Did *Homo erectus* Have Language? The Seafaring Inference

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Various authors have claimed over the years that Homo erectus *had language. Since there is no direct evidence about the matter, this claim represents the conclusion of a multi-step composite inference drawn from putative non-linguistic attributes of the species. Three maritime behaviours are central among these attributes: crossing open seas to get to insular islands such as Flores in the Indian ocean and Crete in the Mediterranean; building complex watercraft for the crossings; and undertaking navigation in making the crossings. Dubbing it the 'Seafaring Inference', the present article reconstructs and appraises the way in which Barham and Everett use the Seafaring Inference to build a case for the claim that* Homo erectus *had language. This composite inference starts from certain lithic objects found on Flores and ends, via six simple inferences, with the conclusion that* Homo erectus *had a form of language. The main finding of the article is that this composite inference is flawed in including a simple inference which is unsound and, accordingly, cannot be used to make a strong case for the claim that* Homo erectus *had language. There is a less well-developed variant of the Seafaring Inference which proceeds from the recovery of lithic objects on Crete. This variant is found to be multiply flawed, there being several simple unsound simple inferences among its components.*

1 Introduction

Homo erectus had language. This claim represents the conclusion of inferences drawn from non-linguistic attributes of these prehistoric humans, there being no direct evidence about what they might have had in the way of language. Central among the non-linguistic attributes are some behaviours in which *Homo erectus* allegedly engaged, including various maritime behaviours. These are crossing open seas to get to insular islands, building complex watercraft for the crossings and undertaking navigation in making the crossings. Thus, from the contention that *Homo erectus* engaged in these maritime behaviours to get to the Indonesian island of Flores in the Indian Ocean, it is inferred that *Homo erectus* had a particular form of human language. I will refer to this inference as the 'Seafaring Inference' and to the pertinent variant of it as the 'Flores Variant'. Being a composite inference, it is made up of six simple inferences linked in a chainlike way. Depicted in outline in Figure 1, these are the Stone-Tools Inference ABC, the Dating Inference CDE, the *Homo erectus* Inference EFG, the Crossing-Open-Seas Inference GHI, the Watercraft Inference IJK and the Language Inference KLM.

In Figure 1 and similar ones following it, boxes contain claims or conclusions and arrows represent inferential steps that link the content of the boxes. In Sections 2–7 below, I unpack my reconstruction of the six simple inferences making up the Seafaring Inference, and I appraise their soundness in the light of doubts that have been raised about some of the inferences in the literature. Whereas a number of these simple inferences are found to be sound, a core one is unsound: the Watercraft Inference with the conclusion that *Homo erectus* built complex watercraft and undertook navigation

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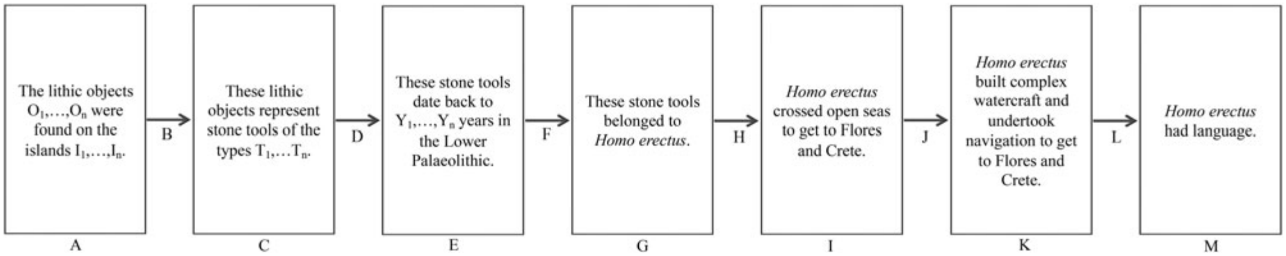

Figure 1. *The seafaring inference.*

to get to Flores and Crete. However, in including only this unsound simple inference, the Flores Variant compares favourably to the Crete Variant, which is a less fully developed variant of the Seafaring Inference. More specifically, all the reconstructible simple inferences making up the Crete Variant are found to be of dubious soundness, except for one: the Stone Tools Inference with the conclusion that stone tools of certain types were found on Crete. In Section 8, I accordingly conclude that in including one or more unsound simple inferences, the Flores Variant and the Crete Variant undermine the soundness of the Seafaring Inference as a whole: and that this composite inference cannot be used to build a strong case for the claim that *Homo erectus* had language, an exercise engaged in recently by Barham and Everett (2021).[1]

For the purpose of reconstructing and appraising the simple inferences at issue, I use the conceptual framework of the Windows Approach to the evolution of language, including the linguistic abilities of prehistoric humans. Using this approach is appropriate since it provides the conceptual constructs that make it possible to do two things in essence: (i) to draw inferences about prehistoric linguistic phenomena about which there is no direct evidence, and (ii) to appraise the soundness of such inferences. Particulars of the Windows Approach have been set out, illustrated and employed in a range of publications, including Botha (2001; 2006; 2009a, b; 2010; 2012; 2016; 2020; in press). As for the basis of the Windows Approach, Botha (2016, 26; 2020, 27) explains that the concepts, distinctions, conditions and other constructs making it up do not embody prescriptions imposed from outside on work on language evolution and related other prehistorical phenomena. These conceptual foundations, rather, are inherent to good empirical work that has been done on such phenomena, submerged under its surface, as it were. In accounts of the Windows Approach such as those listed above, these foundations are merely explicitly articulated.[2] The Windows Approach, accordingly, represents a non-prescriptive, immanent approach to the study of the prehistorical phenomena concerned.

Central to the Windows Approach are the conditions that simple inferences about language evolution and related prehistorical phenomena should meet. An inference is considered simple in the sense of having at a surface level just three basic components: (a) one or more **claims** about some phenomenon SP; (b) a **conclusion** about a distinct, other phenomenon OP; and (c) an **inferential step** by which the conclusion about phenomenon OP is drawn from the claims about phenomenon SP. The claims about phenomenon SP can include (i) statements presenting observational or experimental data about SP; (ii) hypotheses, assumptions, or beliefs about SP; and (iii) conclusions drawn in prior inferences about SP. The surface structure of a simple inference is schematically represented in Figure 2.

Phenomenon SP may, for instance, be an artefact such as a stone tool associated with a species of early humans, whereas phenomenon OP may be an activity or behaviour attributed to them. Or, to give another example, phenomenon SP may be an activity or a behaviour allegedly associated with these humans, while phenomenon OP may be a cognitive ability attributed to them. In simple inferences with the structure depicted in Figure 2, phenomenon SP and phenomenon OP differ ontologically in kind. Phenomenon SP is said to provide a 'window' on or into phenomenon OP, if it is possible to infer from phenomenon SP, or a property of it, something about phenomenon OP, or a property of it. For instance, lithic artefacts of early humans have been viewed as a window on their behaviours. And their behaviours have been considered a window on their cognitive abilities. Inferences of this type have, accordingly, been dubbed 'window inferences'.

