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Scaffolding Knowledge

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Abstract

In this article I argue that often propositional knowledge is acquired and retained by extensive reliance on physical and social scaffolds that create an environment or niche conducive to knowledge. It is incumbent on epistemologists to subject these aids to epistemic assessments. I show that several of the activities involved in the creation of niches within which inquiry can thrive are carried out by whole cultures. New generations benefit from inheriting these niches whilst being able to improve upon them to the advantage of their descendants. Finally, I highlight that the growth of human epistemic achievements is often due to increased outsourcing of cognitive effort and epistemic powers onto impersonal physical and social structures so that human beings can succeed more by contributing less to the solution of problems.

Reality is messy. Other people can be hard to fathom. A striking feature of the way in which human beings figure things out is their tendency to manipulate their physical and social surroundings to facilitate the task of finding answers to their questions. Nowhere is this phenomenon more apparent than in laboratory science (Hacking, 1992). Experimental scientific research always requires creating the kind of laboratory conditions that "clean up" reality by screening off external influences and other kinds of confounders, and by making simplifying assumptions. In short, reality must be shaped, changed, and manipulated to be amenable to being known in the ways that are characteristic of Western experimental science. Further, if that knowledge is to be useful outside the confines of the laboratory, our everyday surroundings need to be modified so as to resemble in the relevant aspects the laboratory conditions (Rouse, 1987). Thus, for example, the advances

made in plant genetics, including the creation of hybrid varieties, would yield limited results without the extensive reshaping of farmland and agricultural practices to create the conditions within which these organisms can thrive (Lacey, 2005, pp. 189 –191). These features of scientific practice are continuous with aspects of ordinary inquiries.

This article has three main aims. The first is to argue that often propositional knowledge is acquired and retained by extensive reliance on physical and social scaffolds that create an environment or niche conducive to knowledge. It is incumbent on epistemologists to subject these aids to epistemic assessments. The second is to show that several of the activities involved in the creation of niches within which inquiry can thrive are carried out by whole cultures. New generations benefit from inheriting these niches whilst being able to improve upon them to the advantage of their descendants. These considerations suggest that much could be gained by understanding our cognitive abilities as having culturally co-evolved with the niches that scaffold them. The final aim is to highlight that the growth of human epistemic achievements is often due to increased outsourcing of cognitive effort and epistemic powers onto impersonal physical and social structures so that human beings can succeed more by contributing less to the solution of problems.

This article consists of four sections. In the first I explain the notions of cognitive scaffold and of epistemic niche and present examples of human engineering of such niches. I show the centrality of scaffolds, and of the niches they constitute, to human cumulative epistemic success. In the second section I examine how the scaffolded knowledge framework I defend differs from Goldman's (2012) system-oriented epistemology and argue that epistemologists should be concerned with the epistemic evaluation of cognitive niches. In the third section, focusing on the notorious case of Otto's notebook, I compare my approach favourably with the extended knowledge framework. Whilst in the first three sections I have focused on the moulding of the material environment to aid knowledge, in the fourth section I switch my attention to the shaping of minds to make them mutually intelligible, trusting and trustworthy. I also briefly address the contemporary development of impersonal structures of accountability as partial replacements of personal trusting attitudes to scaffold the reliable transmission of information.

1 | I

This section begins to make the argument in favour of adopting an expansive conception of epistemology concerned with the epistemic evaluation of cognitive niches that scaffold epistemic achievements in addition to the epistemic assessment of doxastic states and of the activities involved in inquiry. My focus is on two broad families of niches. Physical environments including scaffolds such as technological tools, and especially adapted spatial and temporal structures. Social environments that involve human beings whose minds have been shaped for some specific purpose. My aim in this section is to present the view, defended by supporters of cultural evolution, that human cognitive capacities have co-evolved with the engineered physical and social environments that scaffold these capacities. I illustrate the phenomenon by way of two examples. I rely on these to clarify the notions of a cognitive scaffold and of an epistemic or cognitive niche, and to support the claim that niche construction is often a cultural endeavour that produces downstream cumulative effects.

