values' are not environment-focussed, and particularly not biophysically focussed. Generalised uses and meanings are, instead, of an intrapsychic, psychological nature about standards, principles and beliefs. The studies described thus far suggest that there is indeed a 'Wet Tropics vocabulary' pertinent to the discussion of environmental values, but none of the results are sufficiently indicative of how such values are recognised conceptually. To understand conceptual underpinnings of the environmental values domain, further study was required.

To maintain ecological validity within this research, it was desirable to examine the actual lexical applications and conceptualisations of 'values' within the WTWHA context. The speculated problems in communication concerning the nature of 'values' need to be studied via techniques that do not elicit artificial responses, but will instead capture the psychological reality of the conceptual system in question. The cognitive approach to meaning adopted for this research necessitates a weaker focus on the roles of affect or emotion in the construction of meaning, in favour of

[32] James Deese (1969, p. 40)

the strong focus on conceptual systems. The roles of direct experience and conditioning have been acknowledged throughout, and are not ignored here either, but the complexities of connotative meaning are such that they spill over into all meaning in some way.

It was not expected that a conceptual approach would ever be free of the influences of affect, but rather that the WTWHA values system would be multidimensional, allowing space for many characteristics of meaning to emerge. Accordingly, this phase of the investigation concerns an exploration of the structure of the environmental values concept, specifically of its dimensions and the clustering of statements reflecting features, examples or characteristics of the conceptual domain of Wet Tropics ‘values’.

The notion of ‘values’ in relation to environmental issues is referentially indeterminate, and definitions depend on what connotation of ‘values’ is being assessed. The ‘values’ literature, and indeed the text analyses already described, strongly suggests that the conceptual domain of values is complex, in that it is possible for two or more competing ideas to co-exist. Very broadly, some characteristics of environmental values are often defined using two different but related meanings (Steinhoff, 1980).

The first definition holds that values *are* attitudes of people, who attribute worth to things, be they objects, events, or processes. This equating of ‘values’ with ‘attitudes’ often occurs in research about environmental values, which is part of the larger problem and undoubtedly feeds into the confusion and language slippage.

The second definition holds that ‘values’ *are the result of* human attitudes, reflecting the worth of things relative to other things. Relativity implies ranked worth, so that objects of evaluation are ordered in a hierarchical fashion, from higher to lower. Rokeach employed a ranking system for his Value Survey; however, some of the arguments against the use of the ranking method were discussed earlier.

Moreover, it is unlikely, given the difficulties encountered in presenting a fully comprehensive system of ‘values’, that the conceptual system of values is one-dimensional, and very few researchers would consider such a notion. Indeed, Kuntz (1970) specifically argued against one-dimensionality: “It would be a great advantage to have but one principle against which all values could be ranked from highest to lowest…But it seems meaningless to grade different kinds of value, aesthetic, moral, scientific, as higher or lower relative to each other” (p. 284). The nature of the values system is such that some values, though in themselves reasonable, are contradictory to others; they are antinomies. Kuntz advocated the acceptance of the contradictions rather than a choice between the two, in a plural dimensional order, where vertical, horizontal and oblique relations are at once possible. An excerpt from Schwartz and Bilsky (1987) highlights this point:

> To strive for success by using one's skills usually entails both causing some change in the social or physical environment and taking some risks that may be personally or socially unsettling. This contradicts the concern for preserving the status quo and for remaining psychologically and physically secure that is inherent in placing high priority on security values. Kluckhohn (1951) proposed a hypothesis similar to this one in suggesting that safety (Appolonian) and adventure (Dionysian) values were opposed. (p. 554)

Schwartz’s value typology is one such system where oppositions are taken into account, with relations between opposing values accepted through the structuring of the system along two bipolar dimensions. Values that are in opposition to each other are ranged at opposite ends of the dimensions, and values that are compatible with each other are proximal around the circumference.

Semantic Networks and Concept Maps

The position and strength of the word and concept, ‘values’, in a semantic, conceptual network and its ease of accessibility will depend on its frequency of occurrence in a particular context. To make an example using two extremes, an individual thinking about ‘values’ predominantly when referring to personal, internalised views reflected in ‘attitudes’ or ‘beliefs’ will create a different semantic network from an individual thinking about ‘values’ predominantly in reference to rainforest resources, as ‘things in the forest’. Nodes and links will differ in each individual’s semantic store. There is no assumption being made regarding an ability to verbalise the difference between values, attitudes and beliefs. Semantic networks are theorized models of the idiosyncratic systems that operate in the mind, and are not necessarily explicit. Accessibility in relation to semantic networks refers to the ease or difficulty of access to a word or concept, or to the relationships between them. Not all information or ideas are verbalized, and there is no suggestion here that explicit understanding is necessary or even likely.

Like semantic network maps, concept maps represent a concise structural overview of a concept. Unlike semantic network maps, concept maps do not represent the linking information between the various nodes. Semantic models of cognition, however, do offer further aids to interpretation of concept maps.

In a semantic network, semantic distance is the shortest distance between two concepts, but semantic relatedness depends on the strength of the links and ease of accessibility built up by a person thinking about and using the properties of the concepts (Collins & Loftus, 1975). On a concept map, statement positioning is such that those sorted together more frequently are situated closer together than those statements that are sorted together only rarely, or never. Furthermore, the proximity of clusters of statements depends on the level of similarity (as categorical association) between the different clusters. Thus, on a concept map, distance represents relatedness in the absence of any linking information.

Although not strictly speaking a direct measure of cognition, concept maps are frequently adopted as representations of a collective conceptual reality. Whether the representation and the reality actually correlate depends largely upon the interpretation of the concept map, and thus the procedures employed to generate such a map should ideally produce a replicable product (Trochim, 1989a).

Concepts and Categories

In language, a category is a set of characterised elements that can include individual words forming a semantic category, phrases that share similar, well-defined meanings, or word associations that are based on shared features rather than meaning. Rosch's (1973) work in the seventies, on perceptual and semantic categories, indicated that categorical structures are loosely bound clusters of categorical instances that are representative of the category by varying degrees. Category items do not necessarily form neat structures wherein each item is an equivalent distance from other items. Rather, some items will fit the category criteria more strongly than other items.

Concept content is an aspect of concepts that is subject to the type of concept. For instance, category components depend on whether a concept is concrete or abstract. Simply put, abstract words, such as 'idea', or 'difference', refer to concepts that have no physical representation, but there are degrees of abstractness just as there are degrees of concreteness. Wiemer-Hastings and Xu (2005) gave the examples of 'scientist' being perceived as more abstract than 'milk bottle', even though both have physical representations, whereas 'ambiance' is perceived as more concrete than 'notion', even though neither has physical representation. A better distinction is that abstract concepts are characterized by mental experience whereas concrete concepts are characterized by item features. In their study comparing abstract and concrete concept properties, Wiemer-Hasting and Xu found persons, social states and social artifacts distinctly featured as situational properties of abstract concepts and barely at all for concrete concepts. In contrast, situational properties of concrete concepts were objects, location, living things, and function. Augustine's confession of his difficulty in explaining time is justified in the knowledge that some participants asked to generate property items for abstract concepts reported difficulty with the task (Wiemer-Hastings & Xu, 2005), which suggests that conceptual knowledge is indeed difficult to express verbally.

This noted difficulty leads to two related aspects of concepts: conceptual complexity and expert knowledge. Studies of differences between experts and novices indicate that experts construct more complex knowledge structures than novices (Means & Voss, 1985). Furthermore, knowledge in a specific domain will facilitate the acquisition of new knowledge that is related to that domain (Chiesi et al., 1979), a notion supported by Friendly and Glucksberg's (1970) findings indicating the acquisition of a semantic dimension within a sub-cultural lexicon.

Tanaka and Taylor (1991) compared expert and novice participants to show that basic level categories (the most inclusive and accessible level in a category hierarchy, between subordinate and superordinate levels) can be modified by experience. That is, experts, who have more knowledge about a given domain, can change classification levels and identify attributes that novices either do not recognise or do not consider important. Experts can thus exploit their domain knowledge to verify category membership at the subordinate level just as quickly as at the basic level, as they have increased accessibility to the subordinate level as a function of their expertise (Tanaka & Taylor, 1991).

Differences between judgements by novices and experts have been observed as a general phenomenon, with novices relying on superficial features and experts relying on deeper, underlying beliefs (Medin et al., 1993; Tanaka & Taylor, 1991). Based on these empirical findings about concept formation and modification, it is a reasonable expectation that experts would be able to provide more detailed conceptual knowledge than those relatively naïve to the concept domain. Experts should be able to list more features or examples of a concept, and to categorise item constituents of the conceptual domain with greater structural complexity (Chiesi et al., 1979; Means & Voss, 1985; Tanaka & Taylor, 1991).

Similarity Judgements

An important principle of categorisation is the tendency for similar items to be grouped together. Shepard (1980) considered that a psychological approach using measures such as similarity is "essential in the case of symbolic stimuli such as words, for which the relevant semantic dimensions are not even present in the physical stimuli" (p. 390). Despite empirical evidence to the contrary, the notion of similarity has been attacked for being ambiguous (Tversky & Hutchinson, 1986). Nevertheless, similarity ratings demonstrably facilitate predictability for categorisation tasks and property verification times (Medin et al., 1993).

Similarity is not a fixed concept but is flexible, to the extent that it should be viewed as a process that is open to cognitive manipulation (Medin et al., 1993). Methodologies to study similarity often involve a multidimensional scaling (MDS) procedure involving similarity ratings of paired items, represented in a psychological, conceptual space.

Multidimensional Scaling and Sorting

A practical limitation commonly encountered in MDS studies is the limit on participants' time. For a full matrix of paired similarity judgements, in which each pair of items, or objects, is rated for similarity, only a limited number of objects or items can be compared[33] in a reasonable amount of time. A less-exhaustive alternative, drawing on the notion that category instances are linked by a family resemblance (Medin & Schaffer, 1978; Rosch, 1973), is to have participants sort the items into categories according to broadly specified criteria, including *aspects of meaning* (Rosenberg & Kim, 1975) or *similarity of meaning* (Miller, 1969). For word items, the sorting method has linguistic relevance (Miller, 1969).

In a sorting task, items need only be inspected for grouping purposes without each item having to be compared to and rated against each other item and some items might only be considered once before being grouped. There is also no pre-determined constant against which to judge items (such as in Schwartz's anchored rating survey method where respondents rate items on a 9-point scale of importance as 'a guiding principle in my life'), so that respondents can determine their own categorisation method for grouping items. Methods can vary depending on expertise with the given context. Boorman and Arabie (1972) and Rapp (2002) have described differences in paradigmatic and syntagmatic sorting styles for word items. Those using a paradigmatic style sort items together according to associations of meaning, and these are usually grouped into relatively fewer categories. Those using a syntagmatic style use relatively more clusters and sort items according to lexical frequency.

The sorting method is not without constraints, one of which is that categories are mutually exclusive. That is, one item cannot be sorted into two categories. However, this clear partitioning of the data allows for the assumption that the relations between items can be measured as distances (Miller, 1969) using a distance

[33] The number of judgements is usually calculated using N x (N-1)/2, where N equals the number of objects.

metric, by subtracting the measure of proximity for items *a* and *b* (i.e. the number of subjects who sorted items *a* and *b* together) from the total number of subjects.

Although MDS analysis of sorting and similarity judgement data has wide application in studies of perceptual and conceptual stimuli[34], some researchers (e.g. Tversky, 1977; Tversky & Hutchinson, 1986) perceive other analyses as more appropriate for conceptual stimuli. For example, Tversky and Hutchinson (1986) argued that measures of *centrality* and *reciprocity* produce representations of the hierarchical structure of conceptual domains that are relatively more efficient than the Euclidean distance solutions commonly used in MDS.

The *centrality* measure is an index of the nearest neighbour relationships between elements in the data matrix, and is represented as an additive tree diagram (as with agglomerative cluster analysis). As already noted, indications are against the notion of values systems being one-dimensionally hierarchical in nature. *Reciprocity*, which is defined by the sample mean, indicates the symmetry of the rank order of nearest neighbour proximity. However, measures based on nearest or furthest neighbour relationships rely on outliers in their analyses, and are prone to distort the data.

The sorting method draws on the processes of categorisation in such a way that each item is not submitted to the exhaustive inspection necessary for paired similarity judgements. Items need only be sorted together as clusters that belong together in some designated way. The psychological distance between items is then measured using the degree to which participants do, or do not, sort two items into the same group. An advantage is that any of the underlying psychological dimensions that participants use to sort items into categories are relatively free from

[34] For example, Tversky and Hutchinson (1986) used MDS in comparative analyses of a data base comprised of 100 proximity matrices of perceptual and conceptual stimuli, sourced from many different studies conducted in a period from the 1950s to the 1980s.

contamination by the researcher (Rosenberg & Kim, 1975), and will not necessarily even be identified by the participants. It is therefore unlikely that the sorting process will affect judgements made during the process.

Shepard (1980) described how different types of representations, achieved through multidimensional spatial configurations and non-dimensional tree structures, can be appropriately applied to reveal "complementary aspects of the underlying psychological structure" (p. 390) of perceptual and semantic data. It is thus beneficial to explore and analyse the one data set using different methods of representation.

A concept mapping procedure was thus chosen to explore the conceptual domain of environmental values. Concept mapping, using low-dimensional maps together with hierarchical clusters to represent item associations, typically involves a listing procedure, an iterative item reduction process, and a sorting procedure (Trochim, 1989b). Ratings of the items on a related, complementary characteristic of conceptual meaning are used in conjunction with the sorting procedure to provide an external validation measure of the cluster solutions. The concept mapping procedure was used in the current study to explore the underlying framework of the WTWHA environmental values conceptual system.

Item Generation

The procedure for item generation consisted of a listing task, for which participants were required to list features, examples or aspects of twelve noun phrases. Furthermore, because the word 'values' is associated in the Wet Tropics context with human evaluation as attitudes and beliefs as well as with World Heritage listing criteria, primary reference was considered as a factor that could influence a predominant meaning domain. This factor was explored by inviting different listings for *personal relevance* and *environmental relevance*.

Participants

Participants were eight CRC scientists, including post-graduate students, and six CAFNEC members. Two respondents indicated dual affiliation with the CRC and the CAFNEC and another two with the CAFNEC and the WTMA. Of the fourteen respondents, one nominated management as the stronger environmental association, six nominated science/research, and seven nominated activism/conservation as their stronger environmental association. All of the participants but one were educated to tertiary level. Specific fields of study, where indicated, were mostly environment-focussed. Participants did not receive any reward for participation, and consent was assumed upon receipt of a completed instrument.

Materials

The seven-page instrument (Appendix 3a), which participants received either in printed form or as an electronic copy via email, comprised three sections. The first page outlined the requirements of the study and explained participant confidentiality and voluntary participation. The second page was the demographics section, which requested three pieces of participant information: affiliations with any of ten listed organisations; self-selection into one of three categories according to environmental interests, including reasons for that self selection; and the highest level of education attained, including the relevant field of education.

The ten organisations were the Alliance for Sustainable Tourism, the Cairns and Far North Environment Centre (CAFNEC), the Rainforest Cooperative Research Centre (CRC), the CSIRO Tropical Forest Research Centre, the Department of Natural Resources and Mines, the Department of Primary Industries (Forestry), the Environmental Protection Agency, the Queensland Parks and Wildlife Service, and the Wet Tropics Management Authority (WTMA). Eight of the ten organisations were core partners of the Rainforest CRC, including the WTMA, and the other two were the Rainforest CRC itself and the CAFNEC. Four of the CRC core partners were not included on the list: Aboriginal and Torres Strait Islander Commission, James Cook University, Griffith University and the University of Queensland, as environmental matters are incidental rather than primary to their focus.

Finally, the third section (five-pages) included an explanatory page, containing instructions to respondents with the following explanation:

> Many different modifying words are used with VALUES in this way, presumably with the intention of clarifying a more specific meaning of VALUES but often without the desired result. I want you to see if you can help to clarify some of these various possible meanings by listing features, examples or aspects of the various types of VALUES that people discuss. Some uses of VALUES appear to relate to personal beliefs and feelings, and others to characteristics of the environment. I have not distinguished between these two common domains in listing the modifiers so I also want you to indicate whether you consider each of them is personally relevant (e.g. related to personal beliefs or feelings) or environmentally relevant (i.e. characteristics of, or about, the environment).

The explanatory section included an example of a completed listing for ‘swamp values’. For the listing task, a four-page prompt listed the 12 noun phrases in alphabetical order, with each listing above two columns headed, respectively, *personally relevant* and *environmentally relevant*. The 12 noun phrases were as follows: biodiversity values, conservation values, community values, cultural values, economic values, ecosystem values, environmental values, heritage values, instrumental values, moral values, natural values, personal values.

Procedure

Participants listed features, examples or aspects of the twelve noun phrases. Brain-storming in groups is the strategy typically used in the generation of statements for concept mapping (Trochim, 1989b). However, brainstorming reputedly works best when individuals are allowed to first access their own mental space for information prior to interference from the offerings of others (Furnham & Yazdanpanahi, 1995; Paulus, Larey, & Ortega, 1995). In order to preserve respondents' confidentiality in case of any reluctance to share opinions with others, and because getting participants together at one time was in this case impractical, respondents completed the task independently. Interference from others was incidentally avoided as a result of this decision.

There was no time limit for the task, nor was there a limit on response length, and the number of responses was limited only by the amount of space provided under each listing. Those participants who received electronic copies were not limited by the space restrictions, as they could simply press the *return* key (*Enter* on some keyboards) when typing to add more lines to the document.

Concept Items

The fourteen participants generated 1,267 response tokens to the request to list features, examples or aspects of the 12 values expressions. Counts per participant per expression ranged from zero to 12 responses. The six participants from the conservation group listed 47% of the total responses, and the eight participants from the research group listed 53% of the total. Table 19 is a cross-tabulation of response counts for groups by relevance.

Table 19

Response Counts and Percentages for Groups by Relevance: Environmental and Personal

Group	Environmentally relevant		Personally relevant		Totals	
	Count	%	Count	%	Count	%
CAFNEC[a]	299	24	296	23	595	47
CRC[b]	377	30	295	23	672	53
Total	676	53	591	47	1,267	100

[a]n=6. [b]n=8.

Although the count for *environmentally relevant* responses was relatively higher for the CRC respondents (M = 3.93, SE = 2.04) than the CAFNEC respondents (M = 4.15, SD = 2.31), there was no significant difference between the groups for the mean number of *environmentally relevant* responses, $t_{(12)} = .19$, $p > .05$. There was also no statistical difference between the mean number of *personally relevant* responses from the CRC respondents (M = 3.07, SD = 2.64) and the CAFNEC respondents (M = 4.11, SD = 2.06), $t_{(12)} = .80$, $p > .05$.

Furthermore, there was no significant difference between the mean number of responses from seven participants who filled out pen-and-paper instruments (M = 3.73, SD = 2.31) and the seven who completed electronic copies (M = 3.81, SD = 2.15), $t_{(12)} = .06$, $p > .05$. It is unlikely that there were any response-style differences among the participants.