Simple inferences in which a conclusion is drawn from some phenomenon about another phenomenon of a distinct kind are, by their very nature, not evidently sound. Such inferences, accordingly,

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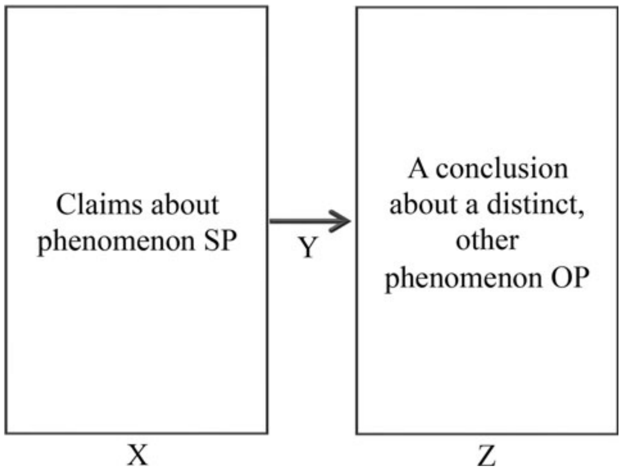

Figure 2. *Surface structure of a simple inference.*

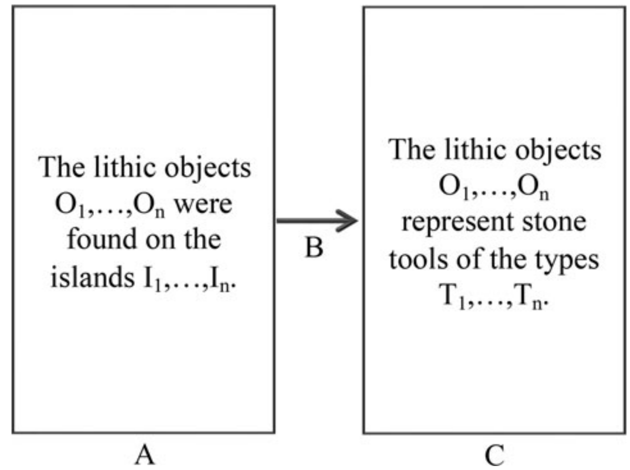

Figure 3. *The stone-tools inference.*

are subject to appropriate soundness conditions. To satisfy such conditions, simple inferences require a second, deeper layer of structure. The function of the components of this deeper layer is to underpin or back the claims, conclusions and inferential steps of the surface layer. In Section 2 below, I set out three soundness conditions that apply to the simple inferences making up the Seafaring Inference.

2 The Stone-Tools Inference

The Stone-Tools Inference is the first in the chain of simple inferences making up the Seafaring Inference. This simple inference includes an inferential step that starts from data about lithic objects that were found on certain islands. And it ends with the conclusion that these objects represent stone tools. The outlines of this inference may be represented in outline as in Figure 3.

In box A, $O_1,\ldots,O_n$ represent lithic objects, also referred to as 'raw materials' and 'pieces of stone'. The islands $I_1,\ldots,I_n$, on which these objects were found include the Indonesian island of Flores in the Indian Ocean as well as Crete and some other islands in the Mediterranean. The archaeological sites on Flores where these lithic finds were made include those at Wolo Sege, Mata Menge and Boa Lesa in the So'a Basin (Brumm *et al.* 2010, 748–9; Morwood *et al.* 1998, 174). From the perspective of the Seafaring Inference, Crete is the most important Mediterranean island, numerous lithic objects having been recovered at various Preveli sites in the Plakias region of southern Crete (Runnels *et al.* 2014, 129; Strasser *et al.* 2010, 145ff).

Lithic finds made on Cyprus and smaller Greek islands such as Kephalonia and Naxos have featured less prominently in the framework of this inference (Runnels 2014a, 214ff; Strasser *et al.* 2016).

The first soundness condition to be met by the Stone-Tools Inference reads as follows:

(1) The Groundedness Condition

An inferential step forming part of a window inference needs to be firmly grounded.[3]

The grounds furnished in the first component of a composite inference such as the Seafaring Inference comprise empirical data about recovered lithic objects. In the case of window inferences further down the inferential chain, the grounds generally represent conclusions of prior inferences. In the case of both the Flores Variant and the Crete Variant of the Stone-Tools Inference, the claims about the lithic objects are well grounded, being underpinned by precise descriptions giving particulars of what was recovered, as well as specifics of where, when and how the finds were made. For instance, in the case of the Mata Menge site on Flores, the lithic objects concerned are described by Morwood *et al.* (1998, 174) as 'angular volcanic rock fragments', 'pieces of volcanic chert' and so on. In the case of Crete, the 'principal raw materials' recovered in the Plakias region are described by Strasser *et al.* (2010, 161) as (pieces of) 'milky quartz and, to a lesser extent, quartzite'. The factualness of these accounts has not been in dispute, which indicates that both variants of the Stone-Tools Inference meet the Groundedness Condition.

The claim in box C in Figure 3 is not an observational statement. It is a conclusion drawn by means of the inferential step represented by arrow B: from properties of the lithic objects $O_1,\ldots,O_n$, it is inferred that these objects represent artefacts, more

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specifically stone tools of the types $T_1,\ldots,T_n$. According to Brumm *et al.* (2010, 749), the stone artefacts recovered at Wolo Sege are predominantly small undifferentiated flakes struck from cobbles by direct hard-hammer percussion. In addition, these authors note, the Wolo Sege artefacts include a bifacially and centripetally worked radial core. As for the artefacts recovered at Mata Menge, 294 of the 507 examined by Brumm *et al.* (2006, 627) are taken to be flakes, 46 retouched flakes and 46 radial cores.[4] The artefacts recovered on Crete, in turn, include quartz hand axes, trihedral picks and cleavers (Strasser *et al.* 2010, 179–84). In the Plakias area of Crete, '[m]ore than 200 lithic artifacts of the Acheulean industrial tradition, including LTCs [i.e. large cutting tools—R.B.] and flake tools such as sidescrapers and denticulates [i.e. tools with edges worked into adjacent notches—R.B.] were collected' (Runnels (2014a, 218).[5]

Which brings us to the inferential step that forms part of both the Flores and the Crete Variant of the Stone-Tools Inference. Represented by arrow B in Figure 3, this step cannot be a bald stipulation asserting the following:

(2) The lithic objects $O_1,\ldots,O_n$ represent stone tools of the types $T_1,\ldots,T_n$.

Like other inferential steps that are constituents of window inferences, inferential step B needs a warrant that authorizes it, as stated in the following, second, soundness condition:

(3) The Warrantedness Condition

An inferential step that ends with a conclusion about a phenomenon that is ontologically distinct from the one from which the step starts needs an appropriate warrant.[6]

How, then, does this condition apply to inferential step B in Figure 3? Lithic objects, being natural objects, and stone tools, being artefacts, belong to different ontological domains. This **fact** implies that a bridge is needed for moving inferentially from claims about lithic objects to conclusions about stone tools. The required bridge has two layers. The first is a warrant that authorizes or licenses inferential step B. A warrant of the kind at issue is a conditional statement, saying the following in the case of the Stone-Tools Inference:

(4) If lithic objects have the characteristics $C_1,\ldots,C_n$, then they represent stone tools of the types $T_1,\ldots,T_n$.

Since (4) is a warrant of an inference drawn in empirical work, it needs to be backed by a well-supported theory or account of the ways in which properties of lithic objects are interrelated with properties of stone tools. This theory forms the second layer of the required inferential bridge, and it is accordingly called a 'bridge theory'.[7]

In the case of the Flores Variant of the Stone-Tools Inference, the bridging is strikingly instantiated by Morwood *et al.*'s (1997, 29ff) discussion of whether 45 stone pieces recovered in a 1994 excavation at Mata Menge can be assigned the status of stone tools. These authors do not simply stipulate that the stone pieces concerned are artefacts. They (1997, 29ff) rather 'assess' the pieces, using the following 'criteria' for stone tools:

(5) (a) Could the stone pieces have been shaped and deposited naturally?
(b) Did the pieces exhibit striking platforms with ring cracks, bulbs of percussion, negative flake scars or regular edge-damage indicative of retouch?
(c) Under high power magnification, did the pieces identified as artefacts have evidence for use-wear residues?

Having applied these criteria to the lithic objects concerned, Morwood *et al.* (1997, 29) conclude that 'some of the stone pieces recovered at Mata Menge are not artefacts and have been deposited by natural processes'. The authors, however, draw the further conclusion that '14 of the recovered stone pieces have characteristics which suggest that they are artefacts ... and some of them are difficult to explain otherwise'. In addition, Morwood *et al.* (1997, 29) find that 'several other pieces of volcanic material with sections of water-rolled cortex have well-defined flake scars, ring cracks, bulbs of percussion and/or systematic edge damage suggestive of retouch'. According to them, the most notable and largest of these pieces has properties that make it a chopper. In a later account, Morwood *et al.* (1998, 174) reiterate these conclusions, stating that the Mata Menge deposits 'contain pieces of volcanic rock and chert identified as artefacts on the basis of well-defined flake scars, ring cracks, bulbs of percussion and systematic edge damage suggestive of retouch'.