I do not provide novel evidence in favour of the kind of account of human cultural evolution defended, for example, by Kim Sterelny (2003, 2012). Instead, I presuppose that these accounts are broadly accurate. However, I rely only on what I hope are two rather uncontroversial aspects of these views. The first is the claim that human beings modify their environment to facilitate their survival. Some of these modifications are technological innovations designed to promote

knowledge and understanding. Computers, calculators, maps are examples of artifacts that scaffold epistemic achievements. These are first created by some inventors and then passed on to future generations that benefit from them, and who sometimes improve upon them. Equally uncontroversial, I hope, is the second claim that adults also shape the minds of children by means of education and the institution of social norms. These mouldings of cognitive abilities and behavioural dispositions are often in the service of enhancing epistemic success.[1]

To home in on the phenomenon of the co-evolution of cognitive capacities and their environmental scaffolds, I would like to present two examples. The first exhibits the tendency to shape reality and minds to facilitate the acquisition and retention of knowledge. The second exemplifies the propensity to mould our surroundings so that to make the knowledge gained in a different context applicable to them.

The first example is the practice of queueing by forming a line. This practice greatly facilitates inquiry into the order in which people arrived at a location. First, it obviates the need for anybody else to observe people as they arrive. Second, it relieves the inquirer of the burden of remembering the order in which people arrived. Both cognitive tasks would require considerable effort. They are made much less onerous by intelligently exploiting spatial features of the environment so as to transform the problem from one requiring the deployment of prolonged observation and memory to one that is essentially exclusively perceptual and can be carried out at a glance (Hutchins, 2005; Kirsh, 1995).

Note, however, that this transformation of a memory task into a perceptual one requires human compliance as well as intelligent spatial design. This epistemic engineering of space would not work if people elbowed each other out of the way. Hence, the task is predicated on the existence of social norms prohibiting queue jumping as well as the design of spaces cordoned by ropes that cajole and constrain people into forming a line.

The second example is the practice of introducing common standards and units of measurement. This practice facilitates the applicability or portability of knowledge gained in one context to a different one. For example, the introduction of universal units of measurement to replace local ones makes it possible for individuals far afield to know, say, how much grain is for sale without having to survey the goods themselves. Further, the introduction of independently monitored and shared quality standards enables individuals who have no expertise about the product to know what they are buying or trading (Porter, 1995, pp. 47–48). These processes of standardisation and homogenisation make knowledge portable by minimising the need for expertise be it in the form of local knowledge or in-depth understanding of the topic. By doing away with reliance on experts these procedures also obviate the vulnerabilities associated with trust in experts who might not have the interests of the layperson at heart (cf., Nguyen, 2021b).

Examples of these kinds are plentiful. Their prevalence offers some support for the conclusion that human beings are prolific epistemic niche engineers. Humans continually change purposefully their physical surroundings, by means of spatial design or the creation of artifacts, and their social environment, by way of education and the adoption of social norms, with the goal of facilitating epistemic achievements such as gaining and disseminating knowledge. I use the term 'scaffold' liberally to refer to these material items, structural arrangements, and social instruments. Some of these are primarily deployed to assist learners but can be subsequently discarded. Others instead are a permanent feature of everyday life (Varga, 2019, p. 51).

Manufactured environmental niches are tailored to the human cognitive abilities which they scaffold. For instance, the limitations of working memory are a well-known bottleneck in human cognition. On average humans are only able to keep in mind three or four chunks of information at a time (Cowan, 2010). This shortcoming can be addressed by the transformation of memory tasks

that rely on the deployment of working memory into tasks that provide answers to the same questions but that only tax perception aided by the intelligent use of space. The practice of queueing is only one culturally shared example. Individuals idiosyncratically engineer their environments all the time to address similar problems. For example, mixologists remember which drinks to prepare in what order by arranging glasses of various shapes in front of them (cf., Clark, 2008, p. 68).

Conversely, human cognitive abilities are transformed by being nurtured in the right epistemic environments. Expert cognition often requires the refinement and calibration of perceptual and attentional capacities so that to be able to see and understand a range of phenomena. Often this training involves learning how to use and read the results produced by sophisticated instruments. For example, radiographers are able to interpret the significance of various marks on x-rays. While the X-ray machine scaffolds the radiographer's perceptual abilities, these capacities have also been trained so as to work successfully in tandem with the machines.

