Bi-relational design: A brief introduction and illustration

Raoul Adam

College of Arts, Society and Education
Division of Tropical Environments and Societies
James Cook University, Australia
Raoul.Adam@jcu.edu.au

Abstract

This paper introduces and illustrates Bi-relational Design (BD) as a general approach to (re)solving wicked problems. BD theorises oppositional, equipositional and para-positional approaches to problem-specific dyads (e.g., subjective/objective) based on a general consensus of research on epistemological development. These epistemic positions are used to inform a design process that includes six iterative and emergent phases: (1) identification, (2) organisation, (3) analysis, (4) evaluation, (5) synthesis and (6) experimentation. The paper illustrates these phases with the design of an interactive rubric to support pre-service teachers' academic literacy during the transition to university. The paper concludes with a consideration of the applications of bi-relational design for problem (re)solution and resource development in contested or complex spaces.

Keywords

epistemology, design theory, design model, Bi-relational Design (BD), academic literacy, higher education

This paper introduces and illustrates *Bi-relational Design* (BD) within the broader design thinking paradigm. It represents one contribution to the "conversation between researchers of design and representatives of other fields" (Stewart, 2011, p. 515) that furthers the conceptual development of design thinking. In broad terms, bi-relational design theorises and proceduralises the "search for the central paradox" (Dorst, 2011) and "reconciliation of opposites" (Hocks, 1976) towards the identification and (*re*)solution of wicked problems in context. It encourages a way of knowing (i.e. an *episteme*) that imagines broad possibilities on a spectrum between related polarities in order to identify and evaluate workable solutions to problems in context.

The second part of the paper illustrates the bi-relational design process in the context of pre-service teachers' academic literacy. The Interactive Rubric for Written Communication (IRWC)[1] presented in this section was created as an integrated online resource for first year pre-service teachers in a Bachelor of Education degree at a regional Australian university. More specifically, the rubric was informed by bi-relational design principles as a response to tensions in academic literacy (e.g.,

[1] <http://libguides.jcu.edu.au/irwc>

multiple/single [understanding of literacy], prescriptive/descriptive [presentation of conventions], concrete/abstract [literacy content], analytic/holistic [assessment of literacy]). The six phases of the bi-relational design process will be illustrated with specific examples from the IRWC.

Design Thinking

Innovation teams must be careful not to remain isolated in either the concrete or abstract realms, but must move fluidly between them in the iterative process of innovation.

(Beckman & Barry, 2007, p. 50).

Though *design thinking* is notoriously difficult to define, Brown (2008) offered one of the more cited definitions: "Design thinking can be described as a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity" (p. 2). More broadly defined, design thinking is an iterative approach to problem-framing and problem-solving that emphasises (a) the *wicked* or fluid and dynamic nature of problems, and (b) the centrality of consumer context, diversity and subjectivity in the (*re*)emergence of solutions.

The "wicked problem" was initially described by Rittel and Webber (1973) as a problem which has no definitive formulation, no immediate or ultimate test of solution, no clear contextual delineation, and is open only to (*re*)solving and (*re*)solution rather than final objective solutions. The concept has various synonyms including "ill-structured problems" (Mitroff et al., 2004), "messes" (Ackoff, 1993), and "social messes" (Horn, 2001). Arguably, the conceptualisation of *design thinking* itself represents a wicked problem framed by central paradoxes such as synthetic/analytical, subjective/objective, divergent/convergent, aesthetic/functional, inductive/deductive and user/producer.
The location of design thinking in relation to these polarities is an important epistemic task. Bi-relational Design (BD) is a deliberate attempt to sustain a dynamic equilibrium between polarities in an abstract sense, while allowing for relational and contextual choices and evaluations in a concrete sense.

Design thinking is sometimes contrasted with scientific thinking in that it emphasises emergent solutions, dynamic systems, subjective realities and divergent approaches, rather than fixed solutions in static systems with objective realities allowing convergent approaches. Beckman and Barry (2007) acknowledged the historical shift between the two epistemes by noting that "design then shifted from a clear-cut problem-solving process to a problem-formulating process" (p. 26). Stewart (2011) identified a "shift in focus" (p. 516) between functionality and experience, production and use. Adams, Daly, Mann and Dall'Alba (2011) noted the historical dominance of epistemology in the epistemology/ontology dyad, and mind in the mind/body dyad. Tonkinwise (2011) argued that design thinking has not yet moved far enough to accommodate the aesthetic dimension of design in the functional/aesthetic dyad. While these shifts of emphasis have been historically and relationally necessary to challenge the hegemony of the analytical approach, the bi-relational design approach introduced here assumes that the opposition is theoretically unnecessary. In theory, BD embraces the necessary tensions, paradoxes, dialectical and dialogical possibilities evident in dyads like analytic/synthetic, subjective/objective, convergent/divergent, quantitative/qualitative and reductive/holistic. In practice, BD allows for evaluative selection, (*re*)balancing, and even re-equilibrating opposition between polarities in context, though, with an awareness of the paradoxical *entanglement* of opposites and degrees of difference between poles.

