Central Place Theory and the Reciprocity between Theory and Evidence
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Information about the prehistoric past is available only in the material remains. To be meaningful, these remains must be interpreted under the influence of a theory of some general or specific aspect of the past. For this reason, prehistoric archaeology clearly shows the reciprocity between theory and evidence and the tension between having to impose information on the evidence in order to discover information in the evidence. We use a specific case in the archaeology of Minoan Crete, a case that uses Central Place Theory as a guide to understanding the evidence, to demonstrate a coherence model of scientific knowledge.

1. Introduction. Much of what has been written under the heading of the philosophy of archaeology has been in the spirit of applying some aspect of philosophy to illuminate and perhaps influence archaeological methods. The so-called New Archaeology of the 1960’s and 70’s sought to fit the study of the material past into a mold taken without changes from empiricist philosophy of science. Subsequent contextualist archaeology adopted a philosophical hermeneutics as the model for reading the past. In contrast, the spirit of this paper is exactly the opposite. Our project is to use a methodological study of archaeology to illuminate and influence the philosophy of science.

We are, of course, not alone in working on a reciprocity between philosophy and archaeology. R. G Collingwood made it clear in his autobiography (1939, 30) that his own participation in archaeology influenced what he believed about general issues of epistemology and metaphysics. More recently, A. Wylie’s work is the best example of using each discipline to inform the other. She both explicitly describes the value of cooperation between philosophy and archaeology (Wylie 1985) and effectively uses a
methodological analysis of archaeology as a guide to philosophy of science (Wylie 1988). The archaeologist M. Schiffer is another advocate of dialogue between philosophy and archaeology (Schiffer 1981). And, in a fruitful collaboration between a philosopher and an archaeologist, J. Kelley and M. Hanen present a variety of archaeological case studies and philosophical theories of science in informative interaction (Kelley and Hanen 1988).

In our work, an important feature of the structure of archaeological knowledge will be revealed and analyzed through a case study. We will describe the use of Central Place Theory and, using the theory, attempt to reconstruct the relationship among the major prehistoric old palace period Minoan settlements, a reconstruction that is essential evidence for an argument about peer-polity interaction. By focusing on the status of evidence in this case we hope to highlight the role of “middle-range theories” (Binford 1977), showing that while theoretical support is a requirement for archaeological evidence, such support is most often implicit and beneath the surface of presentation. Articulating the middle-range theories and showing them to be of no special content, but only regular theories used in a special way, will lead to a decisive epistemological point. The analysis will show that no archaeological claims, neither evidence nor descriptions of the past, are basic in the sense of being self-evident or otherwise without the need of justification. All archaeological claims are in need of support from other claims. This analysis in turn must influence the central question in epistemology between foundationalist and coherence accounts of knowledge.

2. The Coherence Model of Justification. The general point that the material record of the past does not speak for itself has been made often (Binford 1977, Schiffer 1988, Shanks and Tilley 1987, Wylie 1993). Training and expertise are required to realize what the data, whether from individual artifacts, sites or regional surveys, indicate about the past. This requirement is enough to show that the data in the present cannot be useful as evidence of the past without the influence of some background knowledge, the currency of expertise. And since archaeological evidence is useful only if it is relevant to some objects or events in the past, the influential background knowledge must itself be, at least in part, of things in the past. Thus, there is an essential tension in archaeological evidence, a tension between having to impose information on the evidence, on the one hand, and using the evidence to provide information, on the other.

It is important to get beyond this general claim about the evidence to both broaden and deepen our understanding of the structure of the justification of archaeological knowledge. We need to ask about the kinds of claims that function as the background knowledge, whether they are dis-
tungished in terms of their content or their own epistemic status from other constituents of archaeological knowledge. In what follows, we will identify the background knowledge with middle-range theorizing, and argue that the middle-range theories are of no special content but can be any sort of claim that is used in the special role of giving meaning and credibility to the evidence. Furthermore, middle-range theories are themselves tested and justified like any other archaeological claims, since they are just any other archaeological claim.