This array of examples suggests that epistemic niches can be broadly defined as regions of the physical and social environment that afford in the sense of call for, or encourage, the adoption of some specific information processing strategies to accomplish some common cognitive tasks.[2] These niches are engineered when they are intentionally designed for these goals.[3] This engineering consists in the intentional re-design of the environment so as to modify its informational structure (Sterelny, 2003, sects. 8.4 & 8.5). Sometimes the engineering of the physical environment is highly personalised. For example, a person might keep their house keys in a container on a table by the front door so that they do not need to remember each time where they have put them. Sometimes the personalisation involves the distribution of elements of the cognitive task to other people as when the chair of a Q&A session avoids having to remember the order in which hands were raised by allocating numbers to every person who wants to ask a question. In this way, the chair only needs to remember where they got to in the number sequence while those who want to ask a question must remember the number allocated to them by the chair.

Often cognitive niches are sufficiently stable to be inherited by subsequent generations. This is true of many elements of material culture such as clocks, maps, compasses, and books. But it applies equally to the design of the natural and built environment and to the measuring of time. We have inherited forests that have been managed in accordance with scientific forestry principles so that they are monocultures whose yields in timber are expected to be homogenous and easy to calculate (Scott, 1998, ch. 1). Many live in modern cities where roads are built in a grid structure, and every dwelling is allocated a unique address to facilitate the levying of taxes but also the delivery of services (Scott, 1998, ch. 2). We use calendars and clocks to measure hours, days and years so as to coordinate activities with other members of various communities. These physical and symbolic items are culturally transmitted; they greatly enhance practical success, but they also enable knowledge of those facts that subserve such success.

The downstream effect of epistemic niches is also cumulative. That is, subsequent generations are able to improve upon the niches that they have inherited. The evolution of techniques for counting from using one's own fingers, to counting boards, abaci and then calculators is an example of cumulative epistemic engineering. Children are taught to make simple calculations using the fingers on their hands. This method simplifies counting but also lowers the cognitive load of having to retain several chunks of information in working memory. Counting boards, consisting of boards with grooves for sliding counters, work on similar principles as the technique that uses fingers but further simplify calculations that exceed the number ten (since one does not need to remember the number of hands used in the calculation). Counting boards are then replaced at least in China and in some other cultures by abaci where beads have different values depending on their location on a top or bottom row of counters. These abaci enable very complex

calculations that cannot be achieved by mental arithmetic even when scaffolded by the use of fingers or by boards. Finally, the modern calculator has supplanted the abacus. This evolution of the technique of calculation is a clear example of the cumulative effects of niche construction where the initial and more rudimentary techniques unleash the scaffolded abilities required to develop the new technique which in turn further ratchets up the capacities it enables (De Cruz, 2008).[4]

These examples illustrate that frequently even individual epistemic successes are scaffolded by social norms and material artifacts so that they are best understood as cultural epistemic achievements. It is often said that most of what we know we know from other people. When epistemologists make the claim, they often understand it as highlighting the significance of knowledge based on testimony. But this interpretation neglects a much more extensive form of epistemic dependence on the successes of previous generations. Most of what we know, we know because we have books, maps, clocks, calculators, we live in cleverly designed built environments, we conform to social norms about queueing, about truth telling, and so forth.

2 | II

A proper epistemic assessment of many individual epistemic endeavours must take into account the features of the niches within which they take place because these features contribute to enabling or obstructing epistemic success. In addition, they partly determine which cognitive strategies are best adopted within a given context. The examination of these features would thus seem an obvious target of epistemic assessment.

A possible explanation for their relative neglect among social epistemologists might lie in the tendency to think of the examples offered above as exemplifying practical rather than propositional knowledge. It makes sense to think of the knowledge displayed by the radiographer when deciphering an x-ray as a form of know-how. This thought is correct, but it is also incomplete. The radiographer's know-how is also the basis of expert propositional knowledge that could not be had first-hand without possessing the relevant skills. It is rather arbitrary to exclude propositional knowledge acquired by technological means from the domain of study of epistemology.