The fewest responses were made for personal relevance of the noun phrase ‘instrumental values’, and most participants indicated they did not understand this phrase or that it was not at all relevant (e.g. “?”, “not sure what this means”, “not relevant for me”, “don’t understand term”). Table 20 shows the mean response counts by relevance and group for each item.

CAFNEC respondents gave comparatively more personally relevant responses than the CRC respondents for *biodiversity, community,* and *economic values*, as indicated by the mean responses per item in Table 20, although response counts were highly variable. Responses covered a diverse range of topics, from aesthetic and spiritual characteristics such as beauty, awe, and respect for life; to practical matters such as recycling behaviours, tourism and recreation; and to global characteristics such as food chains and ecological webs. Biophysical entities included trees, rocks, animal species, rivers and creeks, and forests.

Table 20

Mean Response Counts by Group and Relevance for each of 12 Noun Phrase Items

Noun phrase		Relevance			
		Personal		Environmental	
		CRC	CAFNEC	CRC	CAFNEC
Biodiversity values	Mean	3.1	7.0	5.0	6.3
	SD	2.2	5.7	2.6	5.5
Conservation values	Mean	3.3	4.7	4.9	6.0
	SD	1.8	4.0	2.2	6.1
Community values	Mean	3.4	7.2	4.5	3.8
	SD	3.3	6.0	2.4	2.7
Cultural values	Mean	2.8	4.2	3.4	3.7
	SD	2.3	2.6	3.0	2.9
Economic values	Mean	2.5	5.5	4.6	6.2
	SD	2.1	2.9	2.7	3.9
Ecosystem values	Mean	2.4	3.3	4.8	4.2
	SD	2.3	2.9	2.1	3.1
Environmental values	Mean	2.6	3.2	4.8	4.7
	SD	3.3	1.5	3.5	2.2
Heritage values	Mean	2.8	3.2	3.6	3.0
	SD	3.0	1.6	2.3	2.1
Instrumental values	Mean	2.6	1.0	1.9	1.2
	SD	3.6	0.6	1.9	1.0
Moral values	Mean	3.1	3.21	3.0	2.7
	SD	3.0	2.3	2.2	2.0
Natural values	Mean	4.4	2.8	3.3	4.0
	SD	4.1	2.0	2.3	2.6
Personal values	Mean	3.9	4.2	3.5	4.2
	SD	4.1	2.7	3.1	2.9

Item Reduction

Although rich in content, such a large set of items is impractical to work with, and an item reduction strategy condensed the number of items for a manageable analysis (Heady & Lucas, 2006; Trochim, 1989b). The reduction in item numbers was necessary, but it is acknowledged that some information on the nature of natural language use is lost through the process (Antaki et al., 2006). However, the sorting procedure would become unmanageable and overly onerous to participants if only redundancies were excluded. As a balance between complete retention of the language used by participants and unacceptable loss of language due to categorical coding of the responses, Gol and Cook’s (2004) rules for item reduction formed the basis for the set of four rules used to reduce the number of items while retaining the dominant ideas emerging from participant groups.

The first rule excluded redundancy (several words or phrases occurred more than once). The second rule excluded responses that were difficult to understand (e.g. “soundscape in the forest”) or too vague (e.g. “can be manipulated”, “can be easily skewed”). The third rule excluded responses that contained either of the words in the respective stimulus noun phrase (e.g. “no excuse for ignoring *environmental values*”). The fourth rule equated level of abstraction (e.g. “functioning biosphere”, “ecosystem function”, etc., were represented by ‘ecosystem, biosphere functioning’) and combined similar responses into a single item (e.g. “interconnections”, “interdependence”, “web of life” and “ecological webs”, etc., were represented by ‘ecological webs, interdependence’).

The principal researcher and a colleague performed the item reduction as an iterative process, and discussed discrepancies between reduction decisions until reaching agreement on a final set of 81 items.

Method: Sorting and Rating

The 81 single words or phrases represent the operationalised meaning and reference domain for ‘environmental values’ within the limited focus of the listing task. Information about how these statements are related to each other, and the structure underlying such relationships, was gathered by way of a sorting task. There was considerable overlap between responses listed as personally and environmentally relevant, so the final set is an integration of both domains.

Participants

Two loosely defined groups were targeted for comparative purposes: those involved in environmental management, research and conservation activism (active), and those who have no direct involvement in environmental matters (inactive). Those targeted as *active* included staff from the Wet Tropics Management Authority (WTMA), researchers and postgraduate students from the Rainforest Cooperative

Research Centre (CRC), and members of the Cairns and Far North Environment Centre (CAFNEC). Reasons for inclusion in the process included involvement in environmental management, in scientific research about the environment, or involvement or interest in environmental conservation and activism.

Students from the first-year psychology student subject pool at James Cook University Cairns campus were targeted as environmentally *inactive* participants. As indicated by the lexical decision results, Expert and Naïve categorisations are only relative in the Wet Tropics context, with naïve participants expected to have some familiarity with the conceptual domain of 'environmental values', and the same distinction applies here. *Inactive* simply indicates in this case that the student participants were not affiliated with any of the *active* groups and thus relatively unaware of WTWHA scientific, management, or conservation issues. The student demographics at JCU are largely consistent with those at other Australian universities with the exception of a higher representation of mature aged students and students from an Indigenous background.

The 68 participants for the sorting and rating tasks comprised two CRC scientists, four CAFNEC members, one WTMA staff member and 61 undergraduates enrolled in an introductory psychology subject at JCU. The JCU participants received partial course credit for participating; other participants received no reward. It was anticipated that all participants would have a similar level of education, and that there would be some crossover involvement between groups so that some participants would be involved with more than one group.

JCU students comprised 90% of the sample, and 48% of participants (including all WTMA, CRC and CAFNEC participants) had completed some form of tertiary education. For the self-selected category association, where participants had a choice of science/research, management, activism/conservation or other, the information is presented in Table 21. Almost 61% of the JCU student participants associated themselves variously with science (9%), management (8%) and activism (43%) in their environmental interests, whereas the other 39% did not select any association category (designated as *other* in Table 21).

Table 21

Cross-tabulation of Self-Selected Category Association by Group as Frequencies and Percentages of the Total Sample Count

Category	Target group								Totals	
	WTMA		CRC		CAFNEC		JCU			
	f	%	*f*	%	*f*	%	*f*	%	*f*	%
Science/research	-	-	(1)	1.5	-	-	(6)	8.8	(7)	10.3
Management	(1)	1.5	(1)	1.5	(2)	3.0	(5)	7.4	(9)	13.4
Activism/conservation	-	-	-	-	(2)	2.8	(26)	38.2	(28)	41.0
Other	-	-	-	-	-	-	(24)	35.3	(24)	35.3
Totals	(1)	1.5	(2)	3.0	(4)	5.8	(61)	89.7	(68)	100

Four of the *active* participants self selected into the expected categories that aligned with their organisation memberships (i.e. WTMA, management; CRC, science/research; CAFNEC, activism/conservation), while three indicated other associations. Specifically, one CRC researcher indicated a management association; however, this is not discrepant with the CRC involvement in designing frameworks for the management of rainforest areas.

Self-selected associations were exploited to designate new Active and Inactive groups. Forty-four participants (65%) nominating *science*, *management* and *activism* associations were collectively designated as *Active* and 24 (35%) participants who selected the *other* association were designated as *Inactive*. These new categories were used for a comparative analysis of category sorts.

Materials

Each of the 81 single words or phrases created through the listing and item reduction procedures was printed on a separate 6cm x 6cm card. Cards were sequentially numbered above each word or phrase for recording purposes. A complete set of cards was randomly ordered for each participant.

An eleven-page instrument (Appendix 3b) accompanied the cards; the document contained an introductory note that included instructions for the unstructured card-sorting procedure, adapted from those used by Rosenberg and Kim (1975):

> In the envelope marked Sorting Task you have a collection of 81 cards, each printed with a single word or a phrase. I'm interested in how you see the words or phrases fitting together into categories on the basis of some aspect of meaning. You might not even be sure exactly how you have grouped them together, and that's okay. Sort the 81 cards into piles representing categories; you decide how many categories, but the following restrictions apply.
>
> 1) Each card can only be placed in one category (you can't choose to place one card into 2 different categories). 2) You must have at least 2 categories: A category cannot consist of all the cards in the set. 3) Categories should ideally be a collection of cards: don't make each card a separate category of one item. 4) All the cards must be placed into a category, so that none of the items is left out of the categorisation procedure. Note: You don't need to take a lot of time over this task; go with your first impressions provided you're comfortable with the categories that emerge.

The instrument also included the same demographics questionnaire as for the listing task procedure, instructions to participants for the sorting task and a related rating task, and recording sheets for each of the tasks.

The recording sheet for the sorting task listed all 81 items in alphabetical order together with the corresponding card numbers, and spaces for participants to list the category number for each card.

The question for the rating task was in three parts: Should the item be used in the discussion of the management/presentation/protection of values in the Wet

Tropics World Heritage Area? The response sheet included a separate scale for each part: *management*, *presentation* and *protection* of values respectively. The recording sheet for the rating task alphabetically listed all the item words or phrases, each accompanied by three anchored scales ranging from 1 = *not at all* to 6 = *yes definitely*.

Procedure

All participants completed the sorting task, followed by the rating task. Participants followed instructions to sort the cards into meaningful categories and to record a category number against each item number. Instructions for the unstructured card-sorting procedure (single sort[35]) were adapted from those used by Rosenberg and Kim (1975), whose sorting restrictions included the instructions that each card can be placed in only one pile, there must be a minimum of two piles, and no card should be left out. Participants recorded their categorisation decisions on recording sheets by writing the category number beside each corresponding item, and used a separate recording sheet to rated each item using a separate six-point scale for each part of the question.

Results: Concept Structure

Results from individual sorts were combined across the 68 participants for a combined concept map, and according to the two designated groups for comparisons of concept structure between those who indicated they were environmentally active and those who indicated no strong environmental interests.

There was no significant difference between the Active group (M = 6.53, SD = 2.76) and the Inactive group (M = 6.96, SD = 3.31) in the number of categories

[35] While Rosenberg and Kim (1975) noted that single-sort data might not provide adequate representation of a concept's psychological categories and dimensions, they also speculated that stimuli that vary on multidimensional continua are less subject to an exclusion bias.

used to sort items, $t_{(66)} = .56$, $p > .05$. Neither was there any difference in the number of categories used to sort items between those educated to high school levels up to and including year 12 (M = 6.62, SD = 3.10) and those with tertiary education (M = 6.81, SD = 2.77), $t_{(66)} = .25$, $p > .05$. It is unlikely that there was any real difference in response style between the groups, and any differences in the concept maps are likely to be psychologically real differences in understandings of the 'environmental values' conceptual domain, rather than effects arising from different response styles.

Data Matrices

Sort data are often referred to as distance scores, but in this case they more correctly indicate a degree of similarity association between pairs of items, because the items are being represented in psychological rather than physical space (Shepard, 1962). To reflect the associative nature of the measure, where items are psychologically proximal, distance scores are hereafter referred to as proximity scores.

Each individual's sort data were initially entered into a binary symmetrical proximity matrix, which is a square table with as many rows and columns as there are items; in this case 81 x 81. For each item, a value of one as a row-by-column entry indicates that the items were sorted into the same grouping, while a value of zero indicates that the items were not grouped together. Values along the diagonal all equal a value of one, as each item is sorted with itself.

The individual matrices were summed to produce a total combination proximity matrix. Instead of binary values, each row-by-column entry in the summed matrices indicates how many times a pair of items was sorted into the same cluster, and this value ranges from zero to the total number of participants (Shepard, 1962). Values along the diagonal this time reflect the number of participants, as each item was sorted with itself by each participant. A high score in the combined matrices indicates frequent pairing and thus a high degree of conceptual association between two items, and a low score indicates non-existent or infrequent pairing of two items, which are more conceptually distinct or, alternatively, in opposition to each other. The whole map is the empirically derived structural framework for the underlying operationalised concept of WTWHA environmental values.

Proximity Analyses: MDS

PERMAP (PERceptual MAPping) computer software (Heady & Lucas, 2006) was used for analysing the matrices. A metric analysis of proximities was conducted using a Euclidean distance metric on the summed matrices of proximity scores. The summed proximity scores were normalised to distance scores by dividing each cell value by the diagonal value (a constant). Diagonal values thus revert to a value of one, and all other cell values fall between zero and one.

Finding the ‘best’ objective function value is the goal of optimisation for proximity solutions. The problem of false results due to local minima (several mapping solutions with objective function values that are close together) is a real one, and particularly so for problems using large numbers of objects with relatively few participants, where objects might easily be caught up in localised patterns of individual sorts rather than finding a global solution that represents the larger picture. However, there are ways to test the stability of the data pattern (Heady & Lucas, 2006). In this case, the data were degraded back to binary level to test the precision of the solution, and in turn verify the pattern stability. Once the strength of the data was thus confirmed, MDS analysis was conducted using the ratio + bounds measure, with the bounds set to a fixed amount of estimated uncertainty (in this case, plus or minus three counts), and precision set to 1/5. Stress (which uses sum-squares rather than root-sum-squares) was selected as a badness measure of the solution's objective function value.

A scree plot, commonly employed in studies using MDS, was constructed using dimensions against objective function values and used to select the best number of dimensions for the proximity analysis (Figure 17).

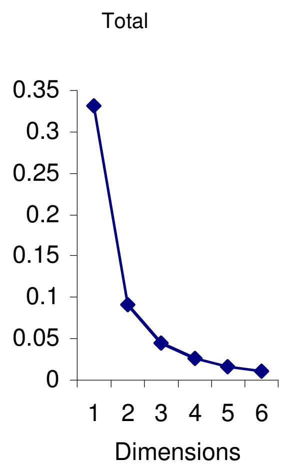

Figure 17. Scree plot using ratio MDS analysis with maximum precision, with objective function values for 1, 2, 3, 4, 5, and 6 dimensions.

As determined by the elbow in the scree plot, a case could be made that MDS analyses of the combined Total data was best solved in either two or three dimensions. There is some agreement that solutions in any more than two dimensions are not practical inasmuch as solutions can only be visualized in two (at the most three) dimensions on the page (Heady & Lucas, 2006; Shepard, Romney, & Nerlove, 1972; Trochim, 1989b). In this case, two-dimensional conceptual mapping configuration was found to be reasonable, meaningful, and interpretable.

Concept Map: Total Combination

The MDS map positions the statements according to their level of association as indicated by the number of times any two items were grouped together in the sorting task. The objective function value (stress) for the configuration was .07 for a two-dimensional solution (R^2 = .39). This stress value is comparable to those reported in other concept mapping studies, but Heady and Lucas (2006) emphasise that stress values vary depending on the number of objects and dimensions.

The solution was stretched to the limits of a bounding circle to reduce overlap and make individual items easier to distinguish. The map was rotated to an orientation consistent with two dimensions: Affect (negative and positive) on a horizontal axis, and Social Orientation (socio-cultural and socio-physical) on a vertical axis, as shown in Figure 18. Items to the left portray a negative valence, while items on the right portray a positive valence. Similarly, items in the lower half portray features of human social relationships, while items in the upper half portray features of human relationships with the environment. This social orientation is not surprising, given the emphasis on mental experience in abstract concepts, and their situational properties characterised by persons, social states and social artefacts (Wiemer-Hastings & Xu, 2005). Table 22 is provided as a key to reading the abbreviated items in Figure 18.

Table 22

Statement List: 81 Single Words and Phrases Generated from the Listing Task, in Alphabetical Order by Short Item Name

Short item name	Item	Short item name	Item
academic	academic studies and research on the environment	medpower	influenced by media power
attitude	attitudes to nature	minimpac	minimising impact through minimising consumption and use
beauty	scenic amenity, beauty	nohumact	not controlled by human action
behavres	behaving responsibly towards the environment	numbspec	sheer number of species on Earth, diversity
behavsus	behaviour that sustains industries	openmind	open-minded, non-judgemental
biashumn	biased towards humans and human well-being	outcomes	outcomes and impacts
builtenv	emphasis on built environment and created objects	ownrship	ownership
catchphr	catch phrase, given lip service or ignored, don't know what it means	paytouse	paying to use the natural environment
cleanair	clean air and water	peaceple	peace, pleasure, appreciation, relaxing in nature
comfamil	comfortably familiar, feeling of belonging	persbelf	personal, spiritual and philosophical beliefs
congreed	consumer greed in society	persresp	personal responsibility
connatur	feel connected to and love nature	polpower	influenced by political power
consider	considering other people's feelings and welfare	preshist	preserving historic sites and architecture as a record of human evolution and culture
corpower	influenced by corporate power	presinte	preservation of interface between people and the environment
custodia	custodianship, guardians of the environment	presprot	preservation and protection of the natural environment
destroy	destroying/exploiting the natural world	pristine	not polluted/pristine
ecocompl	ecological complexity	prothead	putting protection of the environment ahead of protecting visitors to it
ecofunct	ecosystem, biosphere functioning	quallife	quality of life
ecowebs	ecological webs, interconnections	relevbus	relevant to business
enjoying	enjoying plants and animals	relvnted	relevant to education
envirofr	environmentally friendly behaviours	relvtemp	relevant to employment
enviroma	environmental management and planning	resocult	resources are culturally defined
envirowe	environment is the ultimate source of wealth	resoecon	resource economics
evoltion	shows state of evolution	resplife	respect for all life
expherit	experiencing one's heritage	respothe	respect for other people's property and life
families	families, friends, neighbours	restrehb	restoration/rehabilitation
flexissu	flexibility about environmental issues	righexst	right of each species to exist
groupres	group responsibility	safetnet	safety net/refuge for people and animals
health	health and well being	safety	safety
healthsy	healthy ecosystems, resilience of life forms	speakup	speaking up for the environment, conservation message
ignoranc	ignorance of and about the environment	supenvir	support of environmental groups and initiatives
impactre	impacts on range of recreational opportunities	suprecre	system supports recreational activities
indissue	Indigenous and traditional issues	survival	sustains all life, survival
inspirat	engenders strong inspiration	takgrant	taking environment for granted
justice	justice and the legal system	tooload	too loaded, too interpretative, too difficult
knowawar	knowledge and awareness of natural processes	tourism	tourism
legacy	legacy for future generations	uniquens	uniqueness
lifestyl	social, cultural and traditional lifestyle options	wildlife	wildlife and natural features
livewell	live well with little money	wildness	wilderness
mainstab	maintaining stability of species and habitat	worktogr	working together with common interests
maintbal	maintain natural balance		