The distinction between data and evidence is very much like the distinction made by Bogen and Woodward (1988) between data and phenomena. The data, what archaeologists refer to as the stuff “on the ground,” are the particular bits and assemblages of artifacts. But the conclusions that are the products of archaeology are claims about what happened in the past. Thus, the data in the present must be made informative of events and situations in the past. Unlike Bogen and Woodward, we see this link as being secured only with the help of background theoretical influence, with the middle-range theories.

By looking beyond the relation between evidence and its middle-range support, to the relation between the middle-range theory and its evidential support, we hope to show the larger picture of archaeological knowledge. The reciprocity of support between theory and evidence will demonstrate a network of claims without epistemic hierarchy or foundations of justification. The analysis of middle-range theories will be evidence that justification must be found in coherence among claims rather than in relying on any, or any type, as foundation.

Internal coherence as the criterion of credibility runs the risk of circularity. The relation between archaeological theory and evidence is a kind of hermeneutic circle in that specific, particular reports of observation are given meaning under the influence of more general understanding supplied by theories, while the theoretical claims are themselves influenced and given credibility by the specifics of evidence. The reciprocity, and the tension it creates between the need to impose information and the ambition to discover information, do not necessarily degrade the epistemic value of archaeological evidence or preclude the possibility of objectivity in archaeology. The circle is broken and the tension is eased as long as the theories used in support of some particular evidence are not tested and justified by that same evidence. A middle-range theory requires some evidential support, but not necessarily from the very evidence to which it gives meaning. Insisting on an independence between the theory used to support evidence and the theory that benefits from the evidence amounts to a kind of objectivity in the process of justifying archaeological knowledge.

Hodder (1991) makes a clear and sustained case for this hermeneutic
model of archaeological knowledge in his aptly named *Reading the Past*. There is also precedent for applying a hermeneutic structure to the natural sciences, as in *Reading the Book of Nature* (Kosso 1992). In both of these contexts, a Duhem-Quine type network of knowledge is extended to show some details of the dynamics in the relation between theory and observation.

Claims about the nature of middle-range theories, their fit into a coherent network of knowledge, and the escape from circularity, all depend on the details of the relation between data, evidence, and background knowledge. We will present the details through a consideration of prehistoric, Middle Minoan, Crete. In particular we will consider the old palace, or proto-palace period (roughly 1900–1650 BC). One of the vexatious problems in the study of old palace period Crete is, and has been, how the population centers interacted and influenced one another.

Real cases of archaeological knowledge, in their presentation of evidence and conclusions, do not usually show, at least not on the surface, the coherent structure that we claim is essential in the nature of justification. This is because the middle-range theories are not always, and indeed are not usually, explicit in the presentation of evidence. Nonetheless, they must always be available and amenable to articulation if the evidence and, hence, the conclusions it supports are to have any credibility. This is to say that while it may be too strict to insist that one must in fact give justification for all knowledge claims, it is a basic responsibility that the community must at least have justification available, even for evidential claims.

This conclusion is based on principles of what theories do and what is required to make observations relevant to theory. We need to see now that in fact, not only in principle, this is the case and that middle-range theories can be seen in action and can be articulated. We will do this for the case of Middle Minoan Crete. Middle-range theories, the case will show, are not special kinds of theories with a special kind of content. They are not necessarily of middle-generality or of middling confirmation (nor particularly solid confirmation). They are just regular theories that are, in the particular circumstances that we find them here, *used* in a particular way.