The warrant used by Morwood *et al.* (1997) has the general format of (4). That is, the properties involved in Morwood *et al.*'s criteria (5)(a)–(c) instantiate the characteristics represented by $C_1,\ldots,C_n$ in the *if* clause of (4). For example, the property of not having been shaped and deposited naturally mentioned in criterion (5)(a) may be taken as instantiating the characteristic represented by C_1 in the *if* clause of (4). Likewise, the stone tools identified by Morwood *et al.* instantiate the types of stone tools represented by $T_1,\ldots,T_n$ in the *then* clause of (4). For instance, flakes struck from cobbles by direct hard-hammer percussion may be taken as instantiating the type of stone tools represented by T_n.

The warrant used by Morwood *et al.* (1997) in the Flores Variant of The Stone-Tools Inference has not been challenged in the literature. This point indicates that the inferential step—B in Figure 3—from lithic objects to stone tools has not been considered dubious. Nor has the analogous inferential step taken by Strasser *et al.* (2010), Runnels *et al.* (2014) and other authors in the case of the Crete Variant been questioned. This point means that both the Flores Variant and the Crete Variant of the Stone-Tools Inference meet the Warrantedness Condition.

Both variants of the Stone-Tools Inference need also to meet a third condition on the soundness of simple inferences, the one stated as (6):

(6) The Pertinence Condition

The conclusion of a simple inference needs to be properly pertinent.[8]

To be properly pertinent, the entity or entities central to the conclusion of a simple inference must be accurately identified and correctly characterized. Unless this is the case, it is not clear what the conclusion in question is about, or whether there is something in the real world that corresponds to this entity or these entities. In the case of the conclusion of the Stone-Tools Inference, these entities are stone tools. As is clear from the criteria listed in (5) above, stone tools do represent entities that are accurately identified and characterized in archaeological accounts. Both the Flores Variant and the Crete Variant of the Stone-Tools Inference, accordingly, meet the third soundness condition too.

3 The Dating Inference

The Stone-Tools Inference is followed by the Dating Inference in the chain of simple inferences making up the Seafaring Inference. The Dating Inference is reconstructed in outline in Figure 4.

In the case of the stone tools recovered at sites on Flores, the dates represented by $Y_1,\ldots,Y_n$ in box E in Figure 4 include the following:

- Wolo Sege: '1.02 ± 0.02 million years ago' (Brumm *et al.* 2010, 748)
- Mata Menge: 'between 0.88 ± 0.7 and 0.80 ± 0.07 million years ago' (Brumm *et al.* 2010, 748; Morwood *et al.* 1998, 174)
- Liang Bua: 'between 95–74 and 12 kyr' (Brumm *et al.* 2006, 624)

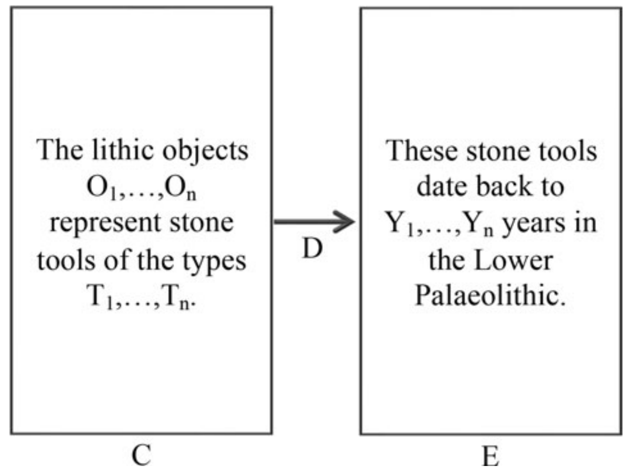

Figure 4. *The dating inference.*

The dates assigned to the Flores stone tools have been widely accepted as accurate. Leppard (2015b, 840), for instance, remarks that '[t]he earliest material from Flores … has good Lower Palaeolithic credentials, dated to 1.02 million years ago (Brumm *et al.* 2010)'. Bednarik (2014, 210) observes in similar vein that '[t]he early stone tools of Flores have been shown to be up to 840 ka old by a variety of dating methods'.

Such favourable judgements of the accuracy of the dating of the Flores artefacts indicate that inferential step D in Figure 4 of the Flores Variant of the Dating Inference is considered well warranted. The warrant concerned is backed by a generally accepted theory of the methods by which lithic artefacts should be dated. The following assumption lies at the core of this theory:

(7) Lithic artefacts should be directly dated by radiometric methods in the stratigraphic contexts where they are found.

In sum, the dates assigned to the Flores artefacts are considered accurate in virtue of being established by means of the so-called direct methods mentioned in (7). Being appropriately bridged, the Flores Variant of the Dating inference can be considered sound.

The stone tools recovered at sites on Crete have been assigned dates such as the following:

- Preveli 3, Preveli 7, Timeos, Stravos 1 and Schinaria 5: 'ca. 190,000–130,000 B.P.' or 'ca. 130,000 B.P. or earlier' (Strasser *et al.* 2010, 186)
- Preveli 7: 'a minimum age of ca. 114 kyr' (Runnels 2014a: 218)
- The sites listed above: '~170 years ago' (Simmons 2012, 896)

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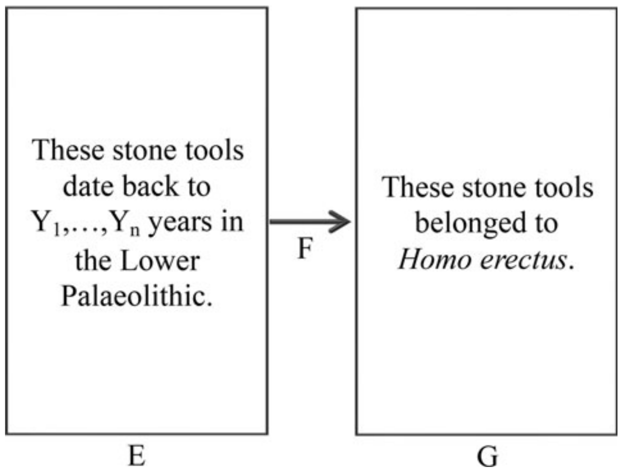

Figure 5. *The* Homo erectus *inference.*

Dates assigned to Crete stone tools have been considered 'controversial', 'problematic' and the like, as is evidenced by judgements such as the following:

> lack of chrono-stratigraphic control over artifacts that are then dated solely on a typological basis (Chelidonio 2001; Kopaka and Manzana 2009; Tourloukis and Karkanas 2012: 2–3) is obviously problematic. Dating artefacts by a combination of typological criteria and pedological context (i.e., top- and sub-soil), which is in turn dated via association with large-scale geological phenomena (in the Cretan case geotectonic uplift of palaeocoastal environments (Strasser *et al.* 2010; 2011)) in the absence of strict stratigraphic context, further complicates the situation. There is evident need for more and better radiometric data … (Leppard 2014, 232–3)[9]

Doubts about the accuracy of the dates assigned to the Crete stone stools are indicative of a lack of adequate bridging of inferential step D in Figure 4 of the Crete Variant of the Dating Inference. The warrant of this step is underpinned by a theory of the dating of lithic artefacts central to which is the following assumption:

(8) Lithic artefacts representing surface finds can be indirectly dated on the basis of data about (a) the techno-types of the artefacts, and (b) the surface geological contexts in which they were found.

This assumption does not provide sufficient backing for the warrant needed to underpin the inferential step in the Crete Variant of the Dating Inference. So this variant cannot be considered sound, in contrast to the Flores Variant.

4 The *Homo erectus* Inference

Following the Dating Inference, the *Homo erectus* Inference is the next link in the chain of simple inferences constituting the Seafaring Inference. This third, simple inference can be represented in outline as in Figure 5.