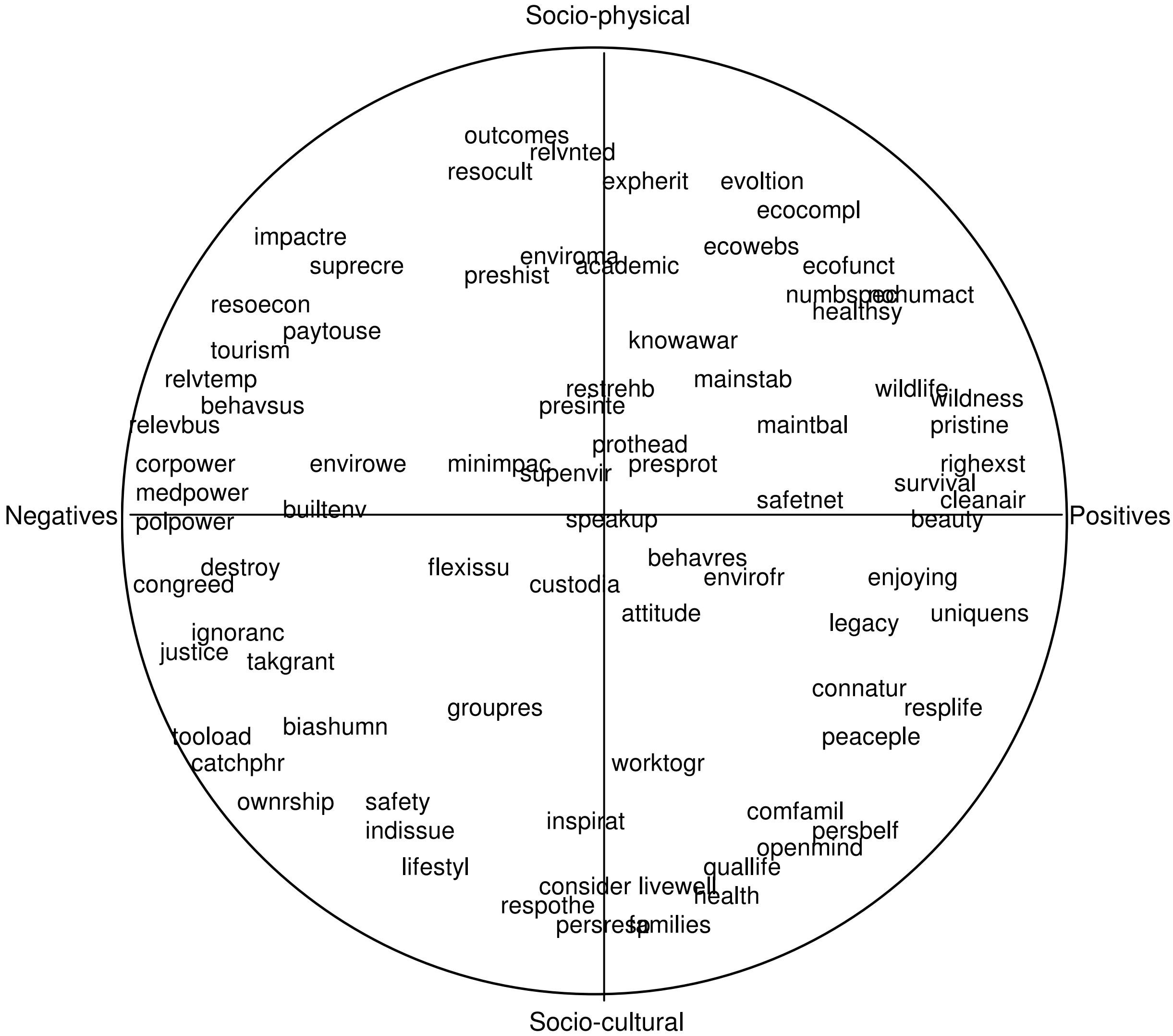

Figure 18. Total Combination: Two-dimensional configuration of the 81 statements showing an Affective dimension (negative/positive) on the horizontal axis and a Social Orientation dimension (socio-physical/socio-cultural) on the vertical axis.

As noted in the literature review, it is likely that the values construct and concept consists of several dimensions. Although other dimensions could be explored in further studies using a multiple sorting technique employing different categorization criteria, the statistical solution for the representation presented here is consistent with the two dimensions described. The affective and social orientation dimensions evoke the theory of value orientations (Kluckhohn, 1967; Kluckhohn & Strodtbeck, 1961), at least to the extent of phrases suggesting subordination to nature, (e.g. *putting protection of the environment ahead of protecting visitors to it; right of each species to exist*), harmony with nature (e.g. *comfortably familiar, feeling of belonging; minimising impact through minimising consumption and use*), or dominance over nature (e.g. *destroying/exploiting the natural world; biased towards humans and human wellbeing*) on the affective dimension. Moreover, the relational orientation is reflected in phrases along the social orientation dimension, from the hierarchically ordered relations characteristic of management and academia (e.g. *environmental management and planning; academic studies and research on the environment*), to shared group decisions (e.g. *support of environmental groups and initiatives; group responsibility*), and down to individual, personal concerns regarding one's own responsibilities (e.g. *respect for other people's property and life; considering other people's feelings and welfare*).

A reasonable expectation, considering the listing task that generated the sorting task items, is that the 12 values expressions used as prompts (biodiversity values, conservation values, community values, cultural values, economic values, ecosystem values, environmental values, heritage values, instrumental values, moral values, natural values, personal values) should underlay the concept map for the 81 items as grouped by all 68 subjects. The circularity of this expectation notwithstanding, the 12 types are not readily discernable as distinct item clusters. Although 'environmental values' and 'natural values', for instance, might potentially be considered as one and the same thing, it was expected that at least some of the types would be readily discernible as item clusters.

Cluster Analysis

Cluster analysis of the 81 x 81 data matrices was performed using MVSP 3.1 (Kovach, 1999), a multivariate statistical package. Cluster analysis is commonly used in conjunction with MDS, as it provides what amounts to a close reading of the high-level overview afforded by the MDS concept maps.

Average linkage was selected as the clustering procedure, together with average distance as the distance measure. Average linkage offers a more balanced approach than either nearest neighbour or farthest neighbour, both of which tend to distort the data, since the distances for both are calculated using outliers. The unweighted pair-group method average measure used for all cluster analyses in this section calculates the mean of all pair distances in each group to calculate the distance between the groups (Kovach Computing Services, 2003). Similarity, or distance, was measured using the Average distance formula (Kovach Computing Services).

The seven-cluster solution reflects the mean number of categories participants used to sort the 81 items (M = 6.69, SD = 2.96). Clusters were named to suit the collective characteristics of the cluster items: 'People using nature'; 'People dominating nature'; 'People in society'; 'People in nature'; 'Wild nature'; 'Environmental unity'; and 'Positive action and behaviour' (turn to p. 216 for a list of items by cluster). Rating scores were used as an external validation measure for the cluster solution, with a reliability analysis showing internal consistency of the clusters.

Rating Task Scores

Mean rating scores (ranging from 1 to 6)[36] were calculated for each item to show the degree to which participants thought items should feature in discussions of the *management*, *presentation* and *protection* of values in the Wet Tropics World Heritage Area. Mean ratings were equivalent across the three dimensions of rhetoric

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[36] Equal intervals were assumed, as this practice is widely accepted in the social sciences (Jaccard & Wan, 1996).

(management, M = 4.28, SD = 0.57; presentation, M = 4.19, SD = 0.56; protection, M = 4.40, SD = 0.53). The positioning of the mean scores in the upper half of the score range indicates that items were generally suitable for use in the discussion of values in the designated contexts. Mean rating scores for individual items were also calculated, and differentially ranked for each of the three domains. Tables 23, 24 and 25 list descriptive statistics for the ten items rated highest and the ten rated lowest for each domain. Comprehensive descriptive statistics for all 81 items are presented in Appendix 3c.

Table 23

*Ten Highest-rated Items and Ten Lowest-rated Items for 'Discussion of the **Management** of Values in the Wet Tropics World Heritage Area'*

Domain	Item	*M*	*SD*
Management: highest ratings	environmental management and planning	5.6	0.8
	preservation and protection of the natural environment	5.4	1.0
	behaving responsibly towards the environment	5.3	1.1
	clean air and water	5.3	1.3
	maintaining stability of species and habitat	5.2	1.2
	working together with common interests	5.1	1.1
	legacy for future generations	5.1	1.3
	academic studies and research on the environment	5.0	1.1
	minimising impact through minimising consumption and use	5.0	1.4
	restoration/rehabilitation	5.0	1.2
Management: lowest ratings	influenced by corporate power	3.5	1.8
	comfortably familiar, feeling of belonging	3.4	1.6
	consumer greed in society	3.4	2.0
	families, friends, neighbours	3.3	1.6
	not controlled by human action	3.3	1.7
	live well with little money	3.2	1.7
	emphasis on built environment and created objects	3.2	1.6
	biased towards humans and human well-being	2.9	1.5
	catch phrase, given lip service or ignored, don't know what it means	2.4	1.6
	too loaded, too interpretative, too difficult	2.2	1.6

Table 24

Ten Highest-rated Items and Ten Lowest-rated Items for 'Discussion of the ***Presentation*** *of Values in the Wet Tropics World Heritage Area'*

Domain	Item	*M*	*SD*
	preservation and protection of the natural environment	5.7	0.6
	environmentally friendly behaviours	5.4	1.0
	maintaining stability of species and habitat	5.4	1.0
	right of each species to exist	5.4	0.9
Presentation:	clean air and water	5.4	1.0
high ratings	legacy for future generations	5.4	1.1
	speaking up for the environment, conservation message	5.3	1.0
	minimising impact through minimising consumption and use	5.3	1.1
	restoration/rehabilitation	5.2	1.1
	personal responsibility	5.2	1.3
	relevant to employment	3.3	1.7
	biased towards humans and human well-being	3.3	1.5
	consumer greed in society	3.2	1.8
	not controlled by human action	3.2	1.6
Presentation:	live well with little money	3.2	1.7
low ratings	influenced by corporate power	3.2	1.9
	relevant to business	3.0	1.7
	emphasis on built environment and created objects	3.0	1.6
	catch phrase, given lip service or ignored, don't know what it means	2.4	1.5
	too loaded, too interpretative, too difficult	2.3	1.6

Table 25

Ten Highest-rated Items and Ten Lowest-rated Items for 'Discussion of the ***Protection*** *of Values in the Wet Tropics World Heritage Area'*

Domain	Item	*M*	*SD*
	behaving responsibly towards the environment	5.5	0.8
	clean air and water	5.5	1.1
	attitudes to nature	5.3	0.9
	preservation and protection of the natural environment	5.2	1.0
Protection:	speaking up for the environment, conservation message	5.2	1.0
high ratings	academic studies and research on the environment	5.1	1.1
	wildlife and natural features	5.1	1.1
	maintaining stability of species and habitat	5.1	1.0
	uniqueness	5.1	1.2
	right of each species to exist	5.0	1.2
	justice and the legal system	3.3	1.5
	consumer greed in society	3.2	1.8
	influenced by corporate power	3.1	1.8
	relevant to business	3.1	1.6
Protection:	biased towards humans and human well-being	3.0	1.7
low ratings	live well with little money	3.0	1.6
	emphasis on built environment and created objects	3.0	1.5
	not controlled by human action	2.9	1.5
	too loaded, too interpretative, too difficult	2.2	1.5
	catch phrase, given lip service or ignored, don't know what it means	2.2	1.4

Of the seventeen items rated highest for the three domains, 10 were shared by at least two domains, with only three of these shared by all domains: *maintaining stability of species and habitat*; *preservation and protection of the natural environment*; and *clean air and water*. Seven items were rated among the highest for only one domain.

For the Management domain, these were *environmental management and planning* and *working together with common interests*. For the Presentation domain, *environmentally friendly behaviours* and *personal responsibility* were among the highest rated items, and among the items rated highest for the Protection domain were *attitudes to nature*; *uniqueness*; and *wildlife and natural features*. Most of the highest rated items are from cluster 7 (Positive action and behaviour), whereas four items rated highest for the Protection domain are from cluster 6 (Wild nature).

There were similarities among the three domains for those items rated lowest, with eight items rated lowest for all three domains. Five of these items are from cluster 2 (People dominating nature): *too loaded, too interpretative, too difficult*; *catch phrase, given lip service or ignored, don't know what it means; consumer greed in society; biased toward humans and human well-being*, and *influenced by corporate power*. *Emphasis on built environment and created objects* is from cluster 1 (People using nature), *live well with little money* is from cluster 3 (People in society), and *not controlled by human action* is from cluster 6 (Wild nature).

As for differences, for the Management domain, *comfortably familiar, feeling of belonging* and *family, friends, neighbours*, both from cluster 3 (People in society), were among the lowest rated items. *Relevant to employment* was rated among the lowest for the Presentation domain, and *justice and the legal system* received one of the lowest ratings for the Protection domain.

On the whole, the ratings appear to align with the affective dimension on the concept map. The majority of the lowest ratings are for items at the negative end of the affective pole, and the majority of the highest ratings are for items at the centre of the pole. The four items among those rated highest for the Protection domain in cluster 6 are, however, more clearly at the positive end of the affective pole.

Reliability Analysis

A reliability analysis of the rating data was performed using SPSS to assess the internal consistency of the ratings within the clusters. Cronbach's alpha (ranging from 0 to 1, with higher values indicating greater reliability) was selected as a reliability coefficient. Reliability statistics are reported in Table 26.

Table 26

Cronbach's Alpha for Ratings of Items within each Cluster

Cluster	Cronbach's alpha by domain		
	Management	Presentation	Protection
1	.57 (.16)	.47 (.11)	.49 (.12)
2	.88	.87	.86
3	.88	.87	.87
4	.71	.53 (.18)	.53 (.19)
5	.81	.74	.78
6	.74	.79	.73
7	.81	.81	.79

Note: Items in brackets are mean inter-item correlations. Pallant (2005) suggests reporting mean inter-item correlations when there are only small numbers of scale items. Clusters 1, 4 and 6 each have fewer than 10 items, but mean inter-item correlations (optimum values range from .2 to .4) are reported only where Cronbach's alpha is less than the recommended minimum of .7.

Alpha levels indicate that internal consistency of the rating data within most clusters ranged from good to excellent, with relatively poor consistency only for clusters 1 (People using nature) and 4 (People in nature), which contain only seven and five items respectively. Few item numbers often lead to low Cronbach's alpha scores, and this could be the case here, although cluster 6 (Environmental unity) contains only six items, yet has good internal consistency.

The mean inter-item correlations reported where alpha scores were below .7 are all below the optimum range from .2 to .4. It would thus appear that internal consistency is low for *People using nature* (cluster 1) over all three domains, while internal consistency is low for the presentation and protection domains for *People in nature* (cluster 4). Nevertheless, internal consistency within the entire set of 81 items was satisfactory for Management (α = .76), Presentation (α = .70), and Protection (α = .68). The seven clusters, listed in Table 27, are visually portrayed on the concept map in Figure 19, with cluster boundaries overlaid onto the original map. Clusters that are closer together on the map are more conceptually similar than clusters that are farther apart.

Table 27

81 Statements and Short Item Names Sorted by Cluster: Total Combination

Cluster 1: People using nature

ownrship	ownership
suprecre	system supports recreational activities
tourism	tourism
paytouse	paying to use the natural environment
impactre	impacts on range of recreational opportunities
resoecon	resource economics
builtenv	emphasis on built environment and created objects

Cluster 2: People dominating nature

tooload	too loaded, too interpretative, too difficult
catchphr	catch phrase, given lip service or ignored, don't know what it means
takgrant	taking environment for granted
ignoranc	ignorance of and about the environment
destroy	destroying/exploiting the natural world
congreed	consumer greed in society
biashumn	biased towards humans and human well-being
justice	justice and the legal system
medpower	influenced by media power
polpower	influenced by political power
corpower	influenced by corporate power
relvtemp	relevant to employment
relevbus	relevant to business
behavsus	behaviour that sustains industries

Cluster 3: People in society

safety	safety
resocult	resources are culturally defined
lifestyl	social, cultural and traditional lifestyle options
indissue	Indigenous and traditional issues
expherit	experiencing one's heritage
worktogr	working together with common interests
groupres	group responsibility
inspirat	engenders strong inspiration
persbelf	personal, spiritual and philosophical beliefs
openmind	open-minded, non-judgemental
livewell	live well with little money
respothe	respect for other people's property and life
persresp	personal responsibility
consider	considering other people's feelings and welfare
quallife	quality of life
health	health and well being
families	families, friends, neighbours
comfamil	comfortably familiar, feeling of belonging

Cluster 4: People in nature

resplife	respect for all life
peaceple	peace, pleasure, appreciation, relaxing in nature
connatur	feel connected to and love nature
enjoying	enjoying plants and animals
attitude	attitudes to nature

Cluster 5: Wild nature

nohumact	not controlled by human action
survival	sustains all life, survival
righexst	right of each species to exist
maintbal	maintain natural balance
uniquens	uniqueness
beauty	scenic amenity, beauty
wildlife	wildlife and natural features
wildness	wilderness
pristine	not polluted/pristine
cleanair	clean air and water

Cluster 6: Environmental unity

evoltion	shows state of evolution
numbspec	sheer number of species on Earth, diversity
healthsy	healthy ecosystems, resilience of life forms
ecofunct	ecosystem, biosphere functioning
ecowebs	ecological webs, interconnections
ecocompl	ecological complexity

Cluster 7: Positive action and behaviour

relvnted	relevant to education
preshist	preserving historic sites and architecture as a record of human evolution and culture
outcomes	outcomes and impacts
flexissu	flexibility about environmental issues
envirowe	environment is the ultimate source of wealth
safetnet	safety net/refuge for people and animals
legacy	legacy for future generations
custodia	custodianship, guardians of the environment
prothead	putting protection of the environment ahead of protecting visitors to it
presinte	preservation of interface between people and the environment
speakup	speaking up for the environment, conservation message
supenvir	support of environmental groups and initiatives
presprot	preservation and protection of the natural environment
restrehb	restoration/rehabilitation
minimpac	minimising impact through minimising consumption and use
mainstab	maintaining stability of species and habitat
knowawar	knowledge and awareness of natural processes
envirofr	environmentally friendly behaviours
behavres	behaving responsibly towards the environment
enviroma	environmental management and planning
academic	academic studies and research on the environment

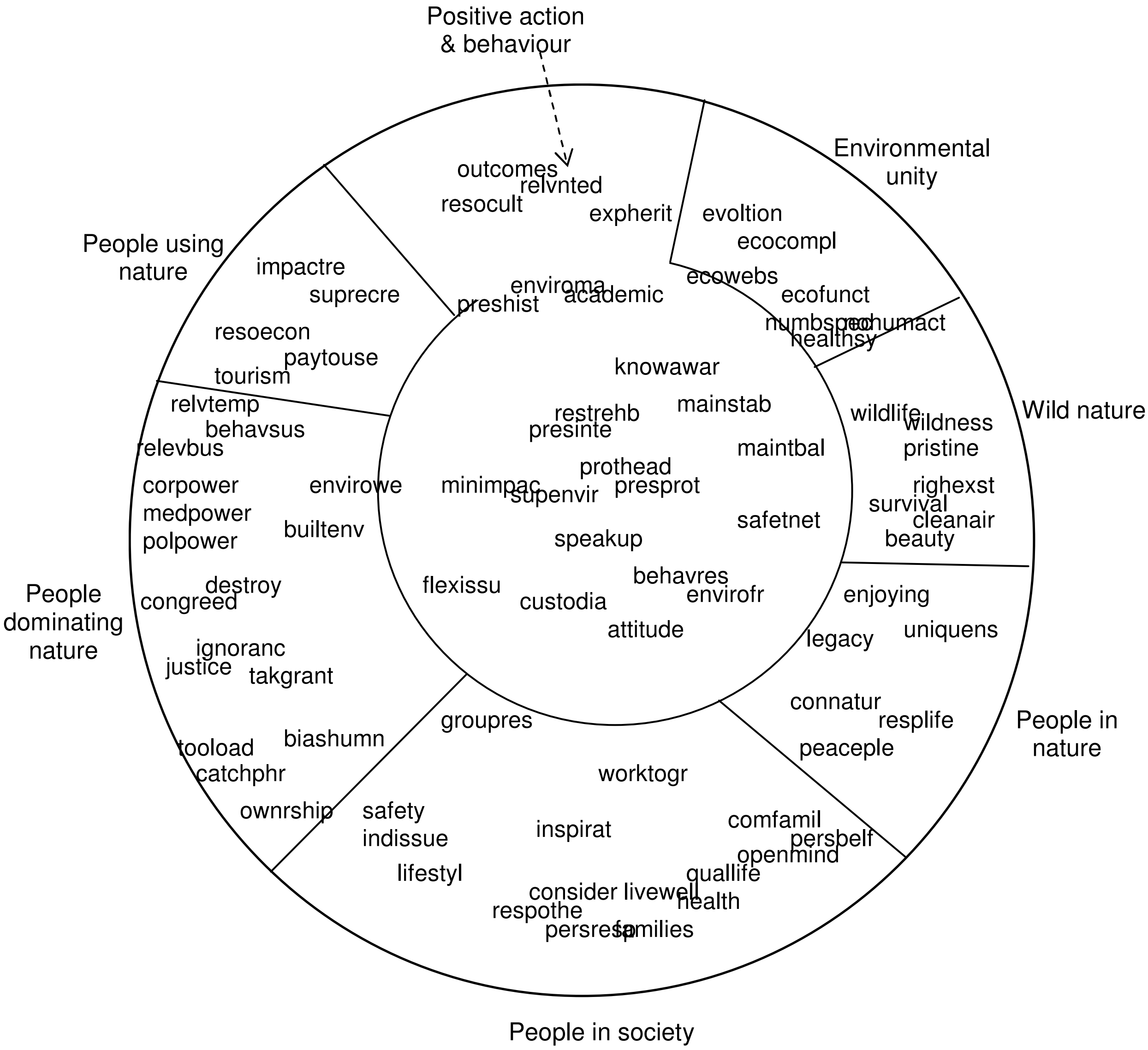

Figure 19. Concept map (Total) showing the seven clusters in two dimensions.