3. Minoan Settlement and Geography: the Hypothesis and Evidence. To highlight our philosophical points about the structure of justification it will be crucial to be clear about which claims are being tested in any particular case, and which claims are being used in support of the testing. In the case presented here, it is a model of peer polity interaction that is the hypothesis being tested. The Central Place Theory we then focus on is being used as a middle-range theory in the context of Middle Minoan Crete.
We will first articulate the hypothesis and the evidence for its testing. In this case, the hypothesis has both a general and a specific presentation. In general it deals with the formation of centers of political and economic authority, that is, the early stages of states, regions of domination and control. The proposed model of this process to be studied here claims that the formation of a centralized state does not generally begin with a single center of authority or a single unit of association. A large, centralized state is usually preceded by a mosaic of several small independent states. This model of peer polity is summarized by J. Cherry (1986, 19), “In many instances of state formation . . . the initial stages in the process do not involve the rise of a single, monolithic, socio-political unit in splendid isolation; on the contrary, the normal pattern suggested by the archaeological record is one that implies a group of relatively small-scale entities in synchronic and interdependent evolution.” Often these “early state modules” (Renfrew 1984, 95) are discussed even in cases with no textual or monumental evidence to show the boundaries which distinguish the modules.

The specific hypothesis to be studied here is an application of this general peer polity model to a study of proto-palatial Crete. Though there is evidence of writing in this culture, the Linear A inscriptions are for us almost entirely indecipherable and the Linear B inscriptions are not useful since they are from the later, Mycenaean period. This constrains the method of study in the sense that, “The Aegean civilizations, before the fourteenth century BC, are thus effectively fully prehistoric” (Cherry 1986, 24). At least by the Mycenaean period, and possibly earlier, the island of Crete was united under the authority of the palace of Knossos, but before that Crete may have been a patchwork of independent but interacting polities which, through their interactions, experienced parallels in development. This is the hypothesis, that interactions among the Minoan polities caused a common cultural development. Cherry’s particular focus is in using the material evidence to demonstrate the interaction and parallel development of the Cretan peer polities.

The evidence in this case is not in new things discovered after the proposal of the hypothesis, but in attention to newly relevant information in old evidence. Similarities, beyond what are to be expected from chance, at coincident times at different polities, are taken to be evidence of communication and influence between peer polities. Six independent polities are identified with the six major palace sites. These sites all have some evidence of early palace remains. Three of these (Knossos, Mallia and Phaistos) are fairly non-controversial palace sites. The remaining three (Khania, Zakros and Monastiraki) should be considered “possible” palace sites of the old palace period. These are the six largest island sites with at least some traditional palace features (see below) based on present ar-
chaeological knowledge (Figure 1). Similarities in the remains in these regions indicate their parallel development as the prelude to unification and dominance of Knossos.

There are some things that need to be clarified about this evidence, and some of the evidential claims need to be made explicit to reveal the structure of the testing. The nature of the similarities (what is similar and in what way) is important, as is the dating of the artifacts to establish coincident rather than sequential similarity. But most important for our analysis is the prerequisite demonstration of the identity of the polities as well as their independence. The archaeologist’s project is to show interaction among states, and this requires as preliminary information a picture of where the states are and that they are distinct. By analogy to chemistry, a microscopic image of interaction between molecules requires identifying individual molecules before we can see them interacting. It is the analogous process of imaging and identifying the individual states which will involve middle-range theories in a way that is informative about the nature of evidence in archeology.

First a note on the evidence of similarities among the artifacts: Claims of similarity in the artifacts are largely data claims in the sense of being about the immediately accessible information in the present material remains. The palaces themselves are part of this aspect of the evidence. Though they differ in their grand structural design, they share details of style to a degree that is greater than would be expected of chance coincidence or environmental influence. For example, the overall conceptions of the palaces, technical innovations and designs, as well as the functional arrangements of the palace including the directional orientation of the

![Figure 1. Crete and the Palaces.](image-url)

John Bennet very generously provided us with the computerized outline map of Crete.
courtyard are so alike as to suggest a shared influence. The central courtyards are rectangular with the long axis located north-south—the larger palaces\(^2\) are aligned within 15 degrees of one another (Cherry 1986, 27–28). The palaces include multistoried blocks of rooms situated around an open court. There is extensive use of large ashlar blocks, ‘lustral basins’ are a common feature, and there is substantial space for storage of agricultural products.