Like the Dating Inference, the *Homo erectus* Inference has two variants: a Flores Variant and a Crete Variant. In the case of the Flores Variant, inferential step F is grounded in the unchallenged conclusion E of the Dating Inference, namely that the stone tools recovered on Flores date back to the Lower Palaeolithic. In this respect, inferential step F is not contentious. But inferential step F does not need to be well grounded only; it must be appropriately warranted as well. The required warrant should be sufficiently restrictive, including conditions such as the two in (9).

(9) (a) If the stone tools dated back to the Lower Palaeolithic, and (b) if *Homo erectus* were the only early human species who inhabited the area where the tools were recovered about a million years ago, then these tools belonged to *Homo erectus*.

In the case of the Flores Variant of the *Homo erectus* Inference, this warrant should be backed by a well-supported account, a bridge theory, of the species of early humans who probably inhabited Flores during the period concerned. Specifically, the theory should include the plausible hypothesis that *Homo erectus* was at the time the only species living on the island.

On a recent account, however, the first skeletal remains of hominins recovered at Liang Bua on Flores have been attributed to *Homo floresiensis*, believed to be a distinct early human species.[10] So the bridge theory concerned has to clarify the relationship between *Homo erectus* and *Homo floresiensis*. According to an early hypothesis entertained by Michael Morwood and his colleagues—the scientists who recovered the *Homo floresiensis* remains—this Hobbit-like species evolved from *Homo erectus* by insular dwarfing (Brown *et al.* 2004, 1060). This hypothesis turned out to be controversial, though. Thus, on the basis of further study of the skeletal remains concerned, it has been hypothesized that *Homo floresiensis* could have had other, non-*erectus*, ancestors. Thus, van den Bergh and seven co-authors, including Morwood and Brumm, mention the alternatives in the following remarks:

> It is a matter of controversy whether this primitive form [i.e. *Homo floresiensis*—R.B.], dated to the Late Pleistocene, evolved from early Asian *Homo erectus* and represents a

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> unique and striking case of evolutionary reversal in hominin body and brain size within an insular environment [Note numbers 1–4 omitted—R.B.]. The alternative hypothesis is that *H. floresiensis* derived from an older, smaller-brained member of our genus, such as *Homo habilis*, or perhaps even late *Australopithecus*, signalling a hitherto undocumented dispersal of hominins from Africa into eastern Asia by two million years ago (2 Ma) [Note numbers 5, 6 omitted—R.B.]. (van den Bergh *et al.* 2016, 245)[11]

Warrant (9) for inferential step F clearly needs to be backed by a well-supported bridge theory. Interestingly, the theory claiming that *Homo floresiensis* is a dwarfed descendant of early Asian *Homo erectus* is believed to derive empirical support from the findings of an analysis by van den Bergh *et al.* (2016) of fossils excavated in 2014 at Mata Menge. According to van den Bergh *et al.* (2016, 245), these fossils represent a mandible fragment and six isolated teeth belonging to at least three small-jawed and small-toothed individuals. On the authors' analysis, the fossils concerned date back to ~0.7 million years ago, thereby constituting the oldest hominin remains from Flores. The authors, moreover, find that the Mata Menge mandible and teeth are similar in dimensions and morphological characteristics to those of *Homo floresiensis* from Liang Bua, and that these fossils are derived, compared with *Australopithecus* and *Homo habilis.* This finding, van den Bergh *et al.* (2016, 245) conclude, supports the theory that *Homo floresiensis* is a dwarfed descendent of early Asian *Homo erectus*. If one accepts this conclusion, warrant (9) for inferential step F is indeed backed by a bridge theory for which there is significant empirical support, a judgement made recently by Antón and Middleton (2023, 45) as well. In being appropriately warranted, in addition to being well grounded, the Flores Variant of the *Homo erectus* Inference can, therefore, be considered sound.

A similar conclusion about the soundness of the Crete Variant of the *Homo erectus* Inference would be open to challenge. First, in the case of this variant, inferential step F in Figure 5 lacks the required grounding. It starts from the contentious conclusion of the Dating Inference, namely that the stone tools in question date back to the Lower Palaeolithic. Second, no *Homo erectus* fossils have been recovered to date at sites on Crete. Thus, according to Runnels (2014a, 217), a human fossil in the form of a cranial fragment found on Crete has been attributed to *Homo sapiens*. In the absence of pertinent fossils, it has accordingly been hypothesized that species other than *Homo erectus* could have been able to reach Crete, staying on the island for a short time. Drawing on work by various authors,[12] Gaffney (2021, 295) maintains that these species are *Homo antecessor*, *Homo heidelbergensis*, *Homo neanderthalensis* and *Homo sapiens*. Neanderthals, specifically, have been singled out variously as the early humans to have reached Crete.[13] Consequently, warrant (9) cannot be invoked to license the Crete Variant of the *Homo erectus* Inference. This point represents a second major doubt about the soundness of this variant.

5 The Crossing-Open-Seas Inference

The Crossing-Open-Seas Inference is the fourth component of the Seafaring Inference. This simple inference is drawn in pursuing the question of what it involved in the Pleistocene to get from mainland Southeast Asia to Flores, and from southeast Europe or north Africa to Crete. As shown in Figure 6, the Crossing-Open-Seas Inference starts from conclusion G of the *Homo erectus* Inference; and, via inferential step H, arrives at conclusion I that *Homo erectus* crossed open seas to get to Flores and Crete, as shown in outline in Figure 6.

Central to this simple inference is the question of the insularity of Flores and Crete. In the case of both islands, it has been maintained that they were insular in the Pleistocene, isolated by open water from and not connected by land bridges to the nearest mainland. Thus, according to Morwood *et al.* (1998, 174), even at times when the sea level was lowest, water crossings were necessary to reach Flores from Southeast Asia. These authors accordingly infer that in this region *Homo erectus* was capable of repeated water crossings, using watercraft. Dennell *et al.* (2014, 99) concur, remarking that Flores would always have been an island that was at least 19 km from other islands on the Sunda Shelf, even when sea levels were over 100 m lower than today.

Insularity has been attributed to Crete as well. For instance, surveying relevant literature, Gaffney (2021, 296) states that Crete was always separated from both Europe and Africa by large channels, and that Pleistocene occupation on the island would have required sophisticated water crossings. In similar vein, Simmons (2014, 207) observes that in the case of oceanic islands such as Cyprus or Crete, there were no connections or land bridges to the mainland during human occupation. He arrives at 'the unassailable conclusion … that seafaring was a necessary means of transport'.[14]

Both the Flores Variant and the Crete Variant of the Crossing-Open-Seas Inference are sound in that inferential step H in Figure 6 is underpinned by an

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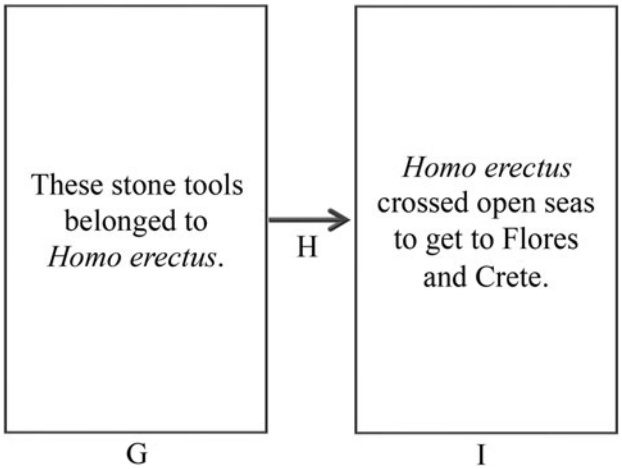