Many recent models of design thinking tend to embrace, rather than choose between polarities. As such, there is an increasing amount of research beginning to explore the cognitive-epistemic nature of design thinking. Much of this research contains implicit recognition of design thinking as an epistemic development that moves beyond the dichotomous or "binary oppositional" relation of dyadic constituents. For example, Dorst (2011) defined design thinking as "a mix of different kinds of thinking" (p. 525) and identified a paradoxical relationship between induction/deduction. Brown (2008) identified "three spaces" including "Inspiration, Ideation, Implementation" (p. 4) and reflected on integrative thinking as valuing analytical processes but also "the ability to see all of the salient—and sometimes contradictory— aspects of a confounding problem and create novel solutions that go beyond and dramatically improve on existing alternatives" (p. 3). McDonnell (2011) implicitly subverted traditional binary oppositions such as freedom/control and creativity/order with phrases such as "enabling constraints" and "order that enables creativity" (p. 557). Similarly, Martin (2010) subverted the simple/complex opposition in his three-phase process: "As understanding moves from mystery to heuristic to algorithm, extraneous information is pared away; [and] the complexities of the world are mastered through simplification" (p. 39). Likewise, Adams, Daly, Mann and Dall'Alba (2011) conceptualised design thinking as "a mixture of creativity and analysis" (p. 588) and seek to "integrate" epistemology and ontology and "overcome the separation" of mind and body (p. 590). Beckman and Barry (2007) identified a four-phase cycle including Observations (contexts), Frameworks (insights), Imperatives (ideas) and Solutions (experiences), and drew on Kolb's (1984) theory of experiential learning to show how these phases cross-cut dichotomies between concrete/abstract and analysis/synthesis. Ritchey (1991) and Owen (1997, 1998) also moved beyond traditional oppositions between analytic and synthetic epistemologies in their approaches to science, systems thinking and design thinking. Finally, though not exhaustively, Martin (2010) expressed this implicitly paradoxical way of thinking: "Neither analysis nor intuition alone is enough. In the future, the most successful businesses will balance analytical mastery and intuitive originality in a dynamic interplay that I call 'design thinking'"(p. 38). The premise of this paper is that the existence of these implicitly paradoxical approaches warrants a more explicit expression of the bi-relational approach and its more integrated use in a design thinking process.

Bi-relational Design (BD)

So be sure when you step,
Step with great care and great tact
And remember that Life's a Great Balancing Act.
Just never forget to be dexterous and deft
And never mix up your right foot with your left.
(Dr Seuss, 1957/1990)

The distinctiveness of BD is that it acknowledges, (a) the centrality of dyadic constructs in the conceptualisation of wicked problems, and (b) the importance of epistemological development in the (*re*)solution of wicked problems. The particular process described here is theorised in relation to a general consensus of psychological research in personal epistemological development and a traditions of dialectical and dialogical thought in philosophy and literary theory.

Dyadic constructs

The dyad is one of the most paradoxically simple and complex cognitive-epistemic constructs. The simplicity of the dyad construct is that it offers structurally clear choices in relation to two (e.g., left/right). At first glance, the dyadic construct may be seen to exacerbate wicked problems due to oversimplification, an early tendency to binary opposition, and a later tendency to a fallacious principle of balance. Using Seuss's (1957/1990) analogy, oppositional relationships reflect a disposition to navigate complex terrain by walking left (or right); fallaciously balanced relationships reflect a disposition to jump straight ahead with two feet facing forward in equal measure, or with two feet bound together as one. However, these particular relationships do not exclusively represent the full range of epistemic relationships between dyadic constituents. Arguably, they can be accommodated by a relational and contextual approach to constituents that allows the most effective choices to be made from the most expansive set of possibilities. Thus, like the "dexterous and deft" walker, the epistemically sophisticated thinker and designer negotiates the complex terrain of a wicked problem with a contextually applied movement (i.e., left or right) selected from a full range of possible movement (i.e., left and/or right by degrees). The utility of the dyadic construct is also that there are many domain-general and domain-specific dyads operant in almost every wicked problem. The affinities and intersections of different dyads (e.g., subjective/objective; holistic/reductive; synthetic/analytic; multilateral/unilateral; liberal/conservative) afford opportunity for paradoxically complex and powerfully simple understandings of wicked problems. So, while the dyadic structure is simple, the content and relations are diverse; and once a dyadic relationship is understood as potentially relational and contextual, as well as oppositional, the designer has a conceptual tool that allows for a fuller spectrum of possibilities and degrees of difference from which to make concrete evaluative choices.

Bi-relational development

In bi-relational design, dyadic constructs are mutually definitive pairs that can be epistemically positioned in multiple ways (e.g., appositionally, oppositionally, equipositionally) and arranged developmentally (Figure 1 & Table A1 - Appendix). Epistemological development relates to changes in ways of knowing and beliefs about the nature of knowledge. In relation to dyadic constructs, ways of knowing that default to *either/or* dichotomies (i.e., oppositions) tend to precede ways of knowing that default to *both/and* multiplisms (i.e., equipositions), which in turn, tend to precede ways of knowing characterised by contextualised, relational and evaluative thinking that draws on *either/or* and *both/and* relationships (i.e., para-positions). In other words:

- *Oppositional epistemologies* emphasise the opposition and irreconcilability of a dyadic concept and the primacy of one or the other pole. For example, in the subject/object dyad applied to an artwork, either the artist or the viewer is seen as the "true" creator of meaning.
- *Equipoisitional epistemologies* emphasise the equidistant or synthetic position that arises from the balance between dyadic poles. For example, in the subject/object dyad applied to an artwork, meaning is seen as the product of a balanced synthesis between artist and viewer or an equidistant tension between artist and viewer.
- *Para-positional epistemologies* reconcile or maintain the paradoxical tension between dyadic relationships in the abstract and the selective application of particular relationships in concrete contexts. For example, the meaning of an artwork may be objectively obvious and/or subjectively contested, depending on its nature and audience.