Further manifestation of a possible association between polities is their building of peak sanctuaries, “a new class of site” (Cherry 1986, 29) which appeared distinctively and roughly simultaneously or shortly before the palaces in the postulated independent regions. Peak sanctuaries are located on the tops of mountains with good visibility (sometimes in view of other peak sanctuaries) and have spectacular vistas (Figure 2). It is sometimes argued that these sanctuaries overlook politically associated territory (Peatfield 1983, 273–280).

Additional evidence of interaction between the palaces is in the stylistic similarities of the Linear A writing. The language itself is unreadable to us, but stylistic patterns at the palaces are identifiable and are clearly alike. And finally, pottery styles, for example designs on Kamares ware (a pottery with bright, colorful, and sometimes plastic, decoration, and named for the cave on Mount Ida where the first large quantities were found), are dated and classified to show a simultaneous development in several regions (Figure 3). The conclusion is that these styles “emerged with the palaces themselves in more than one polity” (Cherry 1986, 37, emphasis in original).

\(^2\)The palace at Zakros is the exception. It differs in other ways, as well, from the larger palaces (Halstead 1981).
The shared features and timing of development of these Minoan artifacts do not distinguish between the alternative explanations: an interaction among equals, on the one hand, or the domination by one of the polities, on the other. This stylistic analysis of the artifacts will be evidence for Cherry's hypothesis only if there is an independent way to suggest that the polities were distinct.

Identifying the polities, that is, producing an image of the specimen, will be informative of the function of middle-range theories in archaeology. This image cannot be generated on the basis of comparisons of the artifactual remains as this would be a confusion with the intermediate conclusions about the similarities between artifacts. The analysis by comparison of styles in the remains would be meaningless if any similarities were interpreted as showing influence between states while any dissimilarities were used to prove political autonomy. The testing needs an alternative and independent way of using the material remains to find information about distinct states and regions of authority. Only once autonomous polities are shown to exist does the evidence for interaction and parallel development become surprising and informative. The analysis of stylistic similarities becomes evidence of interaction between polities only if there is an independent way of showing the identity of the polities.

Creating an image of the individual polities is done in this case by using Central Place Theory. This model of the spatial characteristics of dominance and authority was developed independently of any particular concerns about peer-polity interaction on Crete. At the core of Central Place
CENTRAL PLACE THEORY

Theory is the premise that the size of a settlement is indicative of the extent of its authority or, as applied to economic studies, to the extent of its economic ties. Applying this idea to Minoan Crete and noting the relative sizes of the large palace or possible palace settlements indicates the extent of authority of each of these settlements and, most importantly, that no one of them dominates the others.

4. Central Place Theory: General Background. Central Place Theory warrants a closer and more detailed look as it is the key middle-range theory used to link the material remains (the spatial distribution and relative sizes of sites) to the relevant evidence (the political boundaries of regions of influence on Middle Minoan Crete). There are several variations on the main theme of Central Place Theory. The drawing of Thiessen polygons to represent the boundaries of regions of authority is considered the classic implementation, particularly in a study of economic zones. This model operates on the assumption that human interactions take place in ways that, in the long run, minimize the efforts and costs of those involved. This translates into a pattern of interactions with the nearest serviceable center. Boundaries of zones of association are then drawn (by archaeologists) simply by identifying the class of largest settlements and drawing the straight lines connecting nearest neighbors. The perpendicular bisectors of these lines are drawn and extended to intersect with each other. The area enclosed by this Thiessen polygon is the theorized region of authority of the large settlement at its center, the central place. This simple approach to reconstructing political boundaries on the information of size and location of settlements ignores all natural constraints to interaction and association, constraints such as mountains, rivers, or oceans.

A more sophisticated approach to representing boundaries of political or cultural influence is Renfrew’s XTENT model (Renfrew 1984, Chapter 3). This correlates the size of a settlement to the spatial extent of its influence, but it does not require the categorizing of settlements into distinct size-groups. Any sized settlement has an influence that is a function of its size and of the distance away from the settlement. Small settlements are dominated by larger ones if the influence of the larger is greater than that of the smaller when calculated right on the spot of the smaller. The influence $I_i$ of any settlement $i$ can be calculated in terms of a function $f(C_i)$ of the size $C_i$ of $i$ and the distance $d$ from the settlement to the point where the influence is felt. This is done with a field equation: $I_i = f(C_i) - kd$ where $k$ is a constant representing the decay rate of influence. The boundary of the polity of which $i$ is the central place is then the boundary of all points for which $I_i$ is the largest of all the influences.