Discussion

The circular structure determined in the current study was imposed artificially in the MDS process, but it nevertheless works in the same way as for Schwartz's circular structure, in that the clusters form a continuum, albeit in this case around a central core cluster. Although Schwartz's model does not rely on a central core, Schwartz and Bilsky (1987) proposed that the seven wedges of the values continuum share a common (i.e. centrally located) origin. A continuous progression can be determined in the concept map clusters as a transition from the consideration of natural resources to be exploited and dominated, to considerations of people in their social world, and further to their place in nature. The transition continues to the consideration of nature devoid of human interference, and to the unity of entire ecosystems. At the core of all these considerations are the actions and behaviours of people towards the environment, and their responsibility to protect and preserve the natural world into the future. Thus, three of what Kluckhohn and Strodtbeck (1961) considered to be the five crucial human concerns are represented in the concept map. Although they are not strictly represented as orientation dimensions, the Human-nature, Activity, and Relational orientations of the value orientations theory all find expression in separate clusters of phrases.

The ‘environmental values’ conceptual domain suggested in this statistically derived representation encompasses human social and cultural (anthropocentric) considerations, as more generally acknowledged values, together with biophysical (biocentric, intrinsic) considerations, where the concept system includes features, attributes and processes in nature, although not entirely devoid of human involvement. Existing values typologies suggested the potential for alternative interpretations of the map portrayed here.

Alternative Interpretations

Two comparative interpretations of the map are based on Kellert’s (1993a) biophilia typology reflecting human dependence on nature and Schwartz’s (1994) universal values as a continuum of motivations, both of which were introduced in Chapter 2 and are discussed more fully here. It is not this author’s intention to suggest that Kellert’s typology is in any way circular, or even a clear fit to those clusters derived through the concept mapping procedure. However, Kellert’s typology provides an alternative interpretation of the clusters that is not dramatically removed from the way that the items in the current analysis fit together. It seems likely, at least to this author, that there might be some underlying concept system that all of the various theorized systems are tapping into, even though they have very different foundational perspectives.

Kellert's Biophilia Typology

In contrast to Schwartz's generalised value focus, the *biophilia hypothesis* (Kellert & Wilson, 1993) asserts that humans have a biological need to maintain links with life and lifelike processes. In other words, humans rely on their relationship with the natural world and its influence on the development of emotion, cognition, aesthetic appreciation and spirituality. The negative considerations of such an intimate and necessary relationship extend to the rejection and destruction of natural elements. In support of the biophilia hypothesis, Kellert (1993a) categorised nine of what he presumed to be biologically based 'human valuations of nature'.

Table 28 lists, defines, and describes the functions of each of the biophilia values. Utilitarian, dominionistic and negativistic values represent a negative valence concerning human interaction with the environment, in the exploitation and domination of, and alienation from, nature.

Table 28

Nine Categories of Biophilia Values

Term	*Definition*	*Function*
Utilitarian	Practical and material exploitation of nature	Physical sustenance/security
Naturalistic	Satisfaction from direct experience/contact with nature	Curiosity, outdoor skills, mental/physical development
Ecologistic-Scientific	Systematic study of structure, function and relationship in nature	Knowledge, understanding, observational skills
Aesthetic	Physical appeal and beauty of nature	Inspiration, harmony, peace, security
Symbolic	Use of nature for metaphorical expression, language, expressive thought	Communication, mental development
Humanistic	Strong affection, emotional attachment, 'love' for nature	Group bonding, sharing, cooperation, companionship
Moralistic	Strong affinity, spiritual reverence, ethical concern for nature	Order and meaning in life, kinship and affiliational ties
Dominionistic	Mastery, physical control, dominance of nature	Mechanical skills, physical prowess, ability to subdue
Negativistic	Fear, aversion, alienation from nature	Security, protection, safety

Note: From *Biophilia Hypothesis* by Stephen R. Kellert and Edward O. Wilson, eds, © (1993) by Island Press.

The biophilia values typology was developed in a series of surveys spanning at least twenty years. Kellert statistically clustered his questionnaire items into between seven and nine scales of varying numbers of items, and reported that the nine corresponding biophilia categories were consistently revealed in studies of human *perceptions* of animals (Kellert, 1993b), the nature-related *perspectives* of diverse human groups (Kellert, 1984b, 1985), cross-cultural *perspectives* of nature and animals, and historical shifts in Western-society *perceptions* of animals (Kellert, 1980). Kellert interpreted this consistency as the emergence of "the possibility of universal expressions of basic human affinities for the natural world" (1993a, p. 44).

This purported consistency notwithstanding, a scale for the aesthetic category could not be reliably validated in at least two studies (Kellert, 1984b, 1985). It is also noteworthy that in some of his earlier research, Kellert (1985) described a typology of 'attitudes', not 'values', and in other research used attitudes as indicators of values (e.g. Kellert, 1993b). The interchangeable application of 'values' with other terms, and inconsistencies in the word meaning, feeds into the communication slippage in certain contexts.

Kellert (1993a) argued that biophilia values are expressions of the human need for the development of a meaningful experience of self. According to the biophilia hypothesis, the conservation ethic is driven by the human need for an intimate and meaningful relationship with the natural world, which is potentially advantageous to human evolution. Kellert (1993a) admitted that his argument is largely conceptual, rather than empirical, simply because it reflects an ideal that does not exist. Kellert cited evidence from Japan and the United States in particular, showing that appreciation of the natural world is not as widespread in industrial societies as the biophilia hypothesis would suggest it should be.

Nonetheless, Nash (1990) (a prominent philosopher and author of works on environmental history and management, and environmental education) argued that ethics is still evolving from the self-interest of old towards greater recognition of the rights of all nature, extending beyond the reaches of the solar system. Indeed, Kellert (1993a) noted that, encompassed within the greater concern for only a limited number of species and natural objects, there is a growing tendency among those who are younger and better educated to recognise the rights of all species and objects.

The nine biophilia values can be identified in a configuration that is very similar to the statistically determined seven-cluster configuration in the current study. Figure 20 shows Kellert's biophilia values typology overlaid onto the concept map. Kellert's aesthetic values are represented by some of the items in the ecological/scientific category, but they do not form a distinct cluster on their own. This lack of a specific aesthetic category is not out of character with some of

Kellert's results, where he could not adequately define an aesthetic scale (Kellert, 1984b, 1985).

The eight categories that are represented as distinct clusters include utilitarian, dominionistic, negativistic, symbolic, naturalistic, ecological/scientific, and moralistic values, with humanistic values appearing as human-related rather than nature-related items.

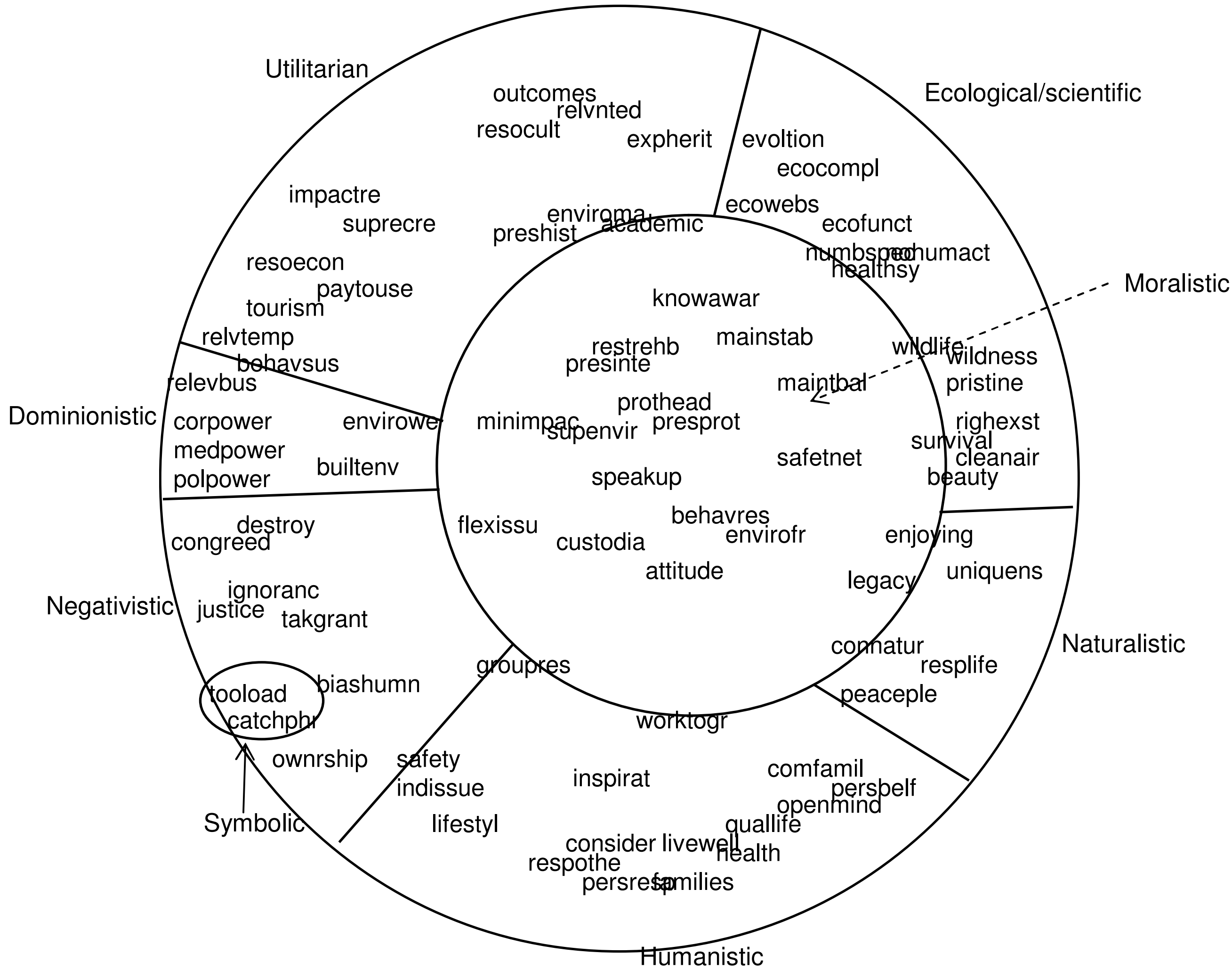

Figure 20. Two-dimensional configuration of the 81 statements showing values categories determined using Kellert's biophilia typology.

The cluster 'Positive action and behaviour' appears to correspond to Kellert's moralistic values (strong affinity, spiritual reverence, ethical concern for nature).

These items are clustered relatively central to both axes (although tending further towards the positive end of the Affective dimension). Items within this cluster reflect environment-related behaviours including *minimising impact through minimising consumption and use; support of environmental groups and initiatives; putting protection of the environment ahead of protecting visitors to it; speaking up for the environment, conservation message; behaving responsibly towards the environment;* and *custodianship, guardians of the environment*. Using the biophilia typology to interpret the cluster configuration, the centrality of moral values suggests that moral and ethical concerns for nature are central to, or at least associated with, all other characteristics.

Directly corresponding to the 'people using nature' cluster are Kellert's utilitarian values (practical exploitation of nature), including *behaviour that sustains industries; paying to use the natural environment; system supports recreational activities;* and *tourism.*

Kellert's dominionistic and negativistic categories, together with the symbolic category items, correspond to the 'people dominating nature' cluster. Dominionistic (mastery, physical control, dominance of nature) and negativistic items (fear, aversion, alienation from nature) include *influenced by corporate/media/political power; consumer greed in society; destroying/exploiting the natural world;* and *taking environment for granted*. Also with negative connotations are two items that appear to correspond with Kellert's symbolic category (use of nature for metaphorical expression, language, expressive thought): *too loaded, to interpretative, too difficult;* and *catch phrase, given lip service or ignored, don't know what it means.*

Among the more positively oriented items on the Affective dimension are some items related to aesthetic values (physical appeal and beauty of nature) in the biophilia typology. These include *clean air and water; not polluted/pristine;* and *scenic amenity, beauty*. However, rather than forming a clearly distinct category, these items are grouped with ecologistic/scientific (systematic study of structure, function and relationship in nature) items. Such items include *shows state of evolution; ecological complexity; ecological webs, interconnections; ecosystem, biosphere functioning; sheer number of species on Earth, diversity;* and *sustains all life, survival*. The ecologistic/scientific category corresponds with two clusters: ‘wild nature’, which contains several aesthetic value items, and ‘environmental unity’.

Also at the positive end of the Affective dimension, and tending towards the socio-cultural (lower) end of the Social Orientation dimension, are naturalistic items (satisfaction from direct experience/contact with nature), including *enjoying plants and animals; uniqueness; respect for all life; feel connected to and love nature;* and *peace, pleasure, appreciation, relaxing in nature*. The naturalistic category corresponds to the ‘people in nature’ cluster.

Items clustered at the socio-cultural end of the Orientation dimension do not fit strictly into any of the biophilia values categories; while they are all features of human social interaction and could thus be considered humanistic, they are not reflective of any attachment to, or love for, nature, as is the definition of this biophilia value. Instead, they reflect human social and cultural interactions. These items include *comfortably familiar, feeling of belonging; considering other people’s feelings and welfare; respect for other people’s property and life;* and *personal, spiritual and philosophical beliefs.* Taking into account that items were generated in response to questions about personal or environmental relevance, it is possible that these items do have some relation to nature as well as society and culture. For instance, *feelings of belonging*, and *personal, spiritual and philosophical beliefs*, could be about the natural environment, inclusive of people, and the humanistic category of biophilia values corresponds with the 'people in society' cluster.

The combined groups' concept map was in many ways similar to the biophilia typology; however, the circular structure of the concept map and the identification of clusters containing items similar to Schwartz's (1994) universalism type suggest an alternative interpretation of the data.

Schwartz's Motivational Continuum

Schwartz (1994) developed his typology to represent what he identified as conscious goals that are responses to three universal requirements: "needs of individuals as biological organisms, requisites of coordinated social interaction, and requirements for the smooth functioning and survival of groups" (p. 21). An explanation using 'values' and 'goals' interchangeably originated in Schwartz and Bilsky (1987), but also appeared in later works (e.g. Schwartz, 1992; 1994):

> Through cognitive development, *individuals become able to represent the requirements consciously as goals or values*; through socialization, individuals are taught the culturally shared terms that enable them to communicate about these goals or values. … A first distinction between different value contents is suggested by the idea that, *because values are goals*, they must represent the interests of some person or group. (Schwartz & Bilsky, 1987, p. 551) [Italics added for emphasis]

Schwartz's two-dimensional space system, derived in his studies using smallest space analysis[37] of the correlations among 56 single values, allows for the partitioning of values represented by "conceptually convenient decisions about where one fuzzy set ends and another begins in the circular structure" (Schwartz, 1994, p.

[37] Smallest space analysis yields results very similar to those from Shepard's proximity analysis and Kruskal's nonmetric MDS when used on the same data (Shepard, 1972).

25). The motivational types are thus an intermixture, rather than distinct clusters. Nevertheless, items at opposite ends of the two abstract dimensions stand in marked contrast.

Strack (2005) argued that the Schwartz values continuum is compatible with other 'values' models and emerges from other 'values' data. Indeed, Schwartz (1994) asserted the possibility that items in lists of specific values, regardless of culture, can be classified into one of the ten motivational types. Nevertheless, although 'protecting the environment', 'a world of beauty', and 'unity with nature' are three of the value statements in Schwartz's survey, listed as universalism types ("Understanding, appreciation, tolerance, and protection for the welfare of all people and for nature", 1994, p. 22), nothing in the stated intentions of his studies suggests any emphasis on environmental issues, or of the environment as central to the universal needs, requisites, and requirements of humans. The point to note here is that an interpretation of items derived using a methodology focused on environmental values is possible even though Schwartz's theory does not have that focus. Such easy-to-make parallels suggest the presence of an underlying system of values that many researchers are tapping into without fully accessing its entirety.

All ten of Schwartz's value types are arguably discernible when the motivational continuum is overlaid onto the concept map, as in Figure 21. Of note is not so much that all items fit perfectly into Schwartz's clusters – indeed, the fit is clearly imperfect – but that many do. Schwartz admitted to rearranging items in his structure in order to find the 'best fit'. For the current interpretation, as for Schwartz's own interpretation of his values system, the types should be read as an intermixture, rather than distinct clusters. Nevertheless, items at opposite ends of the two abstract dimensions should be clearly discriminated from one another, and this is the case with the combined groups' concept map.