Thus, in developmental terms, oppositional epistemologies represent an early disposition; equipositional epistemologies represent a middle disposition; and para-positional epistemologies represent a late disposition. These positions are represented using a see-saw metaphor in Figure 1 and described in detail in Table A1.

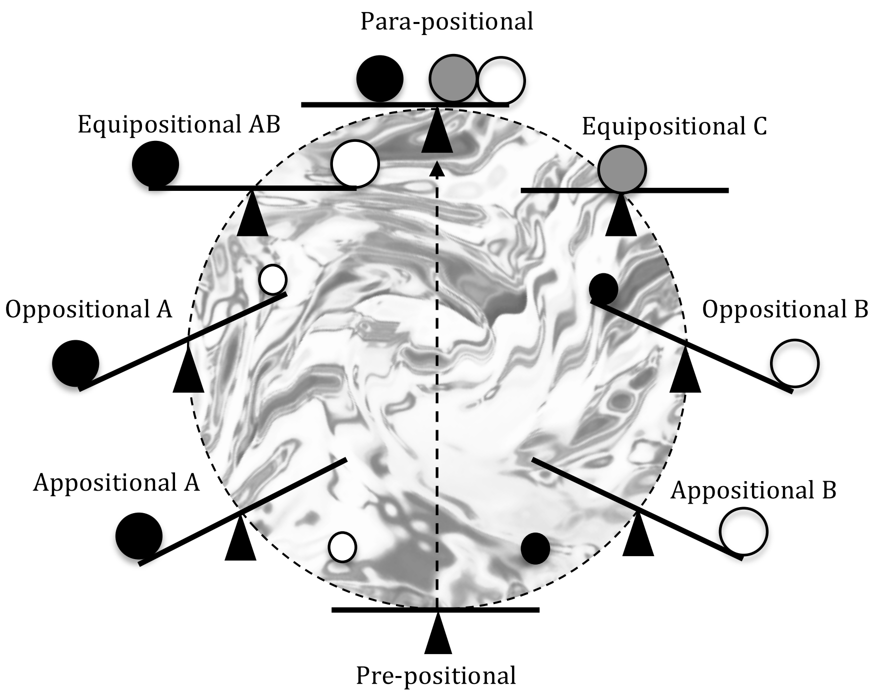

Figure 1. Bi-relational positions

The model presented in Figure 1 uses a see-saw metaphor to represent archetypal positions and developments in relation to dyadic constructs. Bi-relational design is based on para-positional ways of knowing and engaging wicked problems. The para-position is most encompassing of other positions while being attentive to contextual factors that require evaluation and adaptive selection between positions. This is represented by the representation of polarities (i.e. black and white) and syntheses (i.e. grey) in relation to a contextually shifting, rather than static, fulcrum. The model is linear in that epistemological development tends to proceed from pre-positional to para-positional ways of knowing, but cyclic in that para-positional ways of knowing are constantly (re)constructed in relation to other positions in fluid and dynamic contexts (i.e. swirls).

While several theories (i.e., Perry, 1970) of epistemological development imply a movement beyond a disposition to oppositional ways of knowing, few explicitly account for development in relation to domain-specific dyadic constructs and, to the best of the author's knowledge, none explicitly use bi-relational dynamics as the basis for a design process. Either implicit or explicit use of dyadic constructs in determining epistemic positions can be found in the work of Kelly (1955), Perry (1970), Reich (2002) and King and Kitchener (2002, 2004). Kelly (1955) theorised that people create bipolar dimensions of meaning, which they use to make sense of life experiences and anticipate the future. His "Repertory Grid" elicits bipolar constructs to map participant values and judgements in context. Perry's (1970) schema of epistemological development included duality or binary function codings of student narratives to indicate epistemological positions on a nine-point scale. This nine-point scale can be condensed into three overarching positions that serve to inform the bi-relational model presented here, including (1) dualism, (2) multiplism, and (3) commitment within relativism. Reich (2002) proposed a relational and contextual (RCR) approach to knowledge as a final development beyond dualistic either/or thinking. King and Kitchener (2002, 2004) proposed a model of *reflective judgement* using a developmental sequence from pre-reflective to quasi-reflective then reflective reasoning. Reflective reasoning is the ability to appreciate the uncertainties and contextualities of knowledge without being immobilised by doubt and relativity.

Collectively, these approaches support the general consensus of epistemological theories of development identified by Tabak and Weinstock (2008) as proceeding from:

1. "absolutist" – the conception of knowledge and knowing as objective and absolute; to,
2. "multiplist" – regarding all knowledge as subjective and relative and, therefore, indeterminate because of multiple points of view; to,
3. "evaluativist" – the acceptance and integration of subjective and objective aspects of knowledge that would permit a degree of evaluation and judgement of knowledge claims. (p. 178)

The more analytical treatments of epistemology development found in psychology are supported by the more synthetic treatments evident in philosophical and literary theory.

The representation and reconciliation of dyadic constituents is a prominent theme in philosophical and literary discourse. The "reconciliation of opposites" finds expression from Heraclitus to Hegel and Bakhtin. In *Studies of Polarity*, Hocks (1976) reflects, "the reconciliation of opposites is as fundamental to Eliot as it was to Heraclitus" and calls for more attendance to the unification of literary works that is hinted at through the presence "of lines that exhibit paradox and opposition" (p. 92). Likewise, Bakhtin's (1930s/1981) *Dialogic Imagination* described a perennial and relational tension and complementarity between poles that paradoxically sustains and (*re*)solves the form-content dichotomy through unification and separation. Perhaps the most explicit treatment of philosophical dyads is Hegel's (1817/1991) *dialectic,* which describes the iterative generation and synthesis of opposites. Hegel used the term "*Aufhebung*" to describe the paradoxical overcoming and maintenance of contradiction. My claim is that these brief examples illustrate a more generalisable epistemic development that deserves to more fully and explicitly inform design processes, especially in relation to wicked problems. Summarily, BD identifies implicit oppositions that underlie wicked problems and employs a process of transformative design to (*re*)conceptualise these oppositions in ways that better reflect the evaluative, para-positional, paradoxical, and relational-contextual understandings of mature epistemologies.