Figure 6. *The crossing-open-seas inference.*

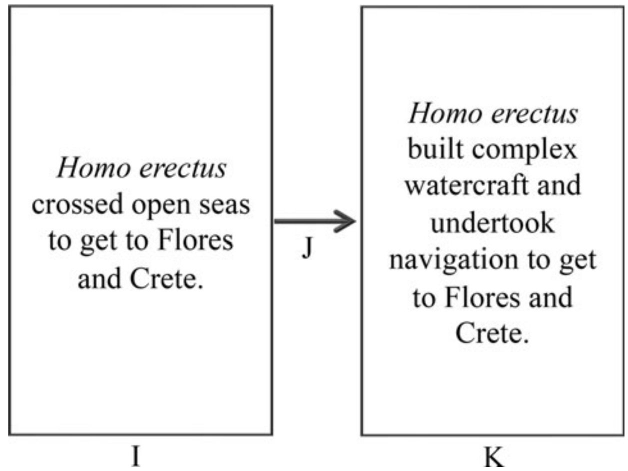

Figure 7. *The watercraft inference.*

appropriate warrant. This warrant, moreover, is backed by the widely accepted theory that Flores and Crete were insular in the Pleistocene. In the case of the Crete Variant of this inference, there is a complication, though. The conclusions of prior inferences in which it is grounded need to be unobjectionable. But in the Crete Variant, this is not so in the case of two of these conclusions: (a) conclusion E in Figure 4 that the stone tools concerned date back to the Lower Palaeolithic; and (b) conclusion G in Figure 5 that the stone tools concerned belonged to *Homo erectus*. Consequently, the Crete Variant of the Crossing-Open-Seas Inference lacks sufficient grounding. In the case of the Flores Variant of this inference, conclusions E and G have not been questioned, which bears positively on the soundness of this variant.

6 The Watercraft Inference

Starting from the conclusion that *Homo erectus* crossed open seas to reach Flores and Crete, the Watercraft Inference ends with the conclusion that these early humans used watercraft and undertook navigation to make the crossings. The outlines of this inference—the fifth component of the Seafaring Inference—are represented schematically in Figure 7.

Capturing the core of the Flores Variant of the Watercraft Inference, Morwood *et al.* (1998, 174) state that '[e]ven at times when the sea level was lowest, water crossings were necessary to reach Flores from Southeast Asia. We conclude that *Homo erectus* in this region was capable of repeated water crossings using watercraft.' This conclusion is also drawn by Bednarik (2014, 211), who maintains that '[t]o reach Flores, human colonizers had to first cross to Lombok, from there to Sumbawa, and thence via Komodo to Flores. These crossings demanded the use of watercraft, particularly as each had to be completed by a genetically viable breeding population including an adequate number of females.'

Two types of watercraft are mentioned in connection with the crossings concerned: boats and non-natural rafts. In this regard, Barham and Everett (2021, 562) have recently subscribed to the idea that *Homo erectus* used boats or rafts to cross to this island. They elaborate on the idea by going into the activities in which *Homo erectus* had to engage in '[c]onstructing a boat or raft'. Thus, they assert that '[c]onstructing a boat or raft involves joining multiple parts to function as a whole, a form of extended hafting' (2021, 562). In addition, they suggest that travelling by boat or raft required *Homo erectus* to engage in further activities such as the provision of food and water as well as fishing.[15]

As for the soundness of the Watercraft Inference, it is important that inferential step J in Figure 7 is both well grounded and underpinned by the right warrant. In the case of the Flores Variant of this inference, inferential step J is firmly grounded in conclusion I of the Crossing-Open-Seas Inference. The warrant for inferential step J, however, is questionable, boiling down to the following claim:

> (10) *Homo erectus* had to build complex watercraft and undertake navigation to cross open sea to reach Flores.

This claim has elicited a considerable measure of scepticism. Dennell *et al.* (2014, 99), for instance, are of the view that '*H. erectus* was unlikely to have been making watercraft a million years ago, and

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still less likely to have willingly undertaken sea voyages.' There are various reasons for this scepticism. The first is that no remains of such boats or rafts have been recovered. According to Simmons (2014, 207), moreover, such recovery 'will remain lacking' since these early craft 'were relatively small and were constructed of materials that would not be preserved through time; thus, finding their actual remains will continue to be elusive'. These observations point to an important lacuna in the empirical grounding of the Flores Variant of the Watercraft Inference.

The second reason for the scepticism about the claim that *Homo erectus* had to build complex watercraft and undertake navigation to cross open sea to reach Floris is rooted in the view that there is a more likely way in which *Homo erectus* probably made the crossing: natural rafting. Thus, citing Smith (2001) and van den Bergh *et al.* (2008), Dennell *et al.* (2014, 99) maintain that 'hominins arrived accidentally on natural rafts of vegetation that had been swept out to sea following a cyclone or tsunami'; and, based on both anecdotal accounts of natural rafting events and pertinent modeling, these authors conclude that 'rafting on natural vegetation was the most likely means by which hominins arrived on Flores'. In similar vein, Langley and Suddendorf (2022, 4) remark that sea crossings to Flores 'might have been the result of an involuntary journey, as individuals may simply have been hanging on for dear life onto something that floats'.[16] Various other authors entertain the view that *Homo erectus* crossed to Flores on natural rafts. Gaffney (2021, 302), for instance, asserts that '*H. erectus* could have deliberately used bundles of mangrove vegetation or bamboo to cross small straits. This seems plausible, given we think most *H. erectus* material culture was noncomposite and did not require extended technological processes to arrive at a useful end result.' These assertions tie in with an account by Anderson (2018, 1), according to which large-diameter bamboo occurred as natural rafts in the western Pacific. According to Anderson, the geography of Wallacea allowed migration solely by drifting to cross short water gaps between islands. In sum, crossing the stretches of open water separating Flores from the nearest other islands did not necessitate the use of boats or non-natural rafts. For this purpose, natural rafts were readily available to *Homo erectus*.

The third reason for the scepticism about claim (10) derives from the view that *Homo erectus* lacked the abilities needed for constructing and navigating complex watercraft. Or, as phrased by Simmons (2014, 204), it has been questioned 'whether or not pre-*Homo sapiens sapiens* had the technological skills and linguistic and cognitive abilities to construct seaworthy vessels and undertake complex navigation. There often seems to be a presumption that they did not'. This presumption has not gone unchallenged. Thus, experimental studies conducted by Bednarik (1998; 2014) showed that present-day humans using the type of tools available to *Homo erectus* can construct rafts and sail them to unknown destinations, navigating all of the passages claimed to have been crossed by *H. erectus* or a similar hominin.

Bednarik's findings, however, do not imply that '*Homo erectus* had the cognitive and cooperative skills (or the impulse) to build rafts and sail into the unknown', Leppard (2015a, 290) argues. Bednarik's findings, that is, have been reached by an analogical argument that fails because of fundamental cognitive and other differences between modern humans and *Homo erectus*. Gaffney (2021, 302) goes even further, arguing that experiments such as Bednarik's (1998) 'have actually done a disservice for the case of deliberate *H. erectus* water crossings in preparing highly complex, multipart rafts made from bamboo. This is unnecessary, as *H. erectus* could have deliberately used bundles of mangrove vegetation or bamboo to cross small straits.' In sum, since the warrant underpinning inferential step J in the Flores Variant of the Watercraft Inference reduces to the dubious claim (10), this inference cannot be considered sound.

Turning to the Crete Variant of the Watercraft Inference, Runnels (2014a, 221) 'infer[s] that open water, if distances to be crossed were great enough to isolate endemic fauna, would have necessitated the use of watercraft by hominins to reach such [i.e. Greek—R.B.] islands.' Furthermore, he maintains that '[e]ven if there was no targeted, purposive, large-scale sustained colonization of Greek islands in the Palaeolithic, this does not invalidate my hypothesis that boats and open-sea routes may have been used by archaic hominins to cross the Mediterranean using islands as way points.' (2014b, 274). Reiterating the idea that boats may have been used by these hominins, Runnels (2014b, 273) asserts that '[t]here is probably agreement that boats were needed to reach offshore islands, even if the type of boat is debatable'. Runnels, however, does not state whether the 'archaic humans' referred to by him included *Homo erectus*. So it is not clear whether he subscribes to conclusion K in Figure 6. In a paper claiming *inter alia* that pre-*sapiens*, as early as 450,000 BP, were sea-crossing the Aegean Sea, Ferentinos *et al.* (2023, 18) subscribe to the view

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that 'the Aegean land/seascape motivated the archaic hominin to develop the necessary cognitive capabilities such as spatial awareness and sea-craft building'. The authors, however, do not claim in so many words that *Homo erectus* crossed by boat to Crete. Thus, dealing with such crossings by early humans, Runnels (2014a, 221) states that 'the use of watercraft implies the use of navigational skills. Even the narrowest of straits has dangerous currents and winds, and some control of the float would have been necessary even for even short crossings.' He speculatively elaborates, 'the hominins must have had navigational skills, including the ability to plot a course, estimate a position, and calculate the rate of travel and distance covered; skills embraced today by the term "dead reckoning" (Huth 2013, 53–80)' (Runnels 2014a, 221–2). It is not clear whether, in the view of Runnels, the presence of these skills indicates that the hominins concerned had language as a cognitive entity as well.