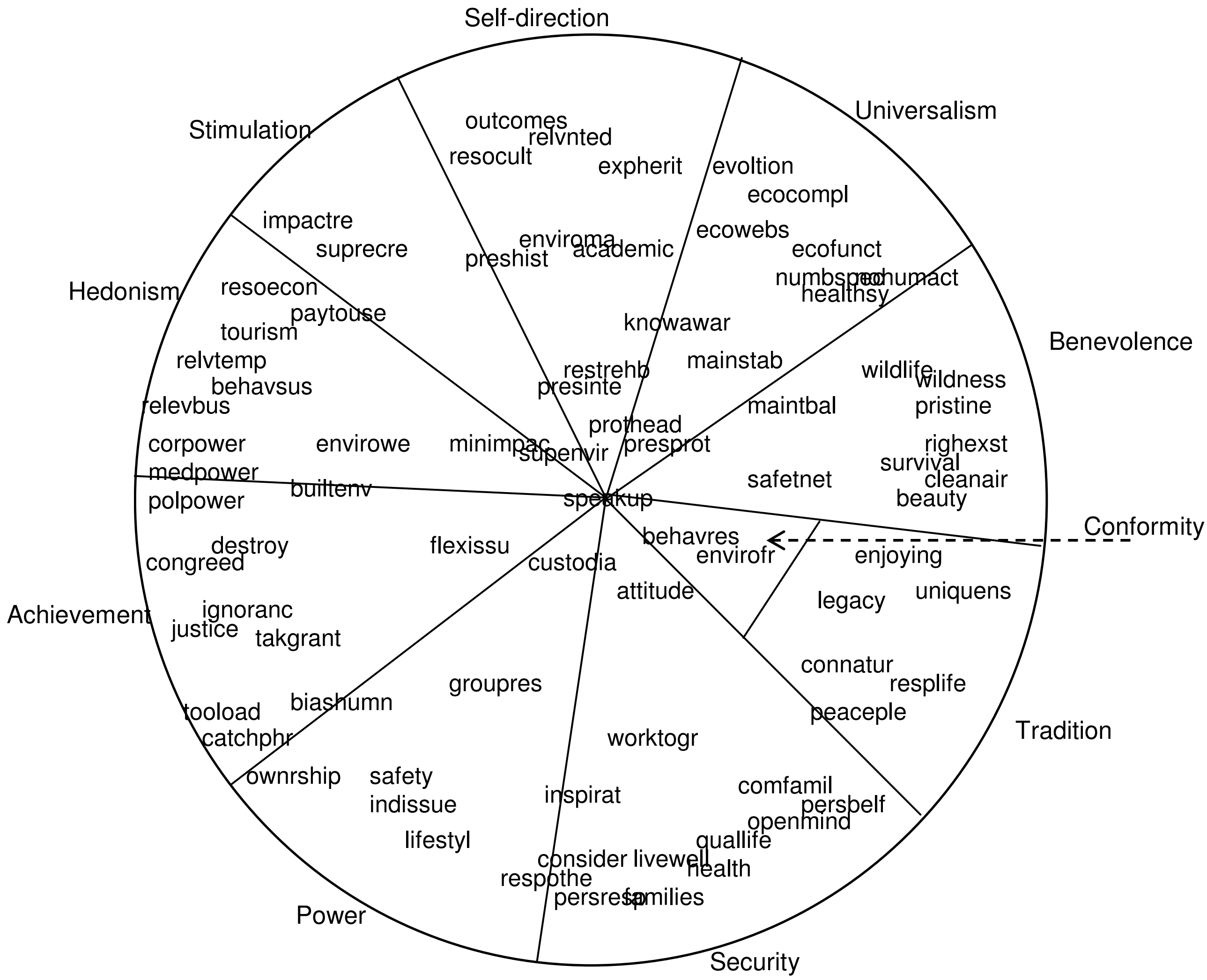

Figure 21. Two-dimensional configuration of the 81 statements showing values categories determined using Schwartz's motivational continuum.

Items partitioned into the universalism and benevolence segments (e.g. *ecological complexity; healthy systems, resilience of life forms; right of each species to exist*), at the Self-transcendence pole, are clearly opposed to items partitioned into achievement and power segments (e.g. *consumer greed in society; destroying/exploiting the natural world; ownership*) at the Self-enhancement pole.

Similarly, items partitioned into stimulation and self-direction segments (e.g. *system supports recreational opportunities; relevant to education; academic studies and research on the environment)*, at the Openness to Change pole, are clearly distinct from items partitioned into security, conformity, and tradition segments (e.g. *considering other people's feelings and welfare; feel connected to and love nature; environmentally friendly behaviours*), at the Conservation pole.

Items on or near the boundaries of adjacent values types share characteristic meaning from both types, while items at opposite poles are contrasted in meaning. Items akin to Schwartz's universalism type reflect biophysical entities and the interrelatedness and unity of ecological systems and their functions. Benevolence ("Preservation and enhancement of the welfare of people with whom one is in frequent personal contact", p. 22) is also represented, provided the values circle is read from an environmental rather than a strictly social perspective (substitute *species* for *people*), in items reflecting the preservation and protection of the environment, and the right to existence and survival of all species.

Power ("Social status and prestige, control or dominance over people and resources", p. 22) and Achievement ("Personal success through demonstrating competence according to social standards", p. 22) are similarly distinguishable, albeit in a negative context, in items reflecting consumer greed, bias towards humans, and the exploitation or ignorance of the environment. Other items with less negative connotations reflect custodianship, group responsibility, ownership, lifestyle options and justice.

Items associated with Security ("Safety, harmony, and stability of society, of relationships, and of self", p. 22), Tradition ("Respect, commitment, and acceptance of the customs and ideas that traditional culture or religion provide", p. 22), and

Conformity ("Restraint of actions, inclinations, and impulses likely to upset or harm others and violate social expectation or norms", p. 22) variously reflect respect for others, personal and spiritual beliefs, group efforts, legacy for the future, respect for all life, responsible behaviour, and environmental advocacy.

Hedonism ("Pleasure and sensuous gratification for oneself", p. 22), Stimulation ("Excitement, novelty, and challenge in life", p. 22) and Self-direction ("Independent thought and action – choosing, creating, exploring", p. 22) are represented variously by items with arguably negative connotations reflecting corporate, media and political power, business, and industry, and those with more positive connotations, including the environment as a source of wealth, recreation, interest in learning, and support of environmental ideals.

It appears that the meanings, associations and referents of 'values' for the participants in the listing task, and for the participants who sorted the items, can indeed be classified into Kellert's biophilia typology and Schwartz's motivation categories. Neither Kellert's typology nor the Schwartz values circle is by no means an ideal fit to the concept map (e.g. cluster analysis revealed seven clusters, not nine or ten), yet even in Schwartz's own studies the structural order of the ten value types did not always conform without adjustment, and several of his sample configurations required moves in order to match the 'ideal' structure. Kellert's typology is also not always consistent, with the aesthetic category prone to unreliability.

Given the methodological differences in how the items for the concept map were obtained in this study, and the small sample of participants in the sorting task, it is surprising that such an approximation to Kellert's and Schwartz's typologies can be discerned. That they are so readily discernible provides convergent validity for the concept mapping procedure and outcomes. Some might draw the conclusion that a concept map mediating a link between Kellert's and Schwartz's values typologies logically suggests the possibility of a direct link between the two. It is certainly plausible that there is some underlying conceptual structure that all three methodologies have tapped into, and Kellert's and Schwartz's typologies possibly do relate in some way. Nevertheless, Kellert's and Schwartz's typologies were derived from theoretical bases that are very different from the operationalised 'environmental values' construct examined in the current study, and it is also possible that a link between them is indirect.

Conclusions

The 'environmental values' concept system and construct domain suggested in the two-dimensional maps represents characteristics of human relationships with the natural world as suggested in Kluckhohn and Strodtbeck's value orientations theory, and the representation includes many elements of Kellert's hypothesised biophilia values. The negative characteristics of the affective dimension have parallels in negativistic and dominionistic biophilia value types, just as the positive characteristics on the affective dimension have parallels in ecological and naturalistic biophilia types. Moreover, utilitarian and humanistic biophilia value types are mirrored by their respective physical and cultural counterpart items in the social orientation dimension.

Human links to life and lifelike processes are represented, as are Schwartz's motivational values, in a circular continuum, with the addition in the currently suggested conceptual structure of a central core of behaviour-focussed items. These aspects are linked to each of the six other aspects of human interactive relationships with the biophysical world.

Participants initially independently listed *features*, *aspects* and *examples* of 12 different 'values' expressions, and the conceptual domains the items represent are expressed as human affinity for the natural world, together with the recognition of its obverse in the potential for human domination over nature. Such expression might be interpreted as presupposing a dichotomised concept of humanity as separate from nature, in which case it is possible that characteristics of 'environmental unity' do not include humanity, but that rather they reflect the recognition of intrinsic values within biophysical objects and processes. Similarly, 'wild nature' is separated from such strictly human-centred considerations, and embraces instead the idea of untainted nature, divorced from human control. Nevertheless, the circular structure suggests an encompassing rather than divisive conceptual representation.

An optimistic conclusion is that the sorting procedure achieves reasonable validation via the convergent interpretations available through Schwartz's and Kellert's typologies, and through characteristics shared with Kluckhohn and Strodtbeck's value orientations. The results reported here also provide support for the biophilia values typology (if not the broader underpinnings of Kellert's argument concerning the development of a meaningful experience of self), in that the biophilia values types are interpretable as item clusters within the conceptual structure. Moreover, the results suggest that the full domain of 'environmental values' is not represented in many current values measures, especially those that consider only human-designated values. The biocentric focus on values, and the characterisation of values as features, attributes and processes in the environment must also be given consideration in the measurement of values.

In a more critical light, however, researchers must consider the possibility that all such interpretive measures are approximate and 'fuzzy', and may well be accessing multiple domains of meaning and reference. Ranking and rating measures have been criticised for lacking psychological validity, in that they do not replicate the cognitive processes of mental organisation. Arguably, the sorting method utilized provides a more psychologically ‘real’ and ecologically defensible method of accessing mental organisation and exploits the human tendency to categorise information. Each of the measures necessarily involves statistical and subjective interpretation, even when such interpretation is theory-driven.

Maio and Olsen found that ‘values’ are widely held beliefs that are rarely questioned, but it is unlikely that people would ever normally need to rank their values according to importance, or rate them according to given criteria. It is much more likely, given our current knowledge of mental models and the organisation of information, that people rely on their background knowledge to incorporate new and existing information into schemata (Lee, 2003), nodes (Steyvers & Tenenbaum, 2005), or logogens (Sadoski & Paivio, 2001) (depending on one’s preference for a theory of mental models). For instance, an applied, work/professional context such as natural resource management (and possibly political debate and media coverage) invokes particular meanings, reference domains, and needs. Whatever the terminology, in each such applied context, information is grouped according to meaning relationships, whether these be semantic or associative.

In the sorting method, participants are asked to group items ‘according to some aspect of meaning’, which is arguably more psychologically real than either ranking or rating. Sorting requires less cognitive engagement from participants, and it is less time-consuming than the other two methods. Concept mapping exploits latent understandings of concepts, and provides an overview of the structural basis of the meaning relationships that form the concepts.

Another advantage of the concept mapping procedure is the generation of items via the listing task, which is usually akin to a brainstorming exercise. Given the findings that individual brainstorming works best, allowing individuals the freedom to produce responses without prompts from others was an auxiliary benefit in the current study. This portion of the study also provided a closer replication of psychologically real mental models of the individuals involved than would the use of values items drawn or adapted from other studies, and from different contexts.

The effect of individual differences on the concept structure must of course be considered. Rosenberg and Kim (1975) suggested alleviating individual bias by partitioning sorters into subgroups of dominant and dormant sorters. Dominant sorters are those whose sorts are most similar to, and dormant sorters are those whose sorts are least similar to, the total group's cluster structure. Given the availability of a substantially larger sample, this type of analysis could be undertaken by splitting sorters into those who are environmentally active and inactive, with an expectation that environmentally active sorters would have more clearly fixed ideas about item associations.

8. Unresolved Issues, Questions, Theoretical Insights and Implications

Even sciences more mature and more rigorous than ours have not fully unified their vocabulary. Nor can diversity and arbitrariness of usage be avoided entirely. In some ways, and at some stage of our enquiries, we all act like Humpty Dumpty and make words mean what we like.[38]

This thesis was undertaken in response to the many diverse sources suggesting that clarification was needed as a result of the problematic overuse and misuse of the word 'values' in reference to the natural resources and economic contexts of the environment and to the core and foundational motivators of human behaviour. It appeared possible that at least some of this overuse and misuse could be due to the important status of the word 'values' as the linguistic referent of a foundational construct relating to why people behave the way they do and how they 'should' behave. Semantic shifts and meaning slippage from disciplinary terminologies into the public domain were further sources of potential confusion. Related and more general concerns about the 'decay' of public language and its potential drain on the influential power of words (Watson, 2003) and insights about 'seductive' word usage (Gowers, 1948/1973) are balanced by notions that ambiguity can be a rich source of complex meaning (Empson, 1930/1973). There is also some credence to the notion that ambiguity plays a germane role within the human psyche, in its air of mystery and doubt. It is not always vital to explain what we mean, as some measure of uncertainty is acceptable in communication, and context fills most of the 'gaps' in

[38] Nadel (1949, p. vi) was referring to the discipline of social anthropology when making this statement, but it has wider relevance across disciplines and to public perceptions of science.

mutual understanding. Importantly, however, there is a distinction between public language and the language of science. In the communication of scientific knowledge, and in the interests of clarity, seductive words and ambiguity have no place. Neither is it acceptable to blithely make words mean what we choose them to mean. There is a need for core terms and constructs, in both 'pure' and applied science, to be precisely defined and specified, and validly operationalised for consistent measurement. This is not happening with respect to 'values' in the environmental domain.

Within the specialised linguistic, physical and social contexts of different scientific disciplines, as in general use, 'values' is a referentially indeterminate word and a multifaceted theoretical and conceptual construct. To persist with current practices in communicating about values in the different scientific cultures and vocabularies of use invites continuing miscommunication, even between those who share similar environmental outlooks and conservation agendas. Thus, instead of discussing this complex concept with no thought to its explanation, in the expectation that others will understand and appreciate the nuances of meaning (drawing on the 'negative capability' described by Keats), careful reflection about 'what values are' was essential to this research. The background literature and each of the studies described in this thesis provide a knowledge base from which to critically and fruitfully consider this morass of meaning and use, and also to examine a set of instances of how the word 'values' is used as an expression relating to the Wet Tropics World Heritage Area. The research objectives included the documentation and analysis of specific instances of how 'values' are discussed in relation to environmental concerns. The use of the Wet Tropics context as a case study allowed for a reasonably comprehensive exploration of how the expression 'values' is used in that specific context. The case study was a documentation of some of the meanings and referents of the expression and their interrelationships. Related objectives were to use the insights gained from this close examination to consider theoretical and practical issues regarding word and construct meanings, and to suggest strategies for addressing problems of confusing language use and indefinite meaning.

Findings from the studies undertaken in this thesis have broader application to other pressing environmental problems and issues, including effective communication, the conduct of credible research, and the management of environmental threats and adverse impacts. Some of the specific insights also apply to general problems of language use and meaning. For instance, pragmatic cues found in linguistic, physical, social, and epistemic contexts contribute to comprehension, as does background knowledge, in an integration of background text information and world knowledge. Interpretations of the correspondence map and cluster diagrams from the text analysis, and the concept clusters in the concept maps, drew on the role being played by these important cues. Given the grounding of this thesis in the broader context of language and meaning, with particular emphasis on finding how best to identify sources of confusing language, and how the confusion might be addressed, the research questions were of a problem-focussed and solution-oriented nature.

Is the Confusion Real?

Following from the literature suggesting that there are confused meanings of the expression ‘values’, the first of the multiple research questions concerned whether there was indeed confusion in the natural language use of, and reference to, environmental ‘values’ in the applied context of the management of a World Heritage Area, specifically the Wet Tropics World Heritage Area. Indeed, it appears likely that concerns for potential misunderstanding through communication slippage between individual environmental scientists, between social and natural scientists, between public servants and scientists with respect to public understanding of science, and between Wet Tropics management and Wet Tropics stakeholders, are well-founded.

A review of the 'values' literature showed that there are several widely accepted denotations for 'values', either as a common expression or as a theoretical and operationalised construct. In addition to these principal generic denotations, there are also denotative and connotative variations specific to particular contexts, with this found to be the case for the Wet Tropics World Heritage Area context. For example, the text analysis findings regarding keyword differentiation between the management, research, and conservation group documents demonstrate that communication about 'values' within even this limited context does indeed convey multiple meanings. In the text analysis, keywords associated with 'values' showed that the expression can carry connotations of economic worth (ECONOMIC, VALUE, RESOURCE), positive and negative attributions (QUALITY, POTENTIAL, THREAT), and physical substance (FOREST, SPECIES, HABITAT, VEGETATION, WATER). Values are additionally associated with environmentally relevant behaviours (ACTIVITY, CONTROL, PROTECTION, CONSERVATION, MANAGEMENT).

However, while the text analysis showed that a diverse set of meanings and associations are drawn upon and applied in discussing values, that type of analysis fails to reveal whether the multiple meanings stem from the commonly experienced difficulty in adequately defining a shared expression, as voiced by Augustine, or from a Humpty Dumpty-like arrogance, with individuals assigning meaning according to idiosyncratic whim. It would be misleading to assume that any word use or word association patterns found in the text analyses stem solely from such group factors and differences. Differences are often, of course, found to be greater between individuals than between groups, and it is indeed possible, and highly likely, that the expression 'values' is used and conceptualised in diverse ways even within the respective groups. Individuals build and draw on their own meaning systems according to experiences integrating language and the world. Individual understandings and uses of 'values' are thus influenced by myriad subtle factors relating to an individual's language and meaning system, cultural linguistic conventions, and specialised learning. In addition, there are multiple levels of use, meaning and communication taking place in any specific context. Idiographic approaches would undoubtedly uncover different aspects of use and meaning from those revealed here.

In these studies, constraints on the form of writing used, depending on the organization involved and the type of document being produced, would also have moderated the language and, as a consequence, the meanings intended for and received by the audience. However, background knowledge, with its influence on the flow of ideas and on their interpretation, bridges the gaps in comprehension. Given the strong influence of background or world knowledge on one's understandings of words and concepts, it is likely that one's workplace and social milieus influence both the intended and received meanings of words.