Principles and Process of Bi-relational Design

This brief section highlights some of the core principles and assumptions of bi-relational design in terms of the nature of knowledge in domains that inform design choices.

1. *Knowledge is commonly defined and evaluated using dyadic constructs and relationships.* For example, the subjective/objective dyad appears in vernacular discourse as "beauty is in the eye of beholder," "perception is reality" and "seeing is believing." Similarly, dyadic relationships are also expressed in common discourse as "seeing in black and white" and "seeing shades of grey."

2. *Domains of knowledge can be characterised by collections of specific dyadic constructs.* For example:
   - mythos/logos and faith/reason help to define the knowledge domain of religion;
   - mind/body and natural/synthetic help to define the knowledge domain of medicine;
   - punishment/rehabilitation and justice/mercy help to define the knowledge domain of law;
   - liberal/conservative and egalitarian/hierarchical help to define the knowledge domain of politics; and,
   - transmission/discovery and intrinsic/extrinsic [motivation] help to define the knowledge domain of education.

3. *Wicked problems arise from the meeting-in-context of dyadic constituents and relationships within a domain of knowledge.* For example, a teacher may choose to design a particular learning activity using a transmissive approach or a

discovery approach within a sequence of learning activities that uses both approaches. And, where two or more teachers are involved in curriculum design and delivery, one teacher may have an oppositional disposition towards transmissive approaches, where another has an equipositional disposition to combine transmissive and discovery approaches for all activities and ages.

4. *Design choices can be informed by dyadic constructs.* For example, a teacher may usefully conceptualise the design of a learning activity by looking at the relative strengths and weaknesses of transmission and discovery pedagogies, and possible relationships between them when applied in a particular learning context.

5. *Design choices can be informed by dyadic relationships.* For example, a teacher may have: (1) an *oppositional* disposition to see transmission as inferior to discovery pedagogies, (2) an *equipositional* disposition to combine the pedagogies or use them equally in all learning contexts, or (3) a *para-positional disposition* to choose between or emphasise pedagogies by degrees with sensitivity to learning context. Arguably, the para-positional disposition is most adaptive and responsive to context.

These principles inform the iterative process of bi-relational design. The bi-relational design process can be loosely conceptualised through six recurrent phases reflecting a linear-cyclic dynamic between user and producer, problem and solution, analysis and synthesis, and content and structure. The six phases are represented in Figure 2 and elaborated in the following sections.

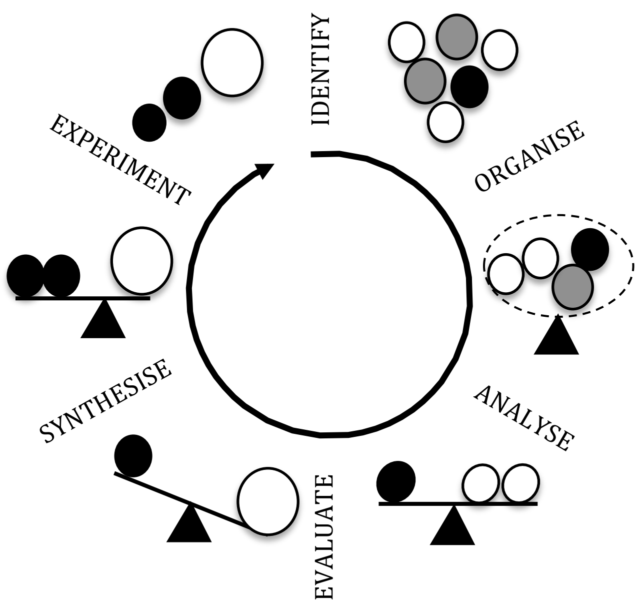

Figure 2. The six recurrent phases of the BD process

The six phases shown in Figure 2 represent a design cycle between the intuitive *identification* of a problem and *experimentation* with a (*re*)solution in context. Intermediate phases *organise* the problem artifacts[2] into useful categories or dimensions; *analyse* the dyadic constructs most relevant to these categories; *evaluate* or diagnose the problem in light of bi-relational dynamics; and *synthesise* a solution by altering the existing dyadic relationships through the addition, subtraction or rearrangement of artifacts. These six iterative phases of the bi-relational design are elaborated as follows:

Identify: This phase involves the initial attempt to identify and describe the problem. The phase is characterised by intuitive, tacit and inductive approaches that identify a general problem at a broad level. The problem is holistically inducted from a collection of *artifacts*. *Artifacts* include any knowledge, information, data, resources or experiences that contribute to the perception of a problem or solution. The guiding question of this phase is: *What is the general problem?*

Organise: This phase involves the first explicit attempt to organise the problem into manageable and functional categories or parts. It may involve the identification of sub-problems or parent-problems. The guiding question of this phase is: *What are the main parts to this problem?*