The soundness of the Crete Variant of the Watercraft Inference has not been discussed in a direct way in the literature. Indirectly relevant, though, is Broodbank's (2014, 268) view of crossings between islands in the Aegean by early humans. He is 'quite prepared to become wholly convinced that … some still earlier maritime activity did take place, not least on the part of Neanderthals, or their immediate ancestors in the Aegean'. But he does 'adamantly question … the hard evidence for the actual scale of such early maritime activity, as well as the wider significance and implications.' Broodbank (2014, 269), moreover, finds it worth stressing that such prehistoric crossings were 'short', probably involved the use of 'modest paddled craft', and might be 'achievable with considerably lower levels of technology or intent' than provided for by Runnels.[17] Notice, in conclusion, that the soundness of the Crete Variant of the Watercraft Inference depends *inter alia* on the tenability of the assumption that the early humans who crossed to Crete included *Homo erectus*. In Section 4, however, this assumption has been shown to be the conclusion of an inference of which the soundness is questionable, the *Homo erectus* Inference. This point undermines the soundness of the Crete Variant of the Watercraft Inference.

It is in principle possible to break down the Watercraft Inference into two distinct simple inferences, reflecting the complexity of the Seafaring Inference more fully. Thus, as observed by an anonymous reviewer, the Watercraft Inference involves two putative *Homo erectus* behaviours that are quite different: that of constructing complex watercraft and that of undertaking navigation. These two behaviours have been closely interlinked by authors who mention them in virtually the same breath: for instance, by Barham and Everett (2021, 562) in the case of crossings to Flores, and by Simmons (2014, 204) in the case of crossings to Greek islands. These behaviours, however, have not been treated equally in the literature. That is, authors have overall attempted to give some particulars of what the construction of complex watercraft by *Homo erectus* might have involved. Navigation, by contrast, has merely been mentioned in a general way, the few speculative remarks made by Runnels (2014a, 221) being exceptional in this regard. This dearth of particulars of the navigation attributed to *Homo erectus* makes it in practice impossible to reconstruct this putative behaviour reliably in a separate component of the Seafaring Inference. In line with the literature, I have accordingly included navigation along with watercraft construction in the Watercraft Inference.

7 The Language Inference

The Language Inference is the sixth and final link in the chain of simple inferences making up the Seafaring Inference. From the prior conclusion that *Homo erectus* built complex watercraft and undertook navigation to cross to Flores, it is inferred that these early humans had language. This inference is schematically reconstructed in outline in Figure 8.

To see what the Language Inference involves, consider the way in which Barham and Everett (2021) construe the link between boat building and navigation, on the one hand, and language, on the other. According to them (2021, 562), '[t]he settlement of Flores and other islands of Wallacea by *H. erectus* or related taxa is arguably a process that required language to collectively plan and execute the crossing of open bodies of water'. As mentioned in Section 6, Barham and Everett (2021, 562) believe that boats or non-natural rafts were used by *Homo erectus* for crossing to Flores. Furthermore, they maintain that '[b]uilding a boat requires the kind of conceptualisation of an arbitrary form intended for an imagined purpose that is only possible by the use of symbols to convey such abstractions'. They insist that '[l]anguage would be necessary … for constructing watercraft and storing provisions (food and water)' (2021, 563). Apparently to support the claim that language would be necessary for the construction of watercraft, Barham and Everett refer to a more comprehensive account by Davidson and Noble (1992) of the first colonization of Australia by modern humans. Davidson and Noble (1992,

140) do argue that 'language is necessary to account for the building of a boat and for the emerging picture of the symbolic and representational abilities of the earliest people in the Australian region'. But they attribute language and the ability to build a boat to modern humans and not to *Homo erectus,* in contradistinction to Barham and Everett.[18]

The claim that *Homo erectus* built boats or rafts for crossing to Flores is fundamental to Barham and Everett's reasoning. This claim is the basis of a range of other claims made by these authors, either explicitly or implicitly. Here are four:

(11) (a) *Homo erectus* built boats by joining multiple parts to function as a whole.
(b) *Homo erectus* planned ahead in storing food and water for crossings.
(c) *Homo erectus* undertook navigation in crossing to Flores.
(d) *Homo erectus* used language in building boats, storing provisions, planning crossings, and communicating about these activities with members of their group.

The discussion in Section 6 sets out three reasons why archaeologists have been sceptical about the inference that *Homo erectus* intentionally crossed to Flores on complex watercraft—boats or rafts—built by them for this purpose. If *Homo erectus* did not build such boats or rafts, the Language Inference would be unsound: inferential step L in Figure 8 would lack the required grounding. And, on account of this failure, claims (11) (a)–(d) would be unsustainable.

The question, then, is: 'What do Barham and Everett offer to substantiate the claim that *Homo erectus* built watercraft and practised navigation to cross intentionally to Flores?' First, referring to Bednarik (2014), Barham and Everett (2021, 563) contend that '[on]going experimental building and testing of rafts using local knowledge of plant resources (*e.g.* bamboo poles, vine bindings and rope making) has demonstrated the feasibility of crossing distances of 20 to 50 km by *H. erectus* using rafts with paddles'. However, as shown in Section 6 above, the literature contains dismissive criticism of this experimentation: it is based on an analogical argument which is flawed in disregarding pertinent cognitive and other differences between *Homo erectus* and modern humans. Barham and Everett do not attempt to counter these criticisms. Second, referring in non-specific terms to Ruxton and Wilkinson (2012), Barham and Everett (2021, 563) claim that '[t]he intentional settlement of these [Wallacean—R.B.] islands by

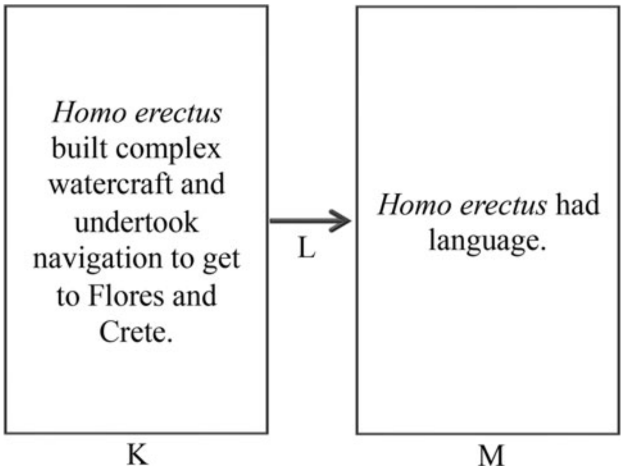

Figure 8. *The language inference.*

genetically viable populations is a more parsimonious explanation than the accidental seeding of hominins on islands by tsunamis or other random natural processes'.[19] But the two authors do not explicate and justify the general notion of 'parsimony' adopted by them. Nor do they set out the specific ways in which intentional settlement would be more parsimonious than accidental seeding. Barham and Everett's recourse to parsimony, accordingly, does not amount to a convincing defence of intentional settlement.