There is flexibility in this model in specifying the function $f$ and the decay constant $k$. These are determined under the influence of the details...
of each case, details such as the regional facilities of communication and the local terrain. The advantage of the XTENT model is that it does not require an assumption that the largest settlements dominate the smaller. One simply enters the data on size and location of all settlements and issues of dominance, and hence an image of boundaries, fall out of the equations.

A third variation on the theme of Central Place Theory is the gravity model which, by analogy with the Newtonian description of gravitation, measures the interaction between two settlements. The intensity of interaction $I_{ij}$ between two places $i$ and $j$ is a function of the population $P_i$ and $P_j$ of each, the distance $D_{ij}$ between them, and a coupling constant $a$, representing the general strength of interaction: $I_{ij} = a[P_iP_j/D_{ij}^2]$ (Hodder 1978, 167). From this, one can generate political boundaries from the calculation of “breaking points” (ibid.), points between two sites where the intensity of interaction is balanced between the two. Unlike the XTENT model this has no way of demonstrating the dominance of larger settlements over smaller, but like XTENT it does allow that larger settlements exert influence over larger areas, larger in proportion to the size of the central settlement.

These three methods of inferring political boundaries from the sizes and locations of settlements have in common the core concepts of Central Place Theory. The population of a settlement is related to the extent of its political or economic control. Insofar as information on the population can be found in the physical size of the site that is preserved in the archaeological remains, the Central Place Theory links the information available in the accessible remains to information of interest about the past. In this sense, the Central Place Theory is ideally suited to be used as middle-range theory. But it is also an accomplishment in its own right, a generalization about social, economic, and political behavior. It works assumptions of the minimization of costs in interactions into a claim about the relation between dominance and space.

5. Testing Central Place Theory. Central place theory itself must be tested against evidence, and this requires an independent way of imaging the boundaries. Like any theory, whether or not it is used as a middle-range

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4Reading $P_iP_j$ for $P_i + P_j$, which appears (presumably mistakenly) in Hodder. This reading is consistent with the subsequent mathematics in Hodder and is the closer analogy to Newtonian gravitation.

5This correlation is by no means obvious. Physical size of a site, in terms of area of extent or number of rooms, is information of population only with middle range theories about the density of living, amount of agricultural land needed to sustain an individual, or the like. If the analysis is applied to a single region at a single time, though, all that is required is the modest assumption that correlation between population and site size is the same at all sites. Central Place Theory only requires information on relative populations of sites, not absolute population.

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theory, this theory needs justification which comes in part by comparison to evidence.

Renfrew both tests and fine-tunes his XTENT model by comparing its results to modern maps of places and boundaries. The function $f$ and constant $k$ must be set, and this is done on a trial-and-refine basis until the process generates maps that simply look right, that is, that include numbers and sizes of independent states that resemble historically and currently known maps. Actual data of settlement sizes and locations are put into the equation to generate predictions of boundaries. This hypothetical map is compared to the actual map and, for modern Europe, the match is quite impressive. The model differs significantly from the actual 1984 map by predicting autonomy for the regions of Azerbaijan and Armenia (Renfrew 1984, 70).

The basics of Central Place Theory are tested by G. Johnson, who uses them to generate hypotheses about the spatial distributions of artifacts and settlements in the Uruk Valley of Mesopotamia (Johnson 1972; 1975). In one case, trade interaction patterns are predicted using Central Place Theory together with the data of settlement sizes and locations. These predictions about Uruk trade patterns are compared against evidence of trade interaction as determined through analysis of pottery-style distributions (Johnson 1975), that is, evidence generated independently of the Central Place Theory it is testing. Again, the Central Place Theory predictions compare favorably.