Analyse: This phase involves the first attempt to interpret the problem in terms of relevant dyadic constructs. The phase involves the identification of dyadic constructs that will help to capture the problem and provide parameters for later evaluation and synthesis. Dyadic constructs are inducted from the problem artifacts and also deducted from the most common dyads that tend to affect a range of problems (e.g., subjective/objective, united/diverse, holistic/reductive, fixed/fluid). The guiding question of this phase is: *What dyadic constructs are most useful in representing and understanding the problem?*

Evaluate: This phase involves representation and assessment of the actual problem in relation to the dyadic constructs. The phase helps to identify the epistemic dimension of the problem by representing the ways in which artifacts represent particular ways of knowing and knowledge positions (e.g., the artifacts represent relatively subjective ways of knowing and this is causing problems for students who are used to more objective methodologies). The guiding question of this phase is: *What epistemic positions and dynamics generate this particular problem?*

Synthesise: This phase involves the design and construction of new artifacts (e.g., products, systems, structures) that address the problems identified and evaluated in the previous phases. The guiding question of this phase is: *What new artifacts could (re)solve the problem or respond more effectively to the central paradox of the problem?*

[2] Artifacts* (i.e., dots) represent any knowledge, information, data and experiences that help to inform a problem.

Experiment: This phase involves the return of the newly synthesised artifacts to the concrete contexts from which the problem was first inducted. The newly designed artifacts may fit or fail the problem based on the fluidity of the context or the adequacy of the design. Given that the fit of a solution is usually temporary given the flux of context, the process of bi-relational design is iterative and cyclic. The guiding question of this phase is: *Has the new artifact addressed or alleviated the problem?*

Summarily, bi-relational design involves (a) the identification of key dyadic constructs and positions that define a problem (e.g., prescriptive/descriptive, concrete/abstract, general/specific, fixed/fluid, replication/innovation, analytic/holistic), and (b) the application of para-positional approaches to tensions between positions. A bi-relational approach maintains the abstract integrity and value of each dyadic constituent (e.g., analytic *and* holistic) while recognising the need for contextualised choices between dyadic constituents (e.g., analytic *or* holistic). The following section provides an illustrative example of the bi-relational design process applied in a higher education context.

The bi-relational design of an interactive rubric

An emerging body of literature explores the applications of design thinking to the learning experience in higher education (Anderson, 2012). Buchanan (1992) observed the movement of design thinking from its more traditional disciplines (engineering and architecture) almost two decades ago: "Designers, are exploring concrete integrations of knowledge that will combine theory with practice for new productive purposes, and this is the reason why we turn to design thinking for insight into the new liberal arts of technological culture" (p. 6). The drift of design thinking into the liberal arts was, in part, a response to the emergence of new communication technologies that challenged the '"bookish culture" of the past" (Buchanan, 1992, p. 9). Burdek and Willis (2011) posed an important question that is taken up by the following illustration of bi-relational design in practice: "If we are, indeed, at a critical juncture in education and scholarship due to the impact of digital technologies and social media, it is worth asking, what will be the role for design?" (p. 555).

One wicked problem engaged by many universities, and perhaps intensified at regional universities with broadening participation commitments, concerns students' experience of academic writing. Arguably, the difficulty that many students experience is exacerbated by the fact that they are often "digital natives" encountering academic writing through traditional pedagogies in the "bookish cultures of the past." The problem is further intensified in teacher education courses that are publically held accountable for school students' personal literacy proficiency. Stated as a question, the wicked problem is this: *How can one effectively support first year students' academic writing in a dynamic transitional space?*

The following example illustrates the use of BD to manage this wicked problem through the creation of a resource to support first year students' academic writing in a School of Education at a regional Australian university (Adam, Wilson & Walker, 2011). The illustrative example is structured using the six phases of BD.

Identify: The general problem was identified as a lack of transitional support for first year students' academic literacy. As with many socially complex problems, the problem was inducted from diverse sources in a shared context. Relevant artifacts (i.e., resources and experiences) were collected through the use of surveys and discussions with students, staff and professional stakeholders, and a review of relevant literature. Some lecturers and tutors raised concerns about the declining standards of students' writing, while others raised concerns about narrow constructions of *literacy* and its reduction to the mechanics of writing. Students expressed frustration over (1) the complexity of the conventions of academic writing, (2) the lack of explicit support for learning these conventions, (3) the overwhelming volume of information, (4) the confusing diversity and occasional inconsistency of information, and (5) the lack of explicit links between literacy information and assessment expectations.

Organise: The initially intuitive identification of the problem was gradually distilled through formal and informal discussions involving academic staff and students. Accordingly, the assemblage of artifacts around the problem was further organised into manageable core areas, including the:

- nature of literacy
- function of academic literacy
- scope of academic literacy
- nature of academic writing
- nature of academic writing conventions
- relationship between academic writing conventions
- relevance of academic writing
- level of information on academic literacy
- fluidity of information on academic literacy
- manageability of information on academic literacy
- interactivity with information on academic literacy
- sources of information on academic literacy
- relevance of information on academic literacy
- integration of information on academic literacy
- assessment of students' academic literacy
- organisation of information on academic literacy
- learning of academic literacy

These categories provided a focus for further analysis of the general problem and subsequent (and concurrent) design of a solution.