Consider for example two individuals who acquire first-hand knowledge of the result of a complex calculation. The first person calculates the result in the head by using the carrying technique. The second knows the result by reading it off a calculator having keyed in the function and input values. It would be odd if epistemology were concerned with the epistemic evaluation of the doxastic state of the first person, but not of that of the second. It would also be odd if epistemologists were not alert to the enormous differences between the two cases. To the extent to which knowledge is an achievement, the knowledge possessed by the second individual is to a significant extent a collective achievement based on the efforts of numerous generations to engineer tools that expand human abilities to solve mathematical problems. The calculator enables humans with rudimentary mathematical abilities to solve complex problems by wholly outsourcing the calculation to a tool and transforming the human contribution to the mathematical task into a perceptual one. What is required on the part of the second person to carry out complex mathematical calculations is the ability to recognise numerals and functors and to read the result on the screen of the calculator.

It would not be entirely true to say that social epistemologists have wholly neglected the epistemic features of engineered environments. Alvin Goldman's (2012) systems-oriented epistemology could be interpreted as addressing this issue.[5] However, Goldman is primarily concerned with what is in effect the epistemology of institutions such as legal systems, educational and

scientific organisations (Goldman, 1999). Hence, he ignores other forms of niche construction that scaffold individuals' activities in the pursuit of knowledge.

In addition, Goldman is almost exclusively interested in the downstream veritistic effects of different systems and institutions that are directly or indirectly concerned with discovering and disseminating truth in a given domain. For example, systems-oriented epistemology can be used to evaluate the adversarial and inquisitorial criminal justice systems. The focus of assessment in this case is the relative reliability of their verdicts (Goldman, 1999, ch. 9). Thus, we can evaluate which system is better, epistemically speaking, by figuring out which results in fewer false convictions for instance. This approach whilst valuable needs in my view to be supplemented by an assessment of how the adoption of one or the other legal model results in the construction of a niche that changes aspects of the reality to be known.

For example, the adversarial system with its practice of cross-examining witnesses in front of a jury, might constitute the kind of hostile environment that vulnerable victims of sexual crimes would experience as a revictimization (Creaton & Pakes, 2022, p. 55; Maier, 2008). If that is the case, the system itself changes the choice architecture for the victims because it creates incentives that make it less likely that they will report the crime. This potential effect of the system is epistemic when the implementation of the adversarial system obstructs knowledge of the occurrence and prevalence of some crimes. It is not, however, a downstream veristic effect of the system insofar as it concerns cases that never come to trial because unreported. These considerations highlight the importance of studying how systems that are designed to find out the truth also shape social reality in ways that facilitate some kinds of knowledge whilst obstructing knowledge of other facts.

3 | III

In this section I show why the scaffolded model provides a more adequate explanation of how humans deal with the epistemic shortcomings of working memory than the account supplied by the extended mind framework.

The paradigmatic example of an extended mental state concerns the solution of a memory task by making use of a notebook to scaffold semantic mnemonic abilities that have been impaired by Alzheimer. Clark and Chalmers (1998) consider the fictional character Otto whose biological memory is impaired and who consults a notebook to find out the address of MOMA in New York City. Clark and Chalmers argue that the vehicles of Otto's mnemonic representations include the notebook as well as intercranial states. Otto's mind would thus be extended to include the on-board biological vehicles of his mnemonic and perceptual cognitive processing but also items that carry mnemonic information but are located outside Otto's skin.

The argument for extending Otto's memory to the notebook relies on a parity principle. Clark and Chalmers claim that some portion of physical reality is part of a given cognitive process just in case that physical item plays a function which were the item located in the head would qualify it as a part of that cognitive process (Clark & Chalmers, 1998, p. 8). More specifically, an item in the physical world outside the head is functionally on a par with an item in the head provided it satisfies some so-called "glue and trust" conditions. These are: (1) the item is reliably available and relied upon often; (2) the information contained in the item is trusted in the sense of being endorsed more or less automatically; (3) that information is easily accessible when needed; (4) that information is currently present because of a past endorsement (Clark, 2008, p. 79). The specification of these conditions is designed to avoid a kind of cognitive bloat that would allocate as part of a subject's mind any tool which they may use to access or retain information. Otto's notebook

would thus be part of his mind, but an academic's personal library would not be an extension of hers since the information it contains is not automatically endorsed.