A test of Central Place Theory that is closer to the case of Minoan Crete is that produced by the Cambridge/Bradford Boiotia survey (Bintliff 1984, Bintliff and Snodgrass 1985). Thiessen polygons were drawn around major settlements of Archaic-Classical Boiotia and these theory-generated boundaries were compared to “actual state boundaries derived from written sources” (Bintliff 1984, 219). The two maps, theoretical and historical, were shown in superposition and the match is impressive (ibid.). Two places, Thebes and Orchomenos, showed significantly larger historical extent than theoretically predicted, but their size matches the textual account of expansion of these two polities. Thus the Central Place Theory worked to image the pre-Classical early state modules, and the image was used with the Classical textual evidence to produce the first frame in a diachronic view of the changing state boundaries. We see the early stages of unification of Boiotia as “this early state mosaic is moving towards a much larger ethnic polity” (ibid.).

6. Using Central Place Theory as Middle-range Theory. In the case of Minoan Crete, the Central Place Theory is not so much tested as it is used to enhance the informational value of the evidence. Thiessen polygons are
drawn to determine the boundaries of the polities, as shown on the map (Figure 4).

There is no textual information to support this mapping. The confidence for this application of Central Place Theory must come from successful testing of the theory in other circumstances, as in Boiotia and the Uruk Valley, and from the independence between the middle-range theory and the hypothesis being tested by the evidence. A similar use of Central Place Theory on the mainland, Mycenaean Greece where there is some textual corroboration is the most relevant demonstration of the success of the theory since it applies to a time and place very close to Minoan Crete. The written evidence of political boundaries is scant even on the mainland and is nowhere explicit. Linear B tablets from Pylos, for example, do not describe boundaries but there are “sufficient topographic clues in the tablets to infer the size and extent of an evidently autonomous kingdom” (Cherry 1986, 24). There is also the Homeric “Catalogue of Ships” (Iliad, Book 2), which lists the polities sending ships on the expedition to Troy. These accounts of autonomous states in Mycenaean Greece sufficiently match the Thiessen polygon regions drawn in that area as to enhance the security in using the Central Place Theory as a tool for imaging polities.

Central Place Theory, then, is used as a middle-range theory for the Minoan Crete study. The very general theory is applied to make the data of settlement size and location relevant as evidence of autonomous polities. The evidence of independent polities is necessary to make the argument about the interactions between polities and it is evidence that cannot come through a written record. Central Place Theory gives license for the inference from settlement-size data to regional-distinction evidence. It re-

Figure 4. Polity Boundaries (six palaces) Generated by Central Place Theory.

*Cherry (1986) draws the boundaries around five, not six, palaces.*
veals what the size and location of the Minoan settlements mean, and in this sense it is exactly what Binford (1977) expects of a middle-range theory. There are certainly other middle-range theories at work in this case, but the goal has been to point out only this one, and the function of middle-range theories in general will not be any further illuminated by an exhaustive list.

This use highlights the intermediate role of evidence and the background knowledge required to give meaning and credibility to the evidence. The evidential claims are used to test and verify descriptions of the past, but they must also rely on descriptions of the past to enhance their informational value and plausibility to make them useful as evidence. The general epistemological point is that any claim that can justify (test and verify) what we claim to know about the past must itself be justified. Evidential claims are not foundational but are part of the network of our knowledge of the past.

This case is particularly informative of the nature of middle-range theories and their use in that it allows a clear assessment of the relation between the hypothesis and Central Place Theory in its role as middle-range theory. The hypothesis is of peer polities. It is about their interaction, in contrast to isolation or confrontation, and about their parallel cultural development. It is about the inter-polity relations which are the initial steps toward the unity of Crete. The central question is, given that there are polities, how do they interact? It is analogous to a biochemist at the stage of having a microscopic image of certain molecules and then asking how the molecules interact with each other.