Analyse: This phase involved the identification of dyadic constructs that could be used to evaluate the sub-categories of the problem. Dyadic constructs were carefully worded to represent the most neutral polarities in the first instance. For example, *unity/diversity* is a more neutral wording than *conformity/diversity*, which places a relatively pejorative value on the left dyadic constituent, or *unity/chaos*, which arguably places a relatively pejorative connotation on the right dyadic constituent. Accordingly, the following dyadic constructs were applied to the categories of the problem:

- nature of literacy *(singular/multiple)*
- function of academic literacy *(analytic/synthetic)*

- scope of academic literacy *(expansive/contractive)*
- nature of academic writing *(objective/subjective)*
- nature of academic writing conventions *(relative/absolute)*
- relationship between academic writing conventions *(integrated/discrete)*
- relevance of academic writing *(theoretical/practical)*
- level of information on academic literacy *(general/specific)*
- fluidity of information on academic literacy *(stable/dynamic)*
- manageability of information on academic literacy *(simple/complex)*
- interactivity with information on academic literacy *(active/passive)*
- sources of information on academic literacy *(singular/multiple)*
- relevance of information on academic literacy *(concrete/abstract)*
- integration of information on academic literacy *(integrated/discreet)*
- assessment of students' academic literacy *(analytic/holistic)*
- organisation of information on academic literacy *(linear/cyclic)*
- learning of academic literacy *(social/personal)*

Evaluate: Having identified relevant dyadic constructs as an analytical framework, the task was then to represent the actual problem-in-context by arranging and evaluating relevant artifacts in terms of this framework. This process gives the problem a particular contextual character in relation to the dyadic framework. The recognition of this character within a broader framework creates a sort of *design space* for the generation of new possibilities, arrangements and solutions. While it is a particularly simplified representation of the process, the problem-in-context is qualitatively identified below, with the bolded term representing the dominant polarity in-context. For example, the dyad "*single/**multiple***" represents the problem-in-context that, while there was no lack of sources of information on academic literacy available to students, the lack of a unifying or coordinating source caused some confusion.

- nature of literacy *(**singular**/multiple)*
- function of academic literacy *(**analytic**/synthetic)*
- scope of academic literacy *(expansive/**contractive**)*
- nature of academic writing *(**objective**/subjective)*
- nature of academic writing conventions *(relative/**absolute**)*
- relationship between academic writing conventions *(integrated/**discrete**)*
- relevance of academic writing *(**theoretical**/practical)*
- level of information on academic literacy *(**general**/specific)*
- fluidity of information on academic literacy *(stable/**dynamic**)*
- manageability of information on academic literacy *(simple/**complex**)*
- interactivity with information on academic literacy *(active/**passive**)*
- sources of information on academic literacy *(single/**multiple**)*
- relevance of information on academic literacy *(concrete/**abstract**)*
- integration of information on academic literacy *(integrated/**discreet**)*
- assessment of students' academic literacy *(analytic/**holistic**)*
- organisation of information on academic literacy *(**linear**/cyclic)*
- learning of academic literacy *(social/**personal**)*

The dominance of one pole or neglect of another often reveals the source of a problem. However, BD does not intend to promote a "tyranny of balance," at least in-context. The premise of BD is not that effective choices are always reflected by middle positions, but that the most effective design choices are selected from the broadest range of relevant possibilities. In the context of the literacy challenges experienced by first year students in the study context, the dyadic evaluation served to identify some key design considerations for the provision of literacy support.

Synthesise: This phase was characterised by the creation of new artifacts (e.g., products, systems, structures) that addressed the problems identified and evaluated in the previous phases. The overall product of this phase was a website known as The Interactive Rubric for Written Communication (IRWC)[3] which was introduced earlier in this paper. The following sub-sections illustrate three design features of the IRWC that were synthesed in response to three dyads:

(1) **integrated**/**discrete** (relationship between conventions);
(2) **general**/specific (level of information); and,
(3) **stable**/dynamic (fluidity of information on academic literacy).

IRWC: Integrated/Discrete (relationship between conventions)

An initial design problem captured by the integrated/discrete dyad (i.e., relationship between conventions) was the dominant perception and practice of literacy as merely grammar (e.g., subject-verb disagreement) and mechanics (e.g., spelling and punctuation). For example, "poor literacy" was used in common staff discourse to mean inaccurate spelling, punctuation and grammar. Common rubrics tended to collapse and compartmentalise literacy into a single criterion as "professional literacies" including spelling, grammar, punctuation and APA referencing. Accordingly, students received the message that literacy was a discrete criterion with little connection to the criteria of *purpose*, *content* or *analysis.* However, the criterion itself was often poorly differentiated with little feedback or instruction on aspects of grammar and punctuation such as apostrophe usage and subject-verb agreement. Arguably, the "professional literacies" criterion was not conceptually integrated enough with other criteria to give students a sense of the "whole of literacy", and not differentiated enough within the criterion to give students feedback on specific errors in their writing.

The BD solution was to construct *academic literacy* broadly using general criteria and an integrating metaphor (Figure 3), while also maintaining discrete sub-criteria. For example, the general criteria for academic writing represented in the IRWC include *Purpose*, *Content*, *Analysis and Synthesis*, *Structure*, *Style*, *Syntax and Grammar* and *Mechanics*. These core criteria are divided into approximately 60 sub-criteria (e.g., *authority of sources*, *inclusive language*, *prepositions*).

The IRWC logo (Figure 3), a rainbow spiral, symbolises two important points about the criteria for written communication. Firstly, the entwined and graduated colours symbolise that the criteria for writing are interdependent. For example, the effective selection of content (Criterion 2) often depends on a clear understanding of purpose (Criterion 1), and effective analysis (Criterion 3) often depends on a good selection

[3] <http://libguides.jcu.edu.au/irwc>

of content (Criterion 2). Secondly, the ascending and expanding spiral symbolises an evolving and expanding capacity for literacy across increasingly diverse and changing contexts. An increasingly literate person develops their capacity to write and read effectively in a range of genres appropriate to different contexts. For example, an effective writer understands the conventions for writing an analytical essay or a personal reflection and the purposes and contexts that are most appropriate for these genres.