The use of a parity principle to justify including the notebook within Otto's extended mind should be *prima facie* puzzling. It is only if the kind of function at work in this case is extremely general such as "the item stores information", that it might seem to make sense to think that a notebook serves the same function as biological memory. Items such as notebooks and shopping lists enable the solution of memory tasks precisely because their properties are extremely different from the features that characterise human declarative semantic memory. The information contained in these devices is not prone to decay; it exceeds what a human could recall at any one point; it is not the condensed amalgamation of different facts and episodes; it does not trade off precision for accuracy. One might even conclude that the reason why these tools can scaffold human memory is that they have none of its frailties and peculiarities. That is, the reason why scaffolding works is that external storage systems are nothing like biological memory. They are not functionally equivalent to it; they instead complement it by doing something it cannot do (Donald, 1991; Sutton, 2010).

Furthermore, even the appearance of a generic functional parity is potentially misleading. The view that human memory serves the function of storing information about the past is not wholly correct. Human declarative memory, in particular episodic memory, is highly constructed. It does not consist in the mere storage and retention of information for future recall. Instead, there might not even be any single piece of information that is committed to mind at some point in the past, continually stored in memory, and then retrieved when that past episode is remembered. The information about past events that is recalled at any point has always undergone significant transformations. It has been amalgamated with information from other events; subjected to selection based on current interests; supplanted, supplemented or modified by information contained in other people's testimony (Sutton et al., 2010).

The highly constructed nature of human episodic memory has prompted some to argue that it has not evolved to store information but to serve other functions such as strengthening social bonds (cf., Michaelian, 2016). Be that as it may, human memory is extremely vulnerable to social influences that deeply affect what information it retains (Loftus, 2005). In short, biological memory is not suited to storing accurate information. It is precisely because notebooks and shopping lists are tailor made for accurate storage that we use them instead of relying on our memories. Memory aids complement human memory; they are not its functional equivalent. Of course, once this claim is accepted, it is hard to justify treating them as extensions of the mind without running the risk of including other kinds of information storage such as books and the world wide web, and thus falling foul of a charge of bloating.

Be that as it may, some of the peculiarities of Otto's example have had a distorting effect on epistemological discussions about the acquisition or retention of knowledge aided by various technologies. The first peculiarity is that Otto uses the notebook to address a cognitive impairment. However, external information storage devices are more frequently deployed to enhance normal human function rather than to correct an impairment. This difference might be epistemically significant since in the first instance but not the second the individual might retain the ability to check occasionally the reliability of the technology when deciding to rely on it. Hence, for instance whatever its merits, Carter and Kallestrup's (2018) argument that Otto's belief about the location of MOMA falls short of knowledge does not generalise to many ordinary cases because that argument is based on Otto's inability to independently check whether the notebook is a reliable source of information.

The second peculiarity of the example lies in the personalised nature of Otto's notebook. This is a feature that is shared by only a few technologies. Mobile phones are perhaps the clearest example since owners curate the information stored in these devices and personalise their functionality (Carter & Palermos, 2016). But this is an unusual case. Most information storage devices get much of their epistemic value from being readily available to large numbers of users. For this reason, they are standardised rather than personalised (Sterelny, 2010). Consequently, they are unlikely to be fully cognitively integrated with biological processes. That is, it is often not the case that there is a seamless two-way feedback loop between the brain and the tool (Palermos, 2014; Pritchard, 2010, 2018). Users might annotate their books and maps, but these two-ways connections are too sporadic and lack the seamless character required for integration. For this reason also, taking the example of Otto's notebook as paradigmatic of knowledge acquired by information processing aided by tools is highly misleading.

I have offered three considerations why the application of the extended mind thesis to understanding the acquisition of knowledge by means of aide memoire is often at least misleading. I have shown that there is no functional parity between biological memory and external storage devices. I have highlighted that we do not often use these tools to correct impairment but to enhance ability, and that the majority of these tools are not personalised. Hence, irrespective of whether Otto gains knowledge using the notebook and of whether the notebook is a component of his mind, there is no reason to believe that most of the information tools we use are best thought of as extensions of the mind. They are, however, scaffolds of cognition (Sterelny, 2010). They are ways of changing our environments to make problems easier to solve, or to make problems that were otherwise beyond our abilities solvable.