In this case, Central Place Theory and the data of settlement remains are used to produce an image of the outlines of the polities. The theory and the settlement data support the basic existence claims about Minoan polities from which the analysis of interaction begins. The fine-structure of the specimen, details about interaction and cultural development, is evidenced in the styles and timing of particular artifacts such as pottery and palace architecture. Central Place Theory, the middle-range theory which accounts for the evidence of the extent of the polities, is independent of the hypothesis about cultural interactions. The credibility of the theoretical account of the location of borders and autonomy of states is not based on the hypothetical claim of interaction. The use of the middle-range theory is not self-serving in the sense of sponsoring evidence in its own behalf.

Again the analogy to microbiology is helpful. Imaging the molecules to study may require a process of dyeing, that is, fixing heavy atoms of a dye to some of the atoms of the specimen molecule. Seeing the microscope-produced image as the boundaries of a molecule requires a theoretical account of the composition of the molecule to associate the parts which
appear (the heavy atoms) with the entire object. Thus claims about the basic composition of the molecule enter the evidential picture as middle-range theories, but they retain a degree of independence from a hypothesis about molecule-to-molecule interactions. The point is that theoretical claims about the basic composition or extent of an object such as a molecule or a polity can be used in accounting for evidence used to test a hypothesis about the details of interactions of the object, and the evidence can still be independent of the hypothesis in a way that makes the test objective and meaningful.

Talking about observing through a microscope is reminiscent of Hacking's (1983) account of observation and intervention. Our description of evidence in archaeology is like Hacking's view of observation in general in its appeal to independence to break problematic circularities in the reciprocity between theory and evidence. But the account of evidence we are presenting, under the influence of the prehistoric archaeological case, has a significant difference from Hacking's. Hacking cites cases in which no theory plays an explicit role in noticing relevant features of evidence (for example, untrained technicians picking out specific events in particle detectors), and treats them as cases of observation that are not theory-laden in an important way. Our contention is that in the archaeological cases, even when no middle-range theories are apparent, they are always necessary for the epistemic enhancement from data to useful evidence.

The independence between the middle-range theory and the hypothesis is an indication of an objective test of the hypothesis, or better, of an objective use of evidence to support a theory. This is not to say that the evidence is objective because the middle-range theory is antecedently well-proven and secure in its link between data in the present and situations in the past. The prior testing of Central Place Theory is only part of the epistemic contribution of the middle-range theory. The claim of objectivity is not, in other words, that Central Place Theory brings its own epistemic security into the process to share with the evidential claims and, derivatively, with the hypothesis. Central Place Theory is not all that secure. The imprecision in the flexibility of parameters and the relatively low number of tests leave Central Place Theory far from being a certain generalization about social authority and space. The epistemic benefit from using Central Place Theory in this case is not so much its own status of confirmation but its independence. In this sense, epistemic justification is not a property of individual claims or theories; it is a relational property among claims.

Again it will be useful to locate this account of observation and evidence with respect to another general description of observation in science, this time Shapere's (1982). And again, there are similarities and differences. Shapere's articulation of the theories required to make meaningful observations of the interior of the sun is essentially a list of the middle-range
theories in this case. With the theoretical description of the formation of the data, the clicks of radioactive decay, the data become informative evidence of events in the interior of the sun. But Shapere never doubts the middle-range theories. The observation is credible because the theoretical support brings a solid epistemic authority. There is a clear epistemic hierarchy at work, and credibility of observation relies on antecedent credibility of the middle-range theories. This is where our model is different. Middle-range theories need not be, and as a matter of practice they rarely can be, very well proven or anywhere near beyond a doubt. Middle-range theories can be useful without being foundational.

7. Testing and Using Theories. The distinction between testing a theory and using a theory to enhance the meaning of evidence is clearly a contextual issue. A particular theory may in one context be regarded as a hypothesis under the authority of some evidence. This is the context of testing. In another situation, the same theory can be the authority of acceptability and meaning of evidence. Both of these roles of theory in archaeology represent a kind of informational link between theoretical claims and evidential claims, and so both represent a kind of fit into the network of knowledge. In either context, as beneficiary of evidence or as benefactor of evidence, a theory is shown to fit coherently into the system. Thus, both kinds of relation between theory and evidence can contribute to justification.