In comparison with generalised contexts, the word 'values', when used in a Wet Tropics context, appears to express and convey meanings that are more environmentally focused than socially focussed, although there is certainly a mixture of environmental, social, and cultural ideas within the conceptual system of 'values' identified and categorised by the Wet Tropics participant sample. As a confirmation of the complex system of meanings constituting the values construct, the radiating clusters of ideas produced through the concept mapping procedure confirmed the multidimensional nature of the environmental ‘values’ meaning system. Conceptions and understandings of ‘values’ in the Wet Tropics context considered in this study encompass various positive connotations of utility, aesthetics, and stewardship, and also incorporate a negative perspective in connotations of greed, destruction and power. The mapped system was readily interpretable using hindsight perspectives from other value systems, including those of Kluckhohn and Strodtbeck (1961), Schwartz (1992; 1994), and Kellert (1996; 2004). Insights afforded by these three readily comparable systems were discussed at length, and the concept maps described in this thesis also share similarities with research findings related to values systems outlined in other studies not discussed in depth here (e.g. Bengston, Webb, & Fan, 2004; Bengston & Xu, 1995; Steinhoff, 1980; Vining & Tyler, 1999). It appears that elements of the overarching conceptual system of ‘values’ share some basic commonalities, and are not uniquely relevant to environmental concerns.

For example, several aspects of human relationships with nature featured in the concept maps, in variations ranging from dominance over nature to harmony with nature. Such understandings include human-environment interactions, the importance of the environment in a ‘natural’, less human-impacted state, and behaviours that promote favourable outcomes for the human-environment relationship. Negative characteristics of these relationships, in the recognition of threats and dangers to the environment, are integral to the conceptual system. Similarly, a range of environment-related activities featured in the concept maps. However, according to Kluckhohn and Stodtbeck’s (1961) value orientations theory, Human-nature and Activity orientations are expressed in all cultures depending on specific needs for ordering thoughts and directing behaviours. It is thus likely that similar aspects would be found in a values system not primed by physical, social and linguistic contexts relating to the environment.

As to the nature, content and structure of the conceptual values system, the limited Wet Tropics context specified for this study nevertheless provided a rich and reasonably comprehensive mapping. A values system encompassing many features of human interaction with the environment also includes behaviour. The items forming the system content are not dissimilar from those found by other means, and even from those purportedly representative of very different meaning domains (e.g. Kellert's socio-ecological perspective and Schwartz's social psychology of motivations perspective). The similarities found when setting out from a completely different operational focus nevertheless suggest that there is indeed a need for critical, in-depth reflection of any data reduction and analysis 'system' purporting to represent the values concept.

Are There Practical Consequences?

The second research question concerned whether confused meaning in the case of 'values' led to any practical consequences for effective communication and management, credible research, and the public understanding of science. Certainly, the inability to satisfactorily express what an individual knows or intends creates difficulties for those whose responsibility or desire it is to report, communicate or explain. Consider the arguments likely to arise between groups of locals and natural resource managers if both agreed on the importance of retaining a specific area's 'values', and the area was subsequently cleared of substantial amounts of non-native vegetation, thereby reducing its visual appeal. Locals might argue that the values (referent: aesthetics) had not been retained, without being able to explain that those values consisted partially of the ability to enjoy seeing ‘natural’ vegetation. Resource managers could correctly respond that the values (referent: natural heritage) had indeed been retained, with the removal of the ‘weed’ species and the increased potential for native species regrowth. Given the possibility that some of the non-native species might be saleable for timber, economists might argue that the values (referent: trees or commodity) had been harvested.[39] Each of the referents is open to further interpretation, as none is truly determinate. In the interests of clarity, it would seem beneficial to develop the habit of using clearer language when discussing issues that involve such a fundamental element of the human condition, that is, the human connection to nature.

Given the overview of the multifaceted values system afforded by the concept maps, it is evident that many of the meanings attached to the expression ‘values’ in relation to environmental concerns are composed of multiple referents and connotations. This diversity of meanings is such that it is difficult to draw out independent referents or domains that are completely divorced from other meanings. Keep in mind that the idea of ‘environmental values’ works as a multidimensional conceptual system. Anyone talking about an aspect of values pertinent to their particular concern will likely draw on a combination of ideas and associations from within that system of mental representation.

Furthermore, the description and representation of the values system advanced here has particular relevance for and reference to awareness and understanding of the underlying theoretical and conceptual domain of environmental ‘values’ only in the real-world physical and social context of a well-known World Heritage Area, the Wet Tropics World Heritage Area of Australia. The cartographical representation

[39] This type of situation did actually occur, in the Chicago area, concerning the restoration of prairie lands and the removal of introduced woodlands (Gobster, 2000).

combining the responses of environmentally aware and active participants with those who are relatively unaware and inactive describes a shared conceptual, emotional and symbolic domain of environmental values in the Wet Tropics context. Other systems and typologies developed on specific underlying assumptions and disciplinary foundations, and with respect to specific lexical and semantic domains, must be considered according to those assumptions and foundations.

What are the Underlying Factors and Processes?

The third research question focused on factors or underlying processes that appear to be creating language slippage and confusion, with consequent breakdown in communications concerning 'environmental values' and what the expression means. The review of communication theories and psychological theories of meaning indicated that communication predominantly relates to socially constructed meanings, with linguistic and extra-linguistic context bridging gaps in lexical knowledge. Lexical meanings of 'values' attributed to environmental, Wet Tropics contexts encompass abstract and concrete referents. In a lexical context pertaining to Wet Tropics natural resource management, research and conservation, the word 'values' refers both to human valuations of environmental features, attributes and processes, and to the features, attributes and processes themselves. Not only are many of the meanings shared by groups with different environment-related agendas, but all the groups also access and use popular culture referents and connotations of 'values'.

Social representations theory, with its emphasis on the dual process of anchoring and objectification, has resonance here, as do the principles of semantic network theories. The former addresses the social processes by which meaning is dynamically constructed, with words or images acting as reference points that bridge the gap between the social and physical worlds. The latter address the individual processes by which meaning is learned through exposure and practice. To engage in a thought exercise along such lines, we might suppose that the expression ‘values’ is anchored in the Wet Tropics discourse as a catch phrase and popular expression through repeated associations over time. The familiarisation process, enacted through constant engagement in interpretations and reinterpretations of one’s physical, social and linguistic surroundings, takes the psychological denotations of ‘values’ and the natural resource denotations of ‘values’ together with a range of other connotative meanings. Anchors are cast upon whatever is needed to objectify ‘values’, to make them ‘real’. In this context, the World Heritage listing of the Wet Tropics as an area of universal significance provides a wealth of iconography in which to situate an entire system of environmental values.

To use the language of social representations theory, ‘environmental values’ has become one of the commonly shared terms, constructs and ideas relevant to the Wet Tropics scientific discourse, and in various social representations it is anchored in popular culture discourse (e.g. old-growth forests, undisturbed vistas, sport fishing). The process of objectifying what is essentially abstract involves forming associations between the anchored notion and images or iconic qualities in order to concretize the idea. According to the tenets of social representations theory, it is highly likely that ‘environmental values’ within the Wet Tropics World Heritage Area are objectified as ‘the Wet Tropics’, including images of ‘rainforest meets reef’, ‘pristine rainforests’, wildlife (native flora and fauna), and other iconic images promoting tourism in the area: “Eventually the image is entirely assimilated into a framework of representations, and becomes an element of reality rather than of thought” (Wells, 1987, p. 444).

According to social representations theory, the conceptual mappings of this system would be merely social representations of the actual communication process through which they are formed, not biophysical attributes. Any interpretation of the system is yet another constructed truth, and yet it is necessary to construct and interpret such representations in order to understand some specific aspects of the meanings they encapsulate. The conceptual mappings surely tap into some of the socially shared themes of meaning that reflect what 'values' are, at least in the Wet Tropics context. Similarities between more generalised values systems, such as those described by Schwartz (1994), Kellert (1996), and Kluckhohn and Strodtbeck (1961), lend credibility to the idea that these themes of meaning also tap into a broader, universal context of environmental concern.

As for factors that influence language slippage, it appears that although the word 'values' is very familiar, as evidenced in its varied use in text and as a conceptual system, some of its referents are indeterminate. In the case of natural resource management, there is a strong potential for adverse consequences, where persistent reference to physical resources as 'values' might lead to the widespread institutionalization and normalization of such reference through a process of anchoring and objectification. However, any argument for such objectification draws on the seductive use of 'values' for this purpose. More suitable substitute words surely exist for reference to natural resources, and yet the World Heritage listing of the Wet Tropics area for its 'outstanding universal value' on more than one criterion seduces people into speaking of the WTWHA's 'values'. Of course, there is more to comprehending the meaning of a word than its linguistic sense. There are the matters of authorship and audience, of the context specific to the situation as well as the linguistic context, of general linguistic rules, and of the richness or dearth of background knowledge from which to form inferences (Johnson-Laird, 1987).

What Insights and Understandings are Offered?

The final research question directed the exploration towards insights or understandings to be found in contemporary psychological or psycholinguistic theory, to assist in addressing problems of language, meaning, and communication in practical and applied contexts. In the natural resource and protected area context of this research, social representations theory offers several insights as already discussed. The various theories of mental representation all explain ways that knowledge is acquired and integrated into existing knowledge structures, whether they are idiosyncratic schemas or networks, or collective, shared representations. Psycholinguistic research findings about the role of sentence context and word associations, together with advances in the field of computational linguistics, offer the foundations for studies of linguistic meaning in texts. It is uncontroversial to say that context, whether sentential or referential, reveals the appropriate sense by which most words are intended (Johnson-Laird, 1987; McDonald & Brew, 2002; Purandare & Pedersen, 2004; Schwanenflugel & LaCount, 1988; Taft, 1991).

What distinguishes this thesis is the application of theories and empirical findings from various disciplines to the study of ‘values’ via meaning. Thus, rather than trying to measure generalised ‘values’ as others have done, through surveys and conventional content analysis techniques, this study has attempted to access and conceptually represent the different meanings, contexts, and representations of ‘environmental values’ as they occur in the natural resource management context of the Wet Tropics. The studies reported here suggest that text analysis and concept mapping constitute available and suitable procedures for measuring, or at least accessing, meanings. The advantages each of these procedures affords over methods such as the semantic differential technique, which arguably measures affect rather than meaning, make them particularly appropriate for further studies into natural language use and shared meanings. The combination of text analysis and concept mapping is suggested as being suitable for other studies investigating the social representations of over-used and misused words and expressions.

Evaluation of the Methodologies

As for the text analysis methodologies, there is obvious merit in quantitative content analyses, and particularly so when large samples of text are available. The exploration and documentation of naturally occurring texts benefits from high ecological validity for studies of language use in a ‘native’ and localised context. Commonly-occurring applications of a specific ‘target word’ in a limited lexical context can be identified through a statistical association approach to text analysis. This approach allows for the investigation of a targeted keyword, and the retention of words in their naturally-occurring contexts reveals characteristic linguistic uses of keywords in documents from separate groups. The procedure also clearly differentiates applications and themes of meaning between groups. Naturally occurring language and its stable characteristics form the basis of an operationally sound means by which to explore meanings and characteristic linguistic uses, and this is particularly so for large samples. Advances in programs for running such analyses bode well for the future of text analysis, and the identification of semantic content in natural language.

As a complement to the text analyses, the concept mapping technique proved efficient in drawing out and structuring the conceptual system underlying understandings of a complex concept, and could certainly be applied to other such studies. The combination of brainstorming, sorting and rating provides an effective, multi-pronged approach for the elicitation, organisation and evaluation of a conceptual system. It adequately addresses the requirements for reliability and validity and compares favourably with other methods employed in the exploration and understanding of such words and constructs as 'values'. While the brainstorming component of the mapping technique is conventionally performed in groups, this study would indicate that individual brainstorming is also a very useful strategy for the elicitation of a sufficiently diverse set of items that are representative of a conceptual system.

The experimental method employed the lexical decision task as an index of semantic and associative memory processes and mechanisms. The artificial nature of such tasks is open to criticism when used alone, and if results are generalised to incommensurable situations. However, the use of this method as a complement to the text analyses, and the use of words drawn from the Wet Tropics corpus of documents, aligns the experimental results with the Wet Tropics context of the study as a whole. There is also precedence for the use of this and other experimental methods, such as the semantic priming paradigm, in studies using distributional information in texts to predict lexical effort (e.g. McDonald, 2000; McDonald & Shillcock, 2001).

The Wet Tropics documents studied through text analysis were considered to be a specialised corpus, and investigating this claim via comparative searches of a larger corpus appeared relevant. The BNC is one of many large corpora commonly employed for studies of distributional information in written and spoken language. A minor drawback in relying on such a resource comes from its temporal limitations, as all BNC documents originated in the period 1960-1994. The dynamic nature of language is such that these corpora and resource banks must change with the times or become outdated (as has occurred with the Kucera and Francis (1967) word norms). It must also be kept in mind that the BNC reflects language use in the British idiom. On the whole, the opportunities afforded by being able to draw on so large and diverse a collection of written language examples (and so readily, with the availability of the BNC online) outweigh these minor problems.

Limitations

Limitations of this study arguably derive, in large part, from fields outside the general field of psychology, although there is precedence for their use. Computerised text analysis is a burgeoning field, due to advances in computational linguistics and data mining techniques developed for Internet searching. Programs designed for analysing text undergo constant improvement, and there are programs available other than those employed in this study. WordStat has shortcomings in its interface capacities and output qualities that make it difficult to wholeheartedly recommend its use. However, the transparency of its workings and its capabilities beyond what was needed for this study warrant recognition and commendation.

The process of finding meanings in texts bypasses direct participation by authors, and is instead reliant upon the researcher's interpretations of analysis outcomes. Both of these elements might be considered limitations, but are counted as strengths in this study, as they heightened the need for careful reflection about what the analyses showed, and how they might be interpreted.

The findings from the concept mapping procedure are broadly consistent with those from other studies of value systems. It is likely that the procedure tapped into a widely shared conceptualisation of an environmental values system, as a network of ideas. The only immediately obvious drawback to that procedure is that the researcher decided on the category names rather than asking participants to designate names. It is suggested that a final task be added to the procedure were similar future research to be undertaken, with other participants asked to categorise items into the seven named clusters, and the groupings analysed for agreement with the statistically derived clusters.

Another task that could be suited for further study, which was beyond the scope of the current aims, is a text analysis of the listing task responses. The listing task is one element of a knowledge elicitation process, and is intended to draw together a collection of expressions that together constitute a conceptual system of knowledge. Items can come from an individual or from many, as for the current study, and the resulting conceptual system is thus either idiosyncratic or shared. An analysis of the items is not conventionally undertaken, and was not considered necessary for the current research aims, but it is worth considering in future studies should a larger sample of items be collected.

Implications

This thesis topic emerged in response to persistent calls for clarity, and resolution, of the confusions surrounding the environmental 'values' construct (arguably a core construct for many disciplines and for public understanding). The conceptual domain of environmental values in the Wet Tropics context appears to reflect a complex, fundamental, and profoundly meaningful understanding of human connections to the natural environment. This language and meaning domain encompasses negative and positive elements of human-environment interaction, and has at its core some behavioural elements of the human-environment relationship. Many of these behaviours involve human stewardship of the Earth, with humans as protectors and managers in control of our own 'encroachment' into the 'natural' world, ideas expressed by Kluckhohn and Strodtbeck (1961) in their ‘value orientations’, and also in the ‘land ethic’ philosophy – the notion that experience builds up to conscience, which dictates action (Leopold, 1949). The idea of stewardship also reflects the argument that human ethics are progressing beyond human self interest to recognising the rights of all ‘nature’ (Nash, 1990). Rather than maintaining areas relatively free from human impact *for the sake of humanity*, there is increasing concern that ‘wild’ places be kept in that state to maintain ecosystem balance.

Essentially, this thesis argues that elements of language and meaning can inveigle communicants in confusion and miscommunication, and yet language and meaning also contain those elements necessary for promoting clarity and shared understanding. The role of language as a core aspect of scientific discourse and research, and its ability to guide attitudes, frame discussions, and shape policy must be considered when reporting on constructs that are prone to loose meanings and consequent communicative slippage. The increasingly common practice of discussing ‘values’ with regard to matters of the environment would benefit from the substitution of the word ‘values’ with more referentially determinate terms and expressions. The practice of merely qualifying ‘values’ with the addition of an adjectival modifier term, such as ‘natural’ or ‘cultural’ (which arguably add to the confusion), is insufficient for differentiating between diverse and often complex meaning fields. It is against the interests of the public understanding of science to persist in promoting social representations that appear to anchor and objectify troublesome expressions in a myriad of diverse contexts.

Conclusion

In summation, I reiterate the stance upon which this thesis is based – that language is the tool with which humans construct their cultural and social worlds (Berger & Luckmann, 1966; Gergen, 1998). Of course, language and meaning considerations are integral to being human, to effective communication, and fundamental to good science, both pure and applied. Language pertaining to the environment, as environmentalism, is powerfully influential in forming moral and political opinion (Harré et al., 1999). Language, however, stems from experience within the linguistic, physical, social, emotional and historical contexts of existence. The studies conducted in attempts to answer the research questions posed here were designed and conducted with this basic tenet in mind, that context is the key to understanding. Attempts to study language and meaning in ignorance of the multiple contexts of their existence cannot sufficiently explain the complex systems of human conceptualization and comprehension.

This chapter began with the question, "what are values?" It appears that the primary response should be to consider another question: "why values?" Indeed, why not attributes, properties or features? World Heritage legislation specifies cultural and natural heritage as monuments, buildings, man-made sites, natural features, geological and physiological formations, and natural sites (UNESCO, 1972) *of universal value*. World Heritage is *to be* valued, but should not be considered to consist *of* values. Any use of the term or expression, 'values', requires careful consideration of the multiple contexts in place. If values are defined and operationalised as the commonly theorised social science construct, reference to psychological denotations should be made explicit. Similarly, terminology signifying natural resources should directly connect the signifier with what is signified. This does not exempt people from a responsibility to be sufficiently reflective and careful in normative uses of language, and to avoid the problems of expecting too much of certain terms and expressions. In the case of ‘values’, people have expected this small word to bear a referential and semantic load that is overtaxed and confounded through a multiplicity of associations, and particularly so in the natural resource management context. In comparison to older, core meanings of ‘values’ referring to worth and desire, these protected area management uses come from relatively recent semantic and associative shifts, and should be offloaded in favour of references to attributes or properties of the biophysical landscape, or to human behaviours pertaining to the environment. ‘Values’ would be better left to their axiological roots, to signify those a priori standards by which to determine whether the human-nature experience is useful, serviceable, or advantageous, and are very much better left situated within the human character rather than in the environment.