In my view the extended mind lens has distorted our understanding of human strategies for addressing memory tasks. We have not solved the problem of the informational bottleneck that is biological working memory by extending or enhancing this biological ability. Instead, we have ingeniously modified our environment so that to bypass the need to remember. That is, the strategy that humans have defaulted to in order to overcome the deficiencies of biological memory is to transform tasks that would require the deployment of this cognitive ability into tasks yielding the answers to the same questions but mostly involving the use of perception resulting in a much-reduced cognitive load. Notebooks and shopping lists do not extend human memory; they are the means to transform memory problems into perceptual tasks (Sterelny, 2003, ch. 8).

The long-term effect of solving memory tasks without relying on biological memory has been a weakening rather than a strengthening of mnemonic abilities. Individuals who lived in oral cultures presumably had better biological memory than people who can write things down. Similarly, London taxi drivers who have to take the knowledge test of the layout of London's streets in order to gain their licence have better long-term spatial memory than drivers who use their cars' satnav systems (Griesbauer et al., 2022).

The human engineering genius has been to construct tools and environments in which we can expand the range of epistemically successful activities whilst doing less ourselves. For example, people with little knowledge of a location are now able to navigate it easily. Individuals with the limited working memory characteristic of ordinary human beings can solve problems that in the past would have required exceptional powers of recall. Persons with the most rudimentary knowledge and understanding of arithmetic can answer questions that before would have required sophisticated mathematical abilities. In short, we have often enhanced success not by strengthening or extending ability in any straightforward sense, but by outsourcing processes, so that less effort and intelligence is required on our part.

It is often claimed that we live in societies characterised by the hyper-specialisation of cognitive expertise (Millgram, 2015). Whilst this observation is undoubtedly true, it is also important to note that we live in a society where we are able to know more without much expertise, cognitive effort or ability.[6] However, the more we outsource cognitive tasks to aspects of our epistemic niches, the less able we become to independently verify the reliability of the technologies on which we depend. This problem has become increasingly acute with regard to our epistemic dependence on automated systems trained on big data. The algorithms deployed by the machines are often inscrutable to human operators, who cannot therefore check the reliability of the outputs provided by the system (Wachter et al., 2017). In this regard then we are moving toward a situation in which ordinary humans might partially share Otto's predicament since we lack the means to independently verify the reliability of the resources on which we epistemically depend.

4 | IV

Human beings, in addition to changing their physical surroundings to scaffold their abilities, also shape each other's minds to fit the environments they create. The generic name for this heterogeneous set of practices is 'mindshaping'. In its broadest sense 'mindshaping' refers to any activity which results in a change of someone's mental states or dispositions (Mameli, 2001). In this sense, if a person insults another causing them to become angry, the insult is a mindshaping activity. For my purposes, however, I adopt a narrower definition according to which mindshaping is any activity whose function is to make a mind match a model by causing it to acquire the states or dispositions of that model (Zawidzki, 2018).[7]

Folk psychological attributions are among the activities that have been taken by some to serve a mindshaping role. According to this view, attributions of mental states to a target mind would change that mind so that it fits the attribution, rather than track the pre-existent states of that mind. For example, belief attributions would function to direct the person to form and sustain beliefs that respond to the evidence in their possession, rather than aim to reflect accurately what the person believes already (McGeer, 2015). One of the advantages of this account would be its ability to explain the transparency of belief. When solicited to self-attribute beliefs, by being asked whether they believe that such and such is the case, subjects do not typically respond by introspecting the contents of their minds but by trying to figure out whether such and such is the case.

In philosophy of mind, mindshaping is often taken to be an account of folk psychology rivalling two more established mindreading approaches: theory-theory and simulation theory. These two views interpret folk-psychological capacities in epistemic terms. They would consist in abilities to theorise about, or simulate in the imagination, the contents of the minds of others in order to predict their behaviour (Goldman, 2006; Gopnik & Wellman, 1994). Mindshaping proposes instead that folk-psychological capacities are abilities to make others form and sustain their beliefs by following shared epistemic norms, acquire desires that conform to shared social norms, and more broadly they would be abilities to mould individuals to act, think, and feel in accordance with socially shared standard (McGeer, 2015).

As an alternative to mindreading accounts, mindshaping theories would have to show that mindshaping capacities do not need some mindreading abilities to get off the