Successfully using a theory, that is, using it to give meaning to the evidence without explicitly questioning its credibility, is an aspect of justification. The use is successful insofar as it generates evidential claims that lead to a coherent description of some aspect of the past. Justification, in this coherence model, comes both from the evidence that supports a theory and the evidence that a theory supports.

This returns us to the concern about circularity in the relation of evidence and theory, since this is the biggest worry in a coherence model of justification. Renfrew (1986, 7) warns explicitly of “the risks of circular reasoning” in using the peer polity hypothesis, a warning that can apply generally to the use of middle-range theory. Circularity will result, he claims, if the peer polity model is used to explain an aspect of the archaeological record, and that same aspect is claimed as evidence in support of invoking the peer polity model. In fact, though, this is not circular. It is an argument in the form of inference to the best explanation, guided by the principle that a hypothesis that better explains the data is more likely to be true, and the hypothesis that is the best explanation is the most likely to be true. Explanatory success, on this principle, is at least some measure of justification. Thus, claiming that a middle-range theory explains an aspect of the archaeological record is redundant with saying that the as-
pect of the record is evidence for the theory. On this analysis, being explanatory is part of the accomplishment of fitting into the network of archaeological claims, and hence part of the accomplishment of justification.

The explanatory success in Cherry’s argument for peer polity interaction on Minoan Crete is his presentation of stylistic similarities in the material remains of independent polities. Central Place Theory helps give meaning to the evidence and in this way it fits into the consistent and sensible system of claims that results. The Central Place Theory image of independent polities pays off by facilitating a coherent account of Minoan Crete. For example, the diachronic description of several independent states preceding the single island state under the control of Knossos not only facilitates a plausible account of the stylistic similarities described by Cherry, it also explains why earlier Linear A writing is discovered at several sites but Linear B has been found only at Knossos. The many-polities model also fits the occurrences of peak sanctuaries into the picture by giving them a function of spreading each palace’s influence within its territories. Using Central Place Theory, in other words, helps to explain the peak sanctuaries, and this adds credibility to the theory and its use in this case. The credibility of Central Place Theory, and any middle-range theory, derives both from its being tested, as in the Uruk and Mycenaean cases, and in its being used, as in the Minoan case. Its justification, in other words, is a product of its fit into a coherent system of claims, a product of its relation to other claims.

Renfrew is right though to warn against the isolated relation in which middle-range theory explains data and data is evidence for middle-range theory. While not strictly circular, it is incomplete. It is only part of the accomplishment of justification, since it establishes only one link to the network. More adequate justification wants a broader coherence. The middle-range theory should be justified not only in terms of what it helps to explain but also as a result of information from other, independent theories and data. Justification results both from being tested and being used to test, from being proven and being useful in proofs. The case of Central Place Theory in Cherry’s argument for peer polity interaction on Minoan Crete gives a good view of this aspect of the structure of archaeological knowledge. It shows how the Central Place Theory fits into one part of the network of knowledge.

Thus the case study undermines the plausibility of a foundational model of knowledge, since any empirical test of a theory must appeal to evidence which depends on middle-range theories. Lacking the privileges of self-evidence or foundation, the epistemic value of evidence must be based on its independence from the hypothesis. Evidence, in other words, is not foundational in the sense of being the terminus of justification, the facts
to which all else must compare. Evidence plays a *pivotal* role in the process of testing in that it both supplies justification and it needs justification. Clarifying this role shows the web-like structure of our knowledge of the past. It is a network of claims that acquires credibility by internal coherence rather than by being built on epistemically privileged, foundational claims. The coherence is demonstrated in the Central Place Theory example in which theoretical claims (the Central Place Theory) are used as middle-range theory in the process of proving other theoretical claims (of interaction between Minoan polities). Coherence does not mean circularity, and using middle-range theories that are independent of the object theory blocks the circularity that would make the outcome of testing a foregone conclusion.

REFERENCES


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