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Appendix 1a

Frequency Details of Document Items in the Sampling Frame for Three Organisations

#	CRC						WTMA						CAFNEC					
	valu	value	values	valuat	valuab	word	valu	value	values	valuat	valuab	word	valu	value	values	valuat	valuab	word
1	4	1	2	1	0	285	17	2	12	2	1	1477	12	6	5	0	1	783
2	11	4	3	1	3	588	4	0	4	0	0	161	7	2	2	1	2	370
3	3	0	2	1	0	388	3	0	3	0	0	229	7	0	6	0	1	381
4	4	2	1	1	0	471	2	0	2	0	0	153	3	2	1	0	0	166
5	17	0	17	0	0	595	2	0	2	0	0	198	7	1	6	0	0	276
6	2	0	2	0	0	60	2	0	1	1	0	145	4	1	3	0	0	189
7	2	1	1	0	0	160	1	0	0	0	1	60	1	1	0	0	0	88
8	2	0	1	1	0	131	1	0	1	0	0	73	6	0	6	0	0	259
9	6	4	1	0	1	645	2	0	2	0	0	161	1	0	1	0	0	74
10	2	1	1	0	0	196	3	0	3	0	0	118	22	1	16	4	1	1031
11	3	1	2	0	0	138	8	0	8	0	0	175	5	2	3	0	0	341
12	2	0	2	0	0	179	4	0	3	0	1	159	7	2	4	1	0	395
13	2	0	1	1	0	310	14	0	14	0	0	398	12	2	9	0	1	638
14	20	5	8	3	4	2081	8	0	8	0	0	454	4	2	1	0	1	227
15	44	4	15	21	4	2962	3	0	3	0	0	410	6	2	2	0	2	321
16	43	3	12	26	2	2538	5	0	5	0	0	328	7	2	4	0	1	390
17	6	1	5	0	0	486	2	1	1	0	0	124	1	0	0	0	1	86
18	16	8	8	0	0	794	9	2	7	0	0	266	15	6	8	0	1	649
19	6	2	1	3	0	389	30	2	24	4	1	1145						
20	7	0	6	1	0	363	5	1	3	0	1	301						
21	7	4	1	2	0	360	2	0	1	0	1	89						
22	18	3	6	3	6	1186	2	0	2	0	0	59						
23	5	0	3	2	1	381												
24	5	0	5	0	0	375												
25	10	2	5	2	1	869												
26	48	12	18	18	0	2933												
27	8	3	3	1	1	519												
28	29	11	18	0	0	1859												
Σ	332	72	150	88	23	22,241	129	8	109	7	6	6,683	127	32	77	6	12	6,664

Appendix 1b

WordStat Default Exclusion List

A
able
about
above
according
accordingly
across
actually
after
afterwards
again
against
ain't
al
all
allow
allows
almost
alone
along
already
also
although
always
am
among
amongst
an
and
another
any
anybody
anyhow
anyone
anything
anyway
anyways
anywhere
apart
appear
appreciate
appropriate
are
aren't
around
as
aside
ask
asking
associated
at
available
away
awfully

B
back
be
became
because
become
becomes
becoming
been
before
beforehand
behind
being
believe
below
beside
besides
best
better
between
beyond
both
brief
but
by

C
came
can
cannot
cant
can't
cause
causes
certain
certainly
changes
clearly
c'mon
co
com
come
comes
concerning
consequently
consider
considering
contain
containing
contains
corresponding
could
couldn't
course
c's
currently

D
definitely
described
despite
did
didn't
different
do
does
doesn't
doing
done
don't
down
downwards
due
during

E
each
edu
eg
eight
either
else
elsewhere
enough
entirely
especially
et
etc
even
ever
every
everybody
everyone
everything
everywhere
ex
exactly
example
except
excluded

F
far
few
fifth
find
first
five
followed
following
follows
for
former
formerly
forth
found
four
from
further
furthermore

G
get
gets
getting
give
given
gives
go
goes
going
gone
got
gotten
greetings

H
had
hadn't
happens
hardly
has
hasn't
have
haven't
having
he
hello
help
hence
her
here
hereafter
hereby
herein
here's
hereupon
hers
herself
he's
hi
him
himself
his
hither
hopefully
how
howbeit
however

I
i'd
ie
if
ignored
i'll
i'm
immediate
in
inasmuch
inc
indeed
indicate
indicated
indicates
inner
insofar
instead
into
inward
is
isn't
it
it'd
it'll
its
it's
itself
i've

J
just

K
keep
keeps
kept
know
known
knows

L
last
lately
later
latter
latterly
least
less
lest
let
let's
like
liked
likely
little
look
looking
looks
ltd

M
made
mainly
many
may
maybe
me
mean
meanwhile
merely
might
mine
more
moreover
most
mostly
much
must
my
myself

N
name
namely
nd
near
nearly
necessary
need
needs
neither
never
nevertheless
new
next
nine
no
nobody
non
none
noone
nor
normally
not
nothing
novel
now
nowhere

Appendix 2a

Lexical Decision Task Stimuli for Four Conditions: High-frequency Environment, Low-frequency Environment, High-frequency Control and Low-frequency Control, and Nonword Fillers

HF_enviroment	HF_control	CELEX_W frequency	LF_environment	LF_control	CELEX_W frequency
*catchment	*aerodrome	1	*funk	*rasp	1
*degrade	*parsimony	1	*reaffirm	*reiterate	1
*ecosystem	*prudish	1	*constrain	*contrite	1
aquatic	anthem	3	sparse	craze	3
evaluate	indulgent	3	operative	contractor	3
nomination	composure	4	prevail	hectare	4
frog	clip	4	homeland	horseback	4
regulate	recipient	4	shrub	squire	4
distribute	digestive	5	mahogany	lavish	5
pest	beak	5	acutely	modestly	5
protocol	formulate	5	offend	forbid	5
tourism	drought	5	pastoral	gorgeous	5
*monitor	*rendezvous	5	*wisely	*nightly	5
plantation	intuition	6	frown	shave	6
aboriginal	analyse	7	temperate	signature	7
dam	surge	8	dump	moist	8
diverse	resign	9	creep	stool	9
habitat	dominance	9	statutory	athlete	9
vegetation	stack	10	popularity	tribal	11
weed	escort	10	obscene	province	11
indigenous	irregular	10	globe	stole	11
undertake	downtown	10	submit	endure	11
heritage	legitimate	11	resolve	retire	11
integrity	bleak	11	decay	merchant	12
exotic	potato	12	quote	charity	14

Nonwords				
twiek	sciv	sopaiety	tored	cumpure
spluild	menth	froar	stelm	stalent
jick	goagle	mintory	frague	wouse
sprar	palsible	fowd	rolution	ulkur
dern	grissock	drait	clist	wreague
thwez	speem	liart	adgo	jallow
vodil	transmursion	bazzle	croll	throg
drulge	gastice	lavenile	crazz	facrobe
sprange	swonce	printh	hovay	ghict
hercle	wint	traph	slorm	gloice
sulphix	laghn	jange	ottend	phrars
neech	estantial	pooze	thrail	frult
peuve	mealare	futish	chapy	huvinity
gnach	pleil	tegregrath	incapid	plect
calmus	derp	diller	kalf	spimpse
scialce	slutch	glurge	lowien	direne
patule	gnake	schelor	irobe	
tyrin	lafe	jorque	polture	
holusion	wost	ghank	woule	
impeith	bief	frate	jont	
pumily	dwalse	valigh	lamend	

Note: * denotes items that were removed from analyses

Appendix 2b

Response Times and Error Rates: Items

(Note: The table of RTs and errors by participants is included in the main text, p. 173)

Mean Response Times in Milliseconds and Mean Percentage Error Rates as a Function of Group, Source and Sample Frequency across Items

Group	Measure	Source			
		Environment words		Control words	
		High freq	Low freq	High freq	Low freq
Expert	RT	693 (8)	716 (12)	735 (8)	728 (12)
	Errors	16.9 (0.9)	16.6 (1.0)	18.1 (1.0)	17.1 (0.9)
Naïve	RT	638 (6)	662 (10)	657 (5)	645 (5)
	Errors	6.1 (1.2)	10.5 (1.6)	8.7 (1.4)	7.1 (0.9)

Note: Items in brackets are standard deviations

A percentage error rate of 16.67% equates with three errors in 21 items

Appendix 2c

z-Skewness and z-Kurtosis Scores

The following tables show *z*-skewness and *z*-kurtosis scores, calculated using the following formulae:

$$z_{skewness} = \frac{skewness}{SE_{skewness}}$$

$$z_{kurtosis} = \frac{kurtosis}{SE_{kurtosis}}$$

With alpha conservatively set to .001, a conventionally accepted index of normality (Tabachnick & Fidell, 2001[40]) for both skewness and kurtosis is a z-score between 3.00 and -3.00. *Z*-scores outside this range are deemed to indicate that the data depart significantly from normality. In these tables, scores outside the specified range are indicated with an asterisk. Departure from normality for the error data is explained by the frequency tables in Appendix 2d, showing that any participant made no more than six errors in each of the four conditions, and no more than six errors were made on any of the word items in each of the four conditions.

RT Data - Subjects

		Enviro High	Enviro Low	Control High	Control Low
Naïve	Skewness	2.33	0.95	1.29	3.28*
	Kurtosis	0.45	-0.96	-0.46	1.38
Expert	Skewness	1.73	0.81	-0.09	-0.34
	Kurtosis	1.43	0.12	0.54	0.12

RT Data - Items

		Enviro High	Enviro Low	Control High	Control Low
Naïve	Skewness	0.04	1.52	-0.31	0.52
	Kurtosis	0.15	-0.56	-0.65	-0.61
Expert	Skewness	0.61	0.55	1.72	0.49
	Kurtosis	-0.95	-0.91	0.88	-0.72

Error Data - Subjects

		Enviro High	Enviro Low	Control High	Control Low
Naïve	Skewness	5.08*	1.99	4.27*	3.13*
	Kurtosis	6.90*	-0.30	2.95	1.20
Expert	Skewness	4.61*	1.92	4.33*	0.60
	Kurtosis	6.53*	-0.11	6.12*	-0.63

Error Data - Items

		Enviro High	Enviro Low	Control High	Control Low
Naïve	Skewness	5.68*	1.15	3.20*	2.34
	Kurtosis	9.28*	-0.90	2.16	0.87
Expert	Skewness	1.98	3.32*	1.65	1.68
	Kurtosis	-0.68	2.18	-0.30	-0.89

[40] Tabachnik, B. G., & Fidell, L. S. (2001). *Using Multivariate Statistics* (4th ed.). Sydney: Allyn and Bacon.

Appendix 2d

Mean Percentage Error Rate Frequencies across 60 Participants

Environment Words High Frequency Condition

Count errors	% errors	Frequency	%	Cumulative %
0	0	35	58.3	58.3
1	5	15	25.0	83.3
2	10	8	13.3	96.7
3	19	1	1.7	98.3
4	24	1	1.7	100.0
	Total	60	100	

Environment Words Low Frequency Condition

Count errors	% errors	Frequency	%	Cumulative %
0	0	21	35.0	35.0
1	5	21	35.0	70.0
2	10	7	11.7	81.7
3	14	6	10.0	91.7
4	19	3	5.0	96.7
5	24	2	3.3	100.0
	Total	60	100	

Control Words High Frequency Condition

Count errors	% errors	Frequency	%	Cumulative %
0	0	27	45	45
1	5	19	31.7	76.7
2	10	6	10.0	86.7
3	14	2	3.3	90.0
4	19	3	5.0	95.0
5	24	1	1.7	96.7
6	29	2	3.3	100.0
	Total	60	100	

Control Words Low Frequency Condition

Count errors	% errors	Frequency	%	Cumulative %
0	0	26	43.3	43.3
1	5	24	40.0	83.3
2	10	6	10.0	93.3
3	14	2	3.3	96.7
4	19	2	3.3	100.0
	Total	60	100	

Mean Percentage Error Rate Frequencies across 21 Items for Two Groups

Environment Words High Frequency Condition

Count errors	% errors	Frequency	%	Cumulative %
0.6	3	9	21.4	21.4
1.0	5	7	16.7	38.1
1.7	8	2	4.8	42.9
2.0	10	1	2.4	45.2
3.0	14	13	31.0	76.2
3.2	15	1	2.4	78.6
3.8	18	4	9.5	88.1
4.0	19	4	9.5	97.6
5.0	24	1	2.4	100.0
5.5	26	9	21.4	21.4
	Total	42	100	

Environment Words Low Frequency Condition

Count errors	% errors	Frequency	%	Cumulative %
0.6	3	5	11.9	11.9
1.0	5	4	9.5	21.4
1.7	8	2	4.8	26.2
2.0	10	1	2.4	28.6
2.7	13	2	4.8	33.3
3.0	14	14	33.3	66.7
3.2	15	1	2.4	69.0
3.8	18	4	9.5	78.6
4.0	19	4	9.5	88.1
4.4	21	1	2.4	90.5
5.0	24	2	4.8	95.2
5.5	26	1	2.4	97.6
6.1	29	1	2.4	100.0
	Total	42	100	

Control Words High Frequency Condition

Count errors	% errors	Frequency	%	Cumulative %
0.6	3	4	9.5	9.5
1.0	5	5	11.9	21.4
1.7	8	7	16.7	38.1
2.0	10	1	2.4	40.5
3.0	14	10	23.8	64.3
3.2	15	1	2.4	66.7
3.8	18	1	2.4	69.0
4.0	19	6	14.3	83.3
4.4	21	1	2.4	85.7
5.0	24	4	9.5	95.2
5.5	26	1	2.4	97.6
6.0	29	1	2.4	100.0
	Total	42	100	

Control Words Low Frequency Condition

Count errors	% errors	Frequency	%	Cumulative %
0.6	3	5	11.9	11.9
1.0	5	7	16.7	28.6
1.7	8	3	7.1	35.7
2.0	10	3	7.1	42.9
2.7	13	1	2.4	45.2
3.0	14	12	28.6	73.8
3.2	15	1	2.4	76.2
3.8	18	1	2.4	78.6
4.0	19	5	11.9	90.5
5.0	24	4	9.5	100.0
	Total	42	100	

Appendix 2e

ANOVA Tables: Participants

Analysis of Variance for Mean Response Times by Participants

Source	*df*	*F*	η_p^2	*p*
		Between subjects		
Group (G)	1	9.47	.140	.003**
Error	58	(26513.53)		
		Within subjects		
Frequency (F)	1	2.11	.035	.152
F x G	1	.13	.002	.723
Error - F	58	(624.30)		
Source (S)	1	10.18	.149	.002**
S x G	1	5.86	. 092	.019*
Error - S	58	(1097.23)		
F x S	1	12.17	.173	.001**
F x S x G	1	.12	.002	. 730
Error - F x S	58	(973.13)		

Note: Values enclosed in parentheses represent mean square errors.
* *p* < .05, ** *p* < .01

Analysis of Variance for Mean Percentage of Errors by Participants

Source	*df*	*F*	η_p^2	*p*
		Between subjects		
Group (G)	1	4.24	.068	.044*
Error	58	(75.85)		
		Within subjects		
Frequency (F)	1	.50	.009	.483
F x G	1	2.45	.040	.123
Error - F	58	(22.23)		
Source (S)	1	.22	.004	.642
S x G	1	1.49	.025	.227
Error - S	58	(13.30)		
F x S	1	6.37	.099	.014*
F x S x G	1	3.89	.063	.053
Error - F x S	58	(22.87)		

Note: Values enclosed in parentheses represent mean square errors.
* *p* < .05, ** *p* < .01

ANOVA Tables: Items

Analysis of Variance for Mean Response Times by Items

Source	*df*	*F*	η_p^2	*p*
		Between subjects		
Group (G)	1	57.71	.591	<.001**
Error	40	(3333.36)		
		Within subjects		
Frequency (F)	1	.74	.018	.393
F x G	1	.02	<.001	.889
Error - F	40	(2646.14)		
Source (S)	1	6.38	.138	.016*
S x G	1	5.37	.118	.026*
Error - S	40	(1262.76)		
F x S	1	6.11	.132	.018*
F x S x G	1	.06	.002	.804
Error - F x S	40	(1708.00)		

Note: Values enclosed in parentheses represent mean square errors.
* $p < .05$, ** $p < .01$

Analysis of Variance for Mean Percentage of Errors by Items

Source	*df*	*F*	η_p^2	*p*
		Between subjects		
Group (G)	1	99.96	.714	<.001**
Error	40	(33.21)		
		Within subjects		
Frequency (F)	1	.27	.007	.608
F x G	1	1.63	.039	.209
Error - F	40	(25.80)		
Source (S)	1	.10	.002	. 754
S x G	1	.83	.020	.367
Error - S	40	(19.32)		
F x S	1	4.46	.100	.041*
F x S x G	1	2.76	.064	.105
Error - F x S	40	(26.13)		

Note: Values enclosed in parentheses represent mean square errors.
* $p < .05$, ** $p < .01$

Appendix 2f

ANCOVA Table: Age as Covariate

Analysis of Covariance for Participant Response Times with Age as a Covariate with Group, Keyword Sample Frequency and Corpus Source

Source	*df*	*F*	η_p^2	*p*
		Between subjects		
Age (A)	1	.83	.001	.831
Group (G)	1	6.12	.097	.016*
Error	57	(26957)		
		Within subjects		
Frequency (F)	1	3.48	.058	.067
F x A	1	2.22	.037	.142
F x G	1	1.52	.026	.223
Error - F	57	(612)		
Source (S)	1	4.93	.080	.030*
S x A	1	1.70	.029	.198
S x G	1	7.31	.114	.009*
Error - S	57	(1084)		
F x S	1	.156	.003	.695
F x S x A	1	.487	.008	.488
F x S x G	1	.508	.009	.479
Error - F x S	57	(982)		

Note: Values enclosed in parentheses represent mean square errors.
* $p < .05$, ** $p < .01$

Analysis of Covariance for Participant Error Rates with Age as a Covariate with Group, Keyword Sample Frequency and Corpus Source

Source	*df*	*F*	η_p^2	*p*
		Between subjects		
Age (A)	1	1.69	.029	.198
Group (G)	1	.56	.010	.457
Error	57	(74.96)		
		Within subjects		
Frequency (F)	1	.58	.010	.452
F x A	1	1.04	.018	.311
F x G	1	3.44	.057	.069
Error - F	57	(22.21)		
Source (S)	1	.098	.002	.755
S x A	1	.032	.001	.858
S x G	1	1.09	.019	.302
Error - S	57	(13.53)		
F x S	1	2.60	.044	.113
F x S x A	1	.78	.014	.380
F x S x G	1	.88	.015	.353
Error - F x S	57	(982)		

Note: Values enclosed in parentheses represent mean square errors.
* $p < .05$, ** $p < .01$

Adjusted Mean Response Times and Error Rates: ANCOVA Analysis

Adjusted Mean Response Times in Milliseconds and Adjusted Mean Percentage Error Rates as a Function of Group, Source and Sample Frequency across Participants

Group	Measure	Source			
		Environment words		Control words	
		High freq	Low freq	High freq	Low freq
Expert	RT	695 (23)	716 (21)	736 (22)	738 (24)
	Errors	3.6 (1.3)	3.4 (1.6)	5.6 (1.9)	3.3 (1.2)
Naïve	RT	640 (16)	659 (14)	658 (15)	641 (17)
	Errors	3.1 (0.9)	7.5 (1.1)	5.3 (1.3)	4.5 (0.8)

Note: Items in brackets are standard errors

A percentage error rate of 4.76% equates with one error in 21 items

Appendix 3a: Listing task

James Cook University
Cairns campus
PO Box 6811 Cairns
QLD 4870 AUSTRALIA
Cricos Provider Code:00117J

School of Psychology
Telephone (07) 4042 1206
Facsimile (07) 4042 1390

MEANING AND UNDERSTANDING STUDY

What's it about?

This study is an exploration of the meanings and understandings of various words and phrases that are widely used among those with an interest in environmental issues. Your participation in this project will provide useful information that is relevant to current concerns about environmental discourse.