In sum, Barham and Everett's claim that *Homo erectus* built and navigated boats or rafts for crossing intentionally to Flores lacks the necessary substantiation. Consequently, as drawn by Barham and Everett, the Flores Variant of the Language Inference is not sound, being grounded in the untenable conclusion of the Watercraft Inference.[20]

The Flores Variant of the Language Inference must meet the third basic soundness condition as well: the Pertinence Condition stated as (6) in Section 2 above. Recall that this condition says that the conclusion of a simple inference needs to be properly pertinent in accurately identifying and correctly characterizing the entity or entities central to it. The entity central to Barham and Everett's conclusion is language which they characterise as 'G_1 language'. Thus, the authors (2021, 563) assert that a 'G_1 language' would be sufficient to convey the information required to navigate between visible islands. They (2021, 565) describe a G_1 language as 'a language based on words as symbols with minimal grammar'. By indicating what they take the term 'language' to denote in the conclusion concerned, Barham and Everett go some way in clarifying the pertinence of the conclusion of the Flores Variant of the

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Language Inference as drawn by them. They obscure the matter, however, by equating language with communication in their definition of 'language as communication based on symbols' (2021, 535). In addition, they subscribe to the view that '[l]anguage is biocultural behaviour' (2021, 535). Crucially, they leave unclear how even the minimal form of grammar as a component of a G_1 language could be construed as something behavioural in a well-developed linguistic ontology. Such an ontology identifies and characterizes linguistic entities in a principled way.[21] This requirement presupposes a clear distinction between, among others, language as a cognitive faculty, speech or speaking as a form of behaviour, and the physical capacities involved in speech or speaking. In terms of this distinction, a species such as *Homo erectus* could have lacked language as a cognitive faculty, but could have had physical capacities similar to those that enable modern humans to speak. However, if *Homo erectus* lacked language as a cognitive faculty, they could not have been able to speak.[22]

A fully developed version of the Crete Variant of the Language Inference has still to be presented in the literature. It has been suggested, though, that early humans needed advanced 'skills' or 'abilities' for crossing open stretches of the Mediterranean to reach islands such as Crete.

8 Conclusion

Returning to the depiction of the Seafaring Inference in Figure 1 in Section 1, recall that this depiction has been said to represent the structure of the inference 'in outline'. The expressions 'in outline' and 'outlines' have also been used in association with the figures representing the structure of the simple inferences in Sections 2 to 7. The function of these qualifications is to indicate that the figures concerned incompletely represent the structure of the inferences. That is, these figures depict components of the surface layer of the inferences only. Omitted are the constructs by which the surface components are underpinned and backed: warrants, bridge theories and other kinds of supporting accounts. This is an important omission since the soundness of inferences has been shown to depend on adequate support by such underlying constructs.

For the Seafaring Inference to be sound, all the simple inferences of which it is composed need to be sound. Having untenable conclusions, unsound simple inferences represent weak, if not broken, links in the chain forming a composite inference. Preceding sections have identified various weak links in the chain forming the Crete Variant of the Seafaring Inference. These weak links include: (a) the Dating Inference, with the conclusion (E in Figures 1 and 4) that the stone tools recovered on Crete date back to the Lower Palaeolithic; (b) the *Homo erectus* Inference, with the conclusion (G in Figures 1 and 5) that these artefacts belonged to *Homo erectus*; and (c) the Watercraft Inference, with the conclusion (K in Figures 1 and 7) that *Homo erectus* built complex watercraft and undertook navigation to get to Crete.

The Flores Variant of the Seafaring Inference is significantly less problematic than the Crete Variant in regard to soundness, incorporating one clearly weak link only: the Watercraft Inference. This simple inference has the untenable conclusion (K in Figures 1 and 7) that *Homo erectus* built complex watercraft and undertook navigation to get to Flores. This untenable conclusion represents a crucial shortcoming. It leaves the Flores Variant of the Language Inference without the necessary grounding. This point, in turn, undermines the soundness of the Seafaring Inference. And this point, ultimately, makes it impossible to use the Seafaring Inference as a component of a strong case for the claim that *Homo erectus* had language.

Finding the Seafaring Inference unsound and its final conclusion (M in Figure 1) untenable does not imply that *Homo erectus* lacked a form of language with one or more properties that resemble features of language as we know it. The Seafaring Inference is but one of the inferential means of drawing conclusions about what *Homo erectus* might have had in the way of language. That is, it is in principle possible to draw inferences about linguistic attributes of these early humans from putative window phenomena other than the alleged maritime behaviours of the species. These other phenomena include:

- The symbolic behaviour attributed to *Homo erectus*. Thus, Barham and Everett (2021, 555ff) contend that *Homo erectus* treated stone tools as symbols and infer from this contention that the species had G_1 language.
- The invasion of a new niche by *Homo erectus*, its ability to manufacture spatially symmetrical tools, and its expanded brain size. From these phenomena it may be inferred, according to Tallerman and Gibson (2012, 29), that *Homo erectus* possessed 'a pre-syntactic protolanguage'.
- The scavenging behaviour attributed to *Homo erectus*. Thus, according to Bickerton and Szathmáry (2011, 4), *Homo erectus* collaborated in confrontational scavenging that required

members to communicate information that lay far outside their sensory range. And this need, in turn, required them to take 'the first step towards symbolism, the capacity that underlies all of human cognition including language'.[23]

The inferences drawn from these putative window phenomena may reveal something of substance about what *Homo erectus* might have had in the way of language. To determine whether this is indeed the case, however, these inferences need to be reconstructed and appraised in the same way as the Seafaring Inference, which has not yet been done.

Notes

1. Earlier, Bednarik (1997, 18) used the topic of the earliest ocean navigation 'as a springboard to delve into the origins of language'. According to him (1997, 49), '[b]oth the apparently rapid spread of erectoid populations and the development of navigational ability seem to have been results of the developing language ability'. He put forward 'the reasonable proposition that language in some form was available 800,000 years ago'. Referring to Bednarik (2003) and Papoulia (2017), Carter *et al.* (2019, 4–5), likewise, remark that '[e]arly seafaring likely implies that pre-*sapiens* populations had more advanced cognitive faculties, including standardized communication, such as language and speech, with technical capabilities to manufacture and successfully navigate waterborne transport'.
2. This articulation has been judged successful, as is clear from remarks such as the following by Gibson and Tallerman (2012, 21): 'Botha's articulation of definitive criteria for inferring the presence of language from archaeological remains constitutes a major contribution to a field sometimes characterized by widely speculative arguments'. Botha (in press) argues that the Windows Approach can be fruitfully used to investigate non-linguistic abilities of early humans as well.
3. Cf. Botha (2016, 19–20, 257–8) for further discussion of this condition.
4. Cf. Gaffney (2021, 273–4) for a survey of the earliest dated lithic material associated with human occupation of Flores and other Southeast Asian islands.
5. Cf. Gaffney (2021, 268–70) for a survey of the earliest dated lithic material associated with human occupation of Crete and other Mediterranean islands.
6. Cf. Botha (2016, 17–19) for the Warrantedness Condition as a core component of the Windows Approach.
7. Cf. Botha (2016, 18–19) for the role of bridge theories in inferences about language evolution. Cf. also Botha (2020) for how such theories feature in the study of linguistic abilities of early humans such as Neanderthals.
8. Cf. Botha (2016, 20–24) for the Pertinence Condition as a core component of the Windows Approach.
9. Cf. Leppard (2014, 232–3) for the following elaboration: 'lack of chrono-stratigraphic control over artifacts that are then dated solely on a typological basis (Chelidonio 2001; Kopaka and Matzana [sic] 2009) is obviously problematic. Dating artefacts by a combination of typological criteria and pedological context (i.e., top- and sub-soil), which is in turn dated via association with large-scale geological phenomena (in the Cretan case geotectonic uplift of palaeo-coastal environments (Strasser *et al.* 2010; 2011) in the absence of strict stratigraphic context, further complicates the situation. There is evident need for more and better radiometric data'. Similar doubts about the accuracy of the dating of the Crete artefacts have been expressed by, among others, Galanidou (2014, 263), Papoulia (2017, 81), Phoca-Cosmetatou & Rabett (2014, 256), Tourloukis & Harvati (2017, 6).
10. See Dorey (2022) for a list of the unusual physical features of *Homo floresiensis*.
11. Cf. Dennell *et al.* (2014, 98–9) for particulars of three of the alternative views of the ancestors of *Homo floresiensis*, including pathological or pigmy *Homo sapiens*. Morwood & Jungers (2009, 640) discuss skeletal evidence suggesting to them that *Homo floresiensis* may not have evolved by insular dwarfing of larger-bodied hominin species over 880,000 years; and that it is more likely to be a late representative of a small-bodied lineage that exited Africa before the emergence of *Homo erectus sensu latu*. In an account of reasons why there have been ongoing arguments about the potential ancestors of *Homo floresiensis*, Stringer (2014, 429), however, concludes that '[i]sland dwarfing from a local *H. erectus* population is still the most widely accepted idea' about the emergence of *Homo floresiensis*. In similar vein, Antón & Middleton (2023, 45) remark that the debate about the 'ultimate origin' of *Homo floresiensis* continues, with the species being an insular dwarf descended from nearby *Homo erectus* as one of the two dominant views. Should future work yield uncontroversial evidence that *Homo floresiensis* represents a small-bodied lineage that exited Africa before the emergence of *Homo erectus*, the Flores Variant of the *Homo erectus* Inference would be unsound, undermining the Seafaring Inference.
12. These authors include Bartsiokas *et al*. (2017), Harvati *et al*. (2009) and Martinez & Arsuaga (1997).
13. Cf. in this regard Broodbank (2014, 268), Gaffney (2021, 302), Galanidou (2014, 260), Leppard (2015b, 829, 839, 842), Runnels (2014a, 212), Simmons (2012, 895, 896; 2014, 9). An archaeological survey of the Stélida chert source on Naxos (Cycladic islands) yielded Mousterian lithic materials believed to have been associated with Neanderthals. From the recovered stone tools—including scrapers and piercers—it has been inferred that Neanderthals

