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# A Comment on ‘Dates and demography: Are Radiometric Dates a Robust Proxy for Long-Term Prehistoric Demographic Change?’

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## Abstract

Attenbrow and Hiscock (2015) raise a series of concerns about the use of radiocarbon dates as data (sum probability distributions), including sample selection, taphonomic bias, and the relationship of charcoal and radiocarbon data to human activity. We show that these concerns have been widely acknowledged and addressed in the literature. We advocate the considered use of dates as data approaches as a heuristic tool for broad regional and continental scale questions, used in conjunction with other archaeological proxies, and within the constraints of documented and well-known methodological limitations.

**Keywords:** Radiocarbon, Dates as data, sum probability, Australian prehistory, demography

Over the last decade the use of radiocarbon dates as a proxy for past human activity has been established as a mainstream technique in the archaeological literature (e.g. Shennan et al., 2013; Timpson et al., 2014). The approach has proliferated through increasing access to large datasets and statistical packages (e.g. Oxcal, Calib), and a desire by many researchers to develop continuous time-series analyses for wider archaeological and palaeoclimatic correlations. Within this emerging field, some of the earliest applications have been undertaken in Australia (e.g. Bird and Frankel, 1991; David and Lourandos, 1997; Holdaway and Porch, 1996; Ulm and Hall, 1996; Smith and Sharp, 1993; Williams, 2012, 2013). Attenbrow and Hiscock (2015) have critiqued aspects of the dates as data approach but have not contextualised their discussions in the recent literature, where these concerns have been rehearsed and largely resolved. Here, we review each of their key issues:

1. **sample selection** – that the diversity of sampling strategies used by individual researchers for radiocarbon dating their sites is likely to create artificial trends in these time-series data;
2. **preservation and recovery** – that taphonomic loss of charcoal and shell increases over time producing positive curvilinear time-series plots. While techniques have been undertaken to correct for this loss, a

further concern is that current correction procedures are based on untested decay curves for Australia; and

3. **charcoal abundance versus radiocarbon dates** – that there is no intrinsic correlation between charcoal abundance and occupation intensity within sites, and hence no relationship with demographic trends.

In relation to (1), clearly on a site-by-site basis, radiocarbon sample selection is a key consideration, as it is for all archaeological data, but the value of time-series analysis, and by far its widest application, is at regional and continental scales using datasets that contain hundreds or thousands of sites and associated data. We argue, and it has been demonstrated in Williams (2012), that larger datasets (>500 dates) offset individual site sampling bias, and the diversity of sampling strategies, resulting in a quasi-random sample of human activity for a given region. Timpson et al. (2014) demonstrate the same findings with as few as six dates. Williams et al. (2015) compared times-series data with over 90 archaeological sites across Australia, and showed close correlation between the archaeological records and radiocarbon data over the last 35,000 years, further suggesting that this issue is only pertinent for time-series curves using small datasets.

Time-decay of archaeological materials (2 above) has been widely discussed in archaeological circles (e.g. Surovell and Brantingham, 2007; Surovell et al., 2009; Williams 2012). On the one hand, it seems indisputable that organic materials decay over time. On the other, the application of this principle to time series radiocarbon data is debatable. Attenbrow and Hiscock (2015) confuse abundance of charcoal (which may disintegrate over time) with frequency of radiocarbon dates (which do not). Australian archaeologists, aided by AMS radiocarbon dating, have not had particular difficulty in obtaining dates from Pleistocene contexts within the last 35ka (albeit on small samples) implying that the date series is not directly biased by taphonomic decay of organics. In the AustArch dataset, for instance, 26% of dates (on a range of materials) are from Pleistocene contexts (Williams et al. 2014). The related issue of a correction factor has been explored in Williams (2013) and Williams et al. (2015). We agree with Attenbrow and Hiscock (2015) that there is no correction factor available specifically for Australia and the need for further work in this area. However, our publications (as well as others internationally) explore both corrected and uncorrected data with consistent trends frequently evident between the two, and indicating that the correction factor is broadly applicable to Australian contexts.

In contrast to Attenbrow and Hiscock (2015), we argue that a general relationship between human activity and abundance of charcoal can be demonstrated except where taphonomy is a major factor (3 above). Williams (2012) investigated the relationship between radiocarbon dates directly associated with human activities (e.g. hearths, burials, middens) and those from detrital charcoal, and demonstrated a correlation between the two different sets of data. This confirms other archaeological studies that show a general correlation between the abundance of charcoal and other types of occupation debris in archaeological sequences (e.g. McNiven et al., 2014; Williams et al., 2015).

In the series of papers reporting our work using sum probability approaches, we have fully reported the methods and assumptions underlying the analyses, published the datasets and carefully acknowledged and considered limitations. We have always been proponents of the use of the technique as heuristic devices prompting further investigation and used in conjunction with a multi-proxy approach. This type of approach

is not uncommon across the wider dates as data and time-series community. As with all archaeological techniques, the approach has methodological constraints and limitations, which researchers need to be aware of, but in contrast to many archaeological techniques, these are well-documented and discussed throughout the literature (e.g. Brown, 2015; Williams, 2012).

As Timpson et al. (in press) have pointed out in a recent response to Torfing et al. (in press) on similar issues, the views expressed by Attenbrow and Hiscock (2015) seem to suggest “that, unless we have complete knowledge of all the factors that might possibly affect the record available to us, which of course we never will, then we cannot say anything at all”. Conversely, we believe if carefully considered and accurately reported, the use of dates as data can be a powerful tool in the archaeologist’s arsenal.

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