Who's asking?

I'm a PhD student with the School of Psychology at JCU Cairns. The study is towards partial fulfilment of the requirements for my PhD degree.

What do I have to do?

Just follow the steps outlined below.

1. Complete the details requested on Sheet 1 (p. 2)
2. Read the information on Sheet 2 (p. 3) and complete the Listing Task (pp. 4-7).
3. Post all pages back to me in the orange envelope in which you received all materials. Feel free to retain this introduction page.

Does anyone else know that I've participated?

No. All data are confidential and will be used for research purposes only, in aggregate form. The only personal information I'm asking for is of a general nature and I don't need your name, age or other identifying information.

Ethics Approval: H1713

Contacts
Tina Langford
Ethics Administrator
Ph: 4781 4342

Dr David Cottrell
School of Psychology
Ph: 4042 1621

Denise Dillon
School of Psychology
Ph: 4042 1652

Points of note

Participation is voluntary. There are no foreseeable risks to you as a participant. Any concerns about the ethical conduct of this study should be addressed to Tina Langford, the JCU Ethics Monitor. Other concerns can be addressed to my supervisor, Dr David Cottrell, or myself.

I appreciate your time and assistance.

Denise Dillon

Meaning and Understanding Study: Sheet 1

1. Please indicate whether you are a member of, or affiliated with, any of the following organizations (tick the boxes for whichever apply).

	1	AST	Alliance for Sustainable Tourism
	2	CAFNEC	Cairns And Far North Environment Centre
	3	CRC	Cooperative Research Centre (Rainforest)
	4	CSIRO	(Tropical Forest Research Centre)
	5	DNRM	Department of Natural Resources and Mines
	6	DPI	Department of Primary Industries (Forestry)
	7	EPA	Environmental Protection Agency
	8	QTIC	Queensland Tourism Industry Corporation
	9	QPWS	Queensland Parks and Wildlife Service
	10	WTMA	Wet Tropics Management Authority

2. Please indicate (from the selection below) which category you are MOST STRONGLY associated with in your ENVIRONMENTAL INTERESTS, and then briefly outline how you belong in this category.

I consider myself most strongly associated with the following category

(please tick one)

❑ Science/Research ❑ Management ❑ Activism/Conservation ❑ Other

for these reason/s: (use the back of this sheet if necessary)

____

____

3. Please tick the relevant item to indicate the highest level of education you have attained and specify the field where appropriate (e.g. BPsych, BSc, MAppSc, etc.).

❑ Year 10	❑ TAFE certificate	❑ Bachelor	❑ PhD
❑ Year 11	❑ TAFE diploma	❑ Masters	❑ Other
❑ Year 12		❑ Doctorate	

Specific field of study:

____

Meaning and Understanding Study: Sheet 2

It can be difficult to know what people mean when an adjective (descriptive modifier) is used before a noun (naming word), particularly when the noun itself is ambiguous (has more than one meaning). For example, we might assume that we know what SUSTAINABILITY means but how is the meaning altered if we prefix SUSTAINABILITY with different descriptive modifiers such as ECONOMIC, ECOSYSTEM or CULTURAL? It does not mean the same thing to talk about ECONOMIC SUSTAINABILITY, ECOSYSTEM SUSTAINABILITY and CULTURAL SUSTAINABILITY, but the meaning of SUSTAINABILITY appears to remain stable.

Many different modifying words are used with VALUES in this way, presumably with the intention of clarifying a more specific meaning of VALUES but often without the desired result. I want you to see if you can help to clarify some of these various possible meanings by listing *features, examples* or *aspects* of the various types of VALUES that people discuss. Some uses of VALUES appear to relate to personal beliefs and feelings, and others to characteristics of the environment. I have not distinguished between these two common domains in listing the modifiers so I also want you to indicate whether you consider each of them is personally relevant (e.g. related to personal beliefs or feelings) or environmentally relevant (i.e. characteristics of, or about, the environment).

You can indicate this simply by listing *features, examples* or *aspects* under the relevant headings for each of the 12 modifiers. Please try to list as many as you can for each. I've included an example in the box below to give you an idea of what I'm aiming for.

SWAMP VALUES	
PERSONALLY RELEVANT	ENVIRONMENTALLY RELEVANT
people's opinions not useful	trees water damp mud frogs mosquitoes ecosystem needed for other systems need protecting retaining a natural state

Appendix 3b: Sorting and Rating Tasks

James Cook University
Cairns campus
PO Box 6811 Cairns
QLD 4870 AUSTRALIA
Cricos Provider Code:00117J

School of Psychology
Telephone (07) 4042 1206
Facsimile (07) 4042 1390

MEANING AND UNDERSTANDING: Part 2

What's it about?

This is a follow-on study from Part 1, an earlier task that circulated in December and January, and I'm asking you to participate now whether or not you completed Part 1 of the study. For Part 2, we have created a list of words and phrases from those generated by a Listing Task. The words and phrases are indicative of the language used to describe VALUES in various contexts relating to the environment. This next stage is about clustering those words and phrases into categories that make sense to you, and rating them for their relevance to informed discussion about VALUES. Your participation in this project will provide useful information that is relevant to current concerns about environmental discourse.

Who's asking?

I'm a PhD student with the School of Psychology at JCU Cairns. The study is towards partial fulfilment of the requirements for my PhD degree.

What do I have to do?

Carefully read the instructions on each page and follow the steps to work through the tasks. Record all responses on the relevant recording sheets:

1. DEMOGRAPHICS FORM (1 page)
2. SORTING TASK (4 pages)
3. RATING TASK (4 pages)

Return all recording sheets together with the demographics form in the envelope provided. Feel free to retain this page for contact information.

Does anyone else know that I've participated?

No. All data are confidential and will be used for research purposes only, in aggregate form. The only personal information I'm asking for is of a general nature and I don't need your name, age or other identifying information.

Ethics Approval: H1713

Contacts
Tina Langford
Ethics Administrator
Ph: 4781 4342

Dr David Cottrell
School of Psychology
Ph: 4042 1621

Denise Dillon
School of Psychology
Ph: 4042 1652

Points of note

Participation is voluntary. There are no foreseeable risks to you as a participant. Any concerns about the ethical conduct of this study should be addressed to Tina Langford, the JCU Ethics Monitor. Other concerns can be addressed to my supervisor, Dr David Cottrell, or myself.

I appreciate your time and assistance.

Denise Dillon

Information About You: Demographics Form

(Please complete this form even if you did so for Part 1 of this study)

2. Please indicate whether you are a member of, or affiliated with, any of the following organizations (tick the boxes for whichever apply).

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____

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❑ Year 11 ❑ TAFE diploma ❑ Masters ❑ Other

❑ Year 12 ❑ Doctorate

Specific field of study:

____

STEP 1: In the envelope marked *Sorting Task* you have a collection of 81 cards, each printed with a single word or a phrase. I'm interested in how you see the words or phrases fitting together into categories on the basis of some aspect of meaning. You might not even be sure exactly how you have grouped them together, and that's okay. Sort the 81 cards into piles representing categories; you decide how many categories, but the following restrictions apply.

1) Each card can only be placed in one category (you can't choose to place one card into 2 different categories).
2) You must have <u>at least</u> 2 categories: A category cannot consist of all the cards in the set.
3) Categories should ideally be a collection of cards: don't make each card a separate category of one item.
4) All the cards must be placed into a category, so that none of the items is left out of the categorisation procedure.

Note: You don't need to take a lot of time over this task; go with your first impressions provided you're comfortable with the categories that emerge.
Suggestion: So that you can see all the cards in each category as you progress, keep the cards face up on the desk and, as you put each card in a category, place it next to (not on top of) the previous card in that category. You may change the assignment of any card to a category any number of times before your final decision. The numbers on the cards are for identification purposes only, so please don't use them in making your judgements.

STEP 2: <u>Do use the card numbers</u> to record your final categories on the recording sheet provided for the Sorting Task. Simply assign a category number to each of your categories and record the <u>category number</u> against the <u>card number</u> for each word or phrase on the sheet. For instance, your category number 1 might contain six cards (e.g. item numbers 5, 12, 13, 28, 32, 70). Use the recording sheet to write the <u>category number</u> 1 against <u>each of these item numbers</u>.

Suggestion: Once you've sorted your categories, organise each group of cards from the lowest to the highest number. This will help in the recording procedure. As you finish recording each group of category numbers, turn the group of cards over and write the category number on the back to keep track of them.

STEP 3: I'm also interested in whether you think each word or phrase should be used in association with VALUES. On the page following the recording sheets for the *Sorting Task* are instructions for a *Rating Task* together with recording sheets. Please follow the instructions carefully.

STEP 4: As a final action, send the *demographic form* and *all recording sheets* back to me in the envelope in which you received all the materials.

Excerpt from Sorting Task Recording Sheet

STEP 2	***Item Number***	***Category Number***
academic studies and research on the environment	1	
attitudes to nature	2	
behaving responsibly towards the environment	3	
behaviour that sustains industries	4	
biased towards humans and human well-being	5	

Excerpt from Rating Task Recording Sheet

STEP 3

Please use the scale of 1 through to 6 (where 1 = not at all and 6 = yes definitely) to indicate **whether you think each numbered word or phrase should be used in discussions of the *management*, *presentation* and *protection* of values in the Wet Tropics World Heritage Area**. Circle or strike through the relevant number from the range on each of the three scales for each numbered word or phrase.

1 = not at all 6 = yes definitely

Should the word/phrase be used in discussions of the…		*MANAGEMENT of values*	*PRESENTATION of values*	*PROTECTION of values*
1	academic studies and research on the environment	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
2	attitudes to nature	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
3	behaving responsibly towards the environment	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
4	behaviour that sustains industries	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
5	biased towards humans and human well-being	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6

Appendix 3c: Mean Rating Scores

#	Short name	Items	Management			Presentation			Protection		
			N	M	SD	N	M	SD	N	M	SD
1	academic	academic studies and research on the environment	68	5.0	1.1	68	4.6	1.4	68	5.1	1.1
2	attitude	attitudes to nature	67	4.7	1.5	67	4.9	1.2	67	5.3	0.9
3	behavres	behaving responsibly towards the environment	68	5.3	1.1	68	4.9	1.4	68	5.5	0.8
4	behavsus	behaviour that sustains industries	67	4.0	1.5	67	3.5	1.5	67	3.5	1.6
5	biashumn	biased towards humans and human well-being	66	2.9	1.5	65	3.3	1.5	65	3.0	1.7
6	catchphr	catch phrase, given lip service or ignored, don't know what it means	66	2.4	1.6	66	2.4	1.5	66	2.2	1.4
7	cleanair	clean air and water	68	5.3	1.3	68	5.4	1.0	68	5.5	1.1
8	comfamil	comfortably familiar, feeling of belonging	67	3.4	1.6	67	3.9	1.6	67	3.7	1.6
9	consider	considering other people's feelings and welfare	67	3.9	1.6	67	3.9	1.7	67	4.0	1.6
10	congreed	consumer greed in society	67	3.4	2.0	66	3.2	1.8	67	3.2	1.8
11	custodia	custodianship, guardians of the environment	67	4.7	1.3	67	4.8	1.3	67	4.3	1.6
12	destroy	destroying/exploiting the natural world	67	4.0	1.9	67	4.3	1.9	67	3.8	1.8
13	ecocompl	ecological complexity	67	4.7	1.4	67	5.0	1.2	67	4.3	1.5
14	ecowebs	ecological webs, interconnections	67	4.6	1.3	67	4.7	1.5	67	4.3	1.6
15	ecofunct	ecosystem, biosphere functioning	66	4.6	1.5	67	4.8	1.4	67	4.0	1.7
16	builtenv	emphasis on built environment and created objects	67	3.2	1.6	67	3.0	1.6	67	3.0	1.5
17	inspirat	engenders strong inspiration	67	3.5	1.5	67	3.9	1.6	67	3.9	1.7
18	enjoying	enjoying plants and animals	68	4.1	1.5	68	4.8	1.4	68	4.8	1.3
19	envirowe	environment is the ultimate source of wealth	67	3.9	1.8	67	3.7	1.9	67	3.6	1.8
20	enviroma	environmental management and planning	68	5.6	0.8	68	5.0	1.3	68	4.6	1.3
21	envirofr	environmentally friendly behaviours	68	4.9	1.3	67	5.4	1.0	67	4.8	1.3
22	expherit	experiencing one's heritage	68	3.9	1.5	68	4.5	1.5	68	4.4	1.4
23	families	families, friends, neighbours	68	3.3	1.6	68	3.6	1.7	68	3.6	1.6
24	connatur	feel connected to and love nature	68	3.8	1.7	68	4.2	1.6	68	4.3	1.4
25	flexissu	flexibility about environmental issues	68	4.0	1.6	67	3.9	1.6	67	3.6	1.5

26	groupres	group responsibility	68	4.9	1.4	68	5.0	1.4	68	4.6	1.4
27	health	health and well being	67	4.2	1.6	67	4.4	1.5	67	4.3	1.5
28	healthsy	healthy ecosystems, resilience of life forms	68	5.0	1.4	68	5.2	1.3	68	4.7	1.5
29	ignoranc	ignorance of and about the environment	67	3.8	1.9	67	3.9	2.0	67	3.6	1.8
30	impactre	impacts on range of recreational opportunities	66	3.8	1.4	66	3.8	1.5	66	3.5	1.4
31	indissue	indigenous and traditional issues	68	4.8	1.3	68	4.9	1.2	68	4.6	1.2
32	corpower	influenced by corporate power	67	3.5	1.8	67	3.2	1.9	67	3.1	1.8
33	medpower	influenced by media power	67	3.5	1.9	67	3.6	1.9	67	3.5	1.8
34	polpower	influenced by political power	67	3.9	1.8	67	3.6	1.9	67	3.4	1.8
35	justice	justice and the legal system	68	3.8	1.6	68	4.0	1.6	68	3.3	1.5
36	knowawar	knowledge and awareness of natural processes	67	4.7	1.4	66	5.1	1.2	67	4.5	1.3
37	legacy	legacy for future generations	68	5.1	1.3	68	5.4	1.1	68	5.0	1.2
38	livewell	live well with little money	68	3.2	1.7	68	3.2	1.7	68	3.0	1.6
39	maintbal	maintain natural balance	67	4.9	1.3	66	5.1	1.2	66	4.8	1.2
40	mainstab	maintaining stability of species and habitat	68	5.2	1.2	68	5.4	1.0	68	5.1	1.0
41	minimpac	minimising impact through minimising consumption and use	68	5.0	1.4	68	5.3	1.1	68	4.8	1.4
42	nohumact	not controlled by human action	67	3.3	1.7	67	3.2	1.6	67	2.9	1.5
43	pristine	not polluted/pristine	67	4.7	1.5	67	5.0	1.4	67	4.9	1.3
44	openmind	open-minded, non-judgemental	67	4.0	1.8	67	3.7	1.8	67	3.7	1.7
45	outcomes	outcomes and impacts	67	4.9	1.4	67	5.1	1.4	67	4.7	1.6
46	ownrship	ownership	67	4.0	1.8	66	3.8	1.7	67	3.6	1.6
47	paytouse	paying to use the natural environment	65	4.3	1.6	65	3.7	1.7	65	3.4	1.5
48	peaceple	peace, pleasure, appreciation, relaxing in nature	67	4.0	1.6	67	4.4	1.5	67	4.6	1.4
49	persresp	personal responsibility	67	4.7	1.5	67	5.2	1.3	67	4.8	1.4
50	persbelf	personal, spiritual and philosophical beliefs	66	3.5	1.7	66	3.8	1.6	67	3.7	1.5
51	presprot	preservation and protection of the natural environment	66	5.4	1.0	66	5.7	0.6	66	5.2	1.0
52	presinte	preservation of interface between people and the environment	65	4.8	1.4	65	4.9	1.3	65	4.5	1.4

53	preshist	preserving historic sites and architecture as a record of human evolution and culture	67	4.7	1.4	67	5.0	1.2	67	4.8	1.1
54	prothead	putting protection of the environment ahead of protecting visitors to it	68	4.6	1.6	68	5.0	1.4	68	4.5	1.5
55	quallife	quality of life	67	4.1	1.6	67	4.4	1.6	67	4.2	1.5
56	relevbus	relevant to business	66	3.7	1.7	66	3.0	1.7	66	3.1	1.6
57	relvnted	relevant to education	68	4.9	1.3	68	4.7	1.5	68	4.8	1.4
58	relvtemp	relevant to employment	67	4.0	1.6	66	3.3	1.7	67	3.4	1.6
59	resoecon	resource economics	66	3.8	1.6	66	3.5	1.6	66	3.5	1.4
60	resocult	resources are culturally defined	66	3.7	1.4	66	3.6	1.5	67	3.6	1.4
61	resplife	respect for all life	67	4.8	1.5	67	5.1	1.4	67	5.0	1.3
62	respothe	respect for other people's property and life	67	4.2	1.6	67	4.4	1.6	67	4.3	1.5
63	restrehb	restoration/rehabilitation	67	5.0	1.2	67	5.2	1.1	67	4.9	1.2
64	righexst	right of each species to exist	68	4.9	1.4	68	5.4	0.9	68	5.0	1.2
65	safety	safety	66	4.7	1.3	67	4.5	1.4	67	4.4	1.4
66	safetnet	safety net/refuge for people and animals	68	4.7	1.3	68	5.1	1.2	68	4.6	1.3
67	beauty	scenic amenity, beauty	67	4.1	1.5	67	4.5	1.5	67	4.9	1.2
68	numbspec	sheer number of species on Earth, diversity	67	4.6	1.5	67	5.1	1.2	67	4.8	1.2
69	evoltion	shows state of evolution	68	3.7	1.6	68	4.0	1.7	68	3.9	1.5
70	lifestyl	social, cultural and traditional lifestyle options	68	3.9	1.4	68	4.3	1.3	68	4.0	1.2
71	speakup	speaking up for the environment, conservation message	68	4.9	1.2	68	5.3	1.0	68	5.2	1.0
72	supenvir	support of environmental groups and initiatives	68	4.9	1.0	68	5.1	1.1	68	4.6	1.3
73	survival	sustains all life, survival	68	4.7	1.4	68	5.1	1.3	68	4.8	1.3
74	suprecre	system supports recreational activities	67	3.8	1.3	67	3.4	1.4	67	3.5	1.3
75	takgrant	taking environment for granted	68	3.8	1.9	68	4.1	1.9	68	3.8	1.8
76	tooload	too loaded, too interpretative, too difficult	66	2.2	1.6	66	2.3	1.6	66	2.2	1.5
77	tourism	tourism	68	4.1	1.5	68	4.1	1.5	68	4.1	1.3
78	uniquens	uniqueness	67	4.7	1.5	67	5.1	1.2	67	5.1	1.2
79	wildness	wilderness	67	4.5	1.5	67	4.9	1.4	67	4.7	1.5
80	wildlife	wildlife and natural features	68	4.9	1.2	68	5.1	1.2	67	5.1	1.1
81	worktogr	working together with common interests	67	5.1	1.1	67	5.0	1.3	67	4.8	1.3