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reached the island some 200,000 years ago (Carter *et al.* 2015; 2019).

14. Runnels (2014a, 216) is also of the opinion that Crete—along with Kephalonia, Zakynthos, Alonnisos, Naxos, Melos and Gavdos—may have been separated from the mainland by open water for most if not all of the Pleistocene. Galanidou (2014, 261), likewise, observes that throughout the Pleistocene Crete was separated from the Eurasian and African mainlands by some great distance and deep waters, and goes on to note that this situation would certainly imply crossing open seas, even if island-hopping.
15. In an earlier essay, Everett (2018, 2–3) claimed that *Homo erectus* 'made seacraft', 'constructing seaworthy crafts capable of carrying 20 people or more'.
16. In discussing the ways of human dispersal, Leppard (2015b, 842) argues that maritime dispersal events which are evolutionarily ancient are extremely rare, and that early dispersal events should perhaps be better understood as outcomes of passive dispersal. According to Langley & Suddendorf (2022, 3, fig. 1) there is not strong evidence for foresight associated with seafaring before roughly 65,000 years ago. Drawing on Smith (2001) and de Queiroz (2005), Morwood & Jungers (2009, 645) earlier expressed the view that 'the small colonizing group could have accidentally crossed to the island [i.e. Flores—R.B.] while clinging to a natural raft of vegetation or an up-rooted tree washed out to sea'. Tying in with this view is the map of predominant ocean currents that flow from north to south in Southeast Asia, the 'Indonesian throughflow', taken over by Morwood and Jungers (2009, 645) from Kuhnt *et al.* (2004). The idea is that these currents could have carried the natural rafts or trees from Sulawesi in the north to Flores in the south.
17. Broodbank (2014, 269-270) has 'tried to suggest a gradation from the simplest "seagoing", to fairly proficient medium-range "seafaring", to extremely skilled, long-range, durationally extended and ideologically inflected "voyaging"'.
18. Barham and Everett's claim that language is necessary for building a boat echoes Everett's (2018, 4) earlier contention that '[i]n addition to the assembly of a raft [sic], the planning for the trip as a whole, the reasoning for the undertaking, would have all required language'. In an earlier account, Barham (2013, 143) states that '([s]ea crossings, whether from Africa or across island southeast Asia, are often considered as markers of the cognitive ability of *H. erectus* to plan in depth, but there also may have been accidental rafting of humans swept out to sea by tsunamis and high tides.)'
19. Ruxton & Wilkinson (2012, 507) argue, among other things, that their model investigations strengthen the plausibility that especially early island colonization (such as *Homo erectus* on Flores) may have occurred as a result of highly anomalous natural events (such as a tsunami). Early work by Tsuji *et al.* (1995) and Monecke *et al.* (2005) is understood by a reviewer to cast doubt on the view that natural rafts were swept into the sea by tsunamis, carrying early inhabitants of Flores to the island.
20. Another concern about this inference springs from the importance attached by Barham & Everett (2021, 562) to the view that '[c]onstructing a boat or raft involves joining multiple parts to function as a whole' requires the use of (symbolic) language. Interestingly, it has been reported that certain species that lack human language are able to use multiple parts to construct tools. For instance, von Bayern *et al.* (2018) report the findings of experiments showing that New Caledonian crows are able to construct novel compound tools through the assemblage of otherwise non-functional elements. It is accordingly problematic to infer the presence of language in a species from its ability to construct composite tools without backing this inference by a well-developed and amply supported theory of the way(s) in which language and tool construction are interconnected in the various pertinent species.
21. Cf. Botha (2016, 21–2; 2020, 14–15) for more discussion of what a principled linguistic ontology involves. In a nutshell, such an ontology is a theory of the large-scale entities that are believed to populate the linguistic domain. These entities include language, (individual) languages, the capacity for language, tacit knowledge of a language or linguistic competence, language behaviour, speech and other forms of language use, linguistic skill and so on. It is important to distinguish between language and a capacity for language. Thus, a species may have a neural capacity for language but may lack language itself. As pursued in this article, the question 'Did Homo erectus have language?' is about language itself and not about the neural capacity for language. Cf. Hillert (2021) for discussion of the evolution of this capacity.
22. The question of whether *Homo erectus* had the physical capacities needed for speech has been discussed at some length. See in this regard, for instance, Capasso *et al.* (2008); Deacon (1997, 252–3, 407); Dunbar (2012); Fitch (2010, 335); Lieberman (1991, 74–6); MacLarnon (2012); MacLarnon & Hewitt (1999) and Wynn (1998). More recently, Everett (2018) has addressed the question 'Did *Homo erectus* speak?', failing, though, to draw the distinction between language as a cognitive entity, speech or speaking as a form of behaviour, and the physical structures involved in speech or speaking. Consequently, Everett (2018, 1) conflates language and speech in maintaining the following: 'The greatest tool in the world is *language*. Without it there would be no culture, no literature, no science, no history, no commercial enterprise or industry. The genus *Homo* rules the Earth because it possesses *language*. But how and when did we build *this kingdom*

of speech?" [emphases added—R.B.]. As noted above, Barham & Everett (2021, 536), likewise, refrain from drawing the fundamental distinction between language and communication as well as the distinction between language and behaviour. A further distinction that should be kept in mind when attributing speech to *Homo erectus* is the distinction between speech and gesture. Thus, according to Tomasello (2014, 49–68), early humans such as *Homo heidelbergensis* cooperatively communicated with the aid of natural gestures, specifically pointing gestures and non-conventional iconic gestures and pantomimes. According to him, there is perhaps a discrete infinity of possible iconic gestures that have semantic content and that can be combined in 'multiunit expressions'. To be able to attribute speech to *Homo erectus*, one should also exclude the possibility that these early humans communicated with the aid of natural gestures of the kind provided for by Tomasello.

23. This idea is developed further by Szilágy *et al.* (2023, 1) who claim that '[p]ower scavenging compelled displaced symbolic communication featuring a limited semantic range; syntax was not required.'

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