Figure 3. The IRWC Logo

Thus, the BD approach that informs the IRWC maintains the integrity of a whole approach to academic literacy *and* the analytic power of discrete sub-criteria. The design of the logo symbolises a para-positional approach to academic literacy that is constructed with an awareness of polarities (e.g., analytic/synthetic, concrete/dynamic, convergent/divergent).

IRWC: General/Specific (Level of Information)
A related design problem concerned the level of information (i.e., general/specific) on academic literacy available to students. Even the most detailed rubrics commonly used in the school were no more than two pages. For some students and staff this was too much detail, while for others it was not enough. For example, some rubrics differentiated "use of evidence" and "logic of argument" under a general analysis criterion, but could not give further explanations or examples of these terms in the space provided. Thus, the design problem involved a lack of depth, flow and direction between the general information in the rubric and specific information in resources that support academic literacy.

The BD solution was to create a manageable and accessible rubric as a gateway to deeper and broader information. Thus, each general criterion in the rubric was hyperlinked to a webpage with a generic structure, which was linked again to specific textbook pages and web-based information relevant to the criterion. Thus, by following just two links, a user could move from the rubric criterion "Academic Vocabulary," to a generic page with definitions, examples, and textbook page identifications; and then to external webpages with an academic phrase-bank and glossary of academic terms. The gateway approach to the level of information allowed for more differentiation of literacy criteria within the rubric. The hyperlinked criteria facilitate an easy flow of information from general criteria to specific examples. They are easily integrated into a range of subject-specific and task-specific rubrics and resources. The BD approach maintains the value of general and specific levels of information while facilitating access and flow along the spectrum between the polarities.

IRWC: Stable/Dynamic (Fluidity of information on academic literacy)
A third design problem related to the dynamic nature of knowledge on academic literacy. This dynamism bordered on chaos and fragmentation for a generation of first year pre-service teachers who are increasingly reliant on web-based information. The *relative* lack of coherent, consistent and centralised understandings and assessments of academic literacy creates confusion for students in a single course. They often feel as if the goalposts and even the game are shifted from task-to-task and subject-to-subject. The design challenge was to create a resource that was stable enough to be relevant and reliable for different tasks in different subjects, yet dynamic enough to evolve and adapt in subject contexts. Too much stability and the resource would soon be made redundant; too much dynamism and the resource would lack meaning.

The BD solution was to design the IRWC on a platform that could be assessed by staff and student users, adapted by staff users, and easily modified by authors. Accordingly, the IRWC was designed as a web-based Library Guide. This platform allowed stability of information through the use of a familiar navigation environment for users at the university; centralisation of knowledge for pre-service teachers engaging with academic literacy in multiple subjects and contexts; and control of information by academic staff. However, it also allowed for dynamic exchange and evolution of information through automated collection of metadata (e.g., number of hits per page or hyperlink); integration of an online "first impression" and "detailed feedback" form; and electronic ease of update based on critical feedback. The dynamism of the IRWC is also embedded into the implementation process, wherein staff can upload annotated samples of work as their assessment tasks change over time. Accordingly, the bi-relational approach facilitates design that can be simultaneously appreciative of the abstract values of integration and discretion, generality and specificity, and stability and dynamism, while making contextual design choices that may favour one or the other constituent of each dyad in the development of a particular design feature.

Experiment: This phase both concludes the cycle of design and creates a new cycle of design. It is essentially the pilot phase for a product or resource, the results of which will lead to the identification of new problems and subsequent iterations. The phase involves the distribution of the resource or product and the collection of user feedback. For example, in the first instance, the IRWC was embedded into a core first year subject by implementing the nine levels of integration recommended in the "for staff" section of the IRWC:

1. Mention the IRWC LibGuide in a lecture as a resource to support academic writing.
2. Provide the IRWC LibGuide URL in a Subject Outline or by group email.
3. Use a hyperlink to embed relevant IRWC criteria in an assessment Task Sheet.
4. Use relevant IRWC criteria as actual criteria in an assessment Criteria Sheet (i.e., rubric).
5. Provide assessment feedback using some specific IRWC criteria to help students access support for specific aspects of their writing.
6. Offer a short demonstration of the IRWC in a lecture or tutorial.
7. Use the IRWC to structure a short lecture or tutorial activity.
8. Use the IRWC to structure a writing workshop for a group of students needing support.
9. Use the IRWC to discuss a particular piece of writing with a small group or individual student.

As indicated in the previous section, the IRWC was designed with the user in mind, to collect user feedback and usage statistics to inform new iterations. Thus, the following feedback mechanisms were factored into the design and implementation of the IRWC:

- First Impressions online feedback survey
- Detailed Impressions online feedback survey
- Metadata collection of site activity
- Collection of solicited and unsolicited student and staff feedback.

The bi-relational design of the experimentation phase allows a two-way flow of information between user and producer. The flow of information from the user in the experimentation phase initiates a new design cycle as producers identify (i.e., Phase 1) and engage even more differentiated and refined problems. Thus, these mechanisms allow the producer/user dyad to be transformed into an iterative user-producer relationship at the core of design thinking.

Conclusion

Summarily, this primarily conceptual paper has introduced BD as one way to utilise relational polarities (i.e., dyads) to give manageable yet meaningful parameters to *relatively* fluid and illimitable problems. The specific process introduced here involved six recurrent phases, including (1) identification, (2) organisation, (3) analysis, (4) evaluation, (5) synthesis, and (6) experimentation. The process was theorised in light of a bi-relational representation of development (i.e., *oppositional*, *equipositional*, and *para-positional* ways of knowing) informed by theory in epistemological development, dialectical philosophy and dialogical literature. This BD process was then illustrated in the second part of the paper in relation to the design of an interactive rubric for academic literacy (i.e. the IRWC).

BD is by no means limited to material or digital problems and products. As a way of thinking grounded in a consensus of theories of epistemological development, it has broad applicability to wicked problems and conflicts that arise from, or are exacerbated by, solely dichotomising (i.e., either/or) ways of thinking. Such problems often arise at complex social, political and cultural interfaces. These problems can be as exacerbated by relativistic indifference as they are by universalistic interference; by disabling complexification as by reductive simplification; and by abstract detachment as by concrete disorientation. There is always a need for meaningful processes to conceptualise and manage, without unnecessarily oversimplifying, these problems. Design thinking provides an overarching framework for approaching wicked problems. As conceptualised here, bi-relational design provides a specific process and set of conceptual tools that operate within this framework to provide a small but arguably important perspective on wicked problems. Furthermore, the process and conceptual tools of BD give some functionality to an important, but largely under-operationalised body of theory and research in epistemological development that recognises profound differences between ways of knowing. Summarily, BD represents an accessible "way of knowing" and designing in complex or "wicked" spaces.

Finally, there is a meta-sense in which *design thinking* itself, presents a wicked problem that bi-relational design seeks to engage through its *para-positional* approach to knowledge and knowing: Does design thinking *necessarily* represent a divergent, holistic, synthetic, creative and qualitative approach to problem-solving? And, if so, can it be operationalised in context to provide meaningful and concrete (*re*)solutions? Buchanan's (1992) observation rings true: "design continues to expand in its meanings and connections, revealing unexpected dimensions in practice as well as understanding" (p. 5). As presented here, BD assumes a dynamic equilibrium between relational polarities separated only by degrees. Thus, it allows for relational and contextual meanings *and* authentic in-context choices. It moves beyond simple oppositions to convergent, analytical, reductive, reproductive and quantitative approaches to problem solving. Rather, BD acknowledges the relationality and complementarity of these dyadic constituents (e.g., divergent/convergent, analytic/synthetic, qualitative/quantitative) as necessary for the recognition and authentic engagement of wicked problems in real worlds *and* The Real World.

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Appendix : Table A1

General descriptions of bi-relational positions towards a para-positional (i.e., evaluativist or relational-contextual) way of knowing

Para-positional
This position is characterised by (a) the full realisation of the paradoxical and relational status of dyadic constructs and (b) a commitment to the (re)production and (re)solution of paradox in dynamic contexts. The position reflects a relative tendency to approach wicked problems using relational perspectives of A (i.e., knowledge as concrete, subjective, local, synthetic, holistic, dynamic) and B (i.e., knowledge as abstract, objective, universal, analytic, reductive, fixed) in a manner that recognises their entanglement and is dependent on context. Thus, the position is able to draw on previous positions (e.g., Oppositional A or B), though always with an understanding of the fluidity of context, and thus with an adaptive ability to change positions accordingly. The prefix *para* is chosen for its multiple meanings including beside (e.g., parallel), beyond (e.g., paranormal), union (e.g., parabiosis), and opposition (e.g., parachute). This position may also appear as post-epistemological and post-dyadic in that, while implicitly encompassing A (i.e., knowledge as concrete, subjective, local, synthetic, holistic, dynamic) and B (i.e., knowledge as abstract, objective, universal, analytic, reductive, fixed), the position can be characterised by seemingly effortless and unified epistemic flow between contexts.
Equipositional
This position reflects a relative tendency to approach wicked problems using relatively polarised epistemic perspectives of A (i.e., knowledge as concrete, subjective, local, synthetic, holistic, dynamic) *and* B (i.e., knowledge as abstract, objective, universal, analytic, reductive, fixed) in equal measure. (A equals B). Alternatively, it can reflect a relative tendency to approach wicked problems using an equalising "middle position" representing a balanced combination of epistemic perspectives A (i.e., knowledge as concrete, subjective, local, synthetic, holistic, dynamic) and B (i.e., knowledge as abstract, objective, universal, analytic, reductive, fixed). (A plus B equals C)

Oppositional A	**Oppositional B**
This dichotomising position reflects a relative tendency to approach wicked problems from the epistemic perspective of A (i.e., knowledge as concrete, subjective, local, synthetic, holistic, dynamic), with an opposition to B. (A as against B)	This dichotomising position reflects a relative tendency to approach wicked problems from the epistemic perspective of B (i.e., knowledge as abstract, objective, universal, analytic, reductive, fixed), with an opposition to A. (B as against A)
Appositional A	**Appositional B**
This position reflects a relative tendency to approach wicked problems from the epistemic perspective of A (i.e., knowledge as concrete, subjective, local, synthetic, holistic, dynamic), without a relational awareness of B. (A without knowledge of B)	This position reflects a relative tendency to approach wicked problems from the epistemic perspective of B (i.e., knowledge as abstract, objective, universal, analytic, reductive, fixed), without a relational awareness of A. (B without knowledge of A)
Pre-Positional	
The state before the manifestation and awareness of content and form that enable a position. This is not to say that the individual is a tabular rasa, as there may be genetic dispositions to particular ways of knowing and cultural dispositions to particular ways of knowing that will position an individual (either inclusively or exclusively) from a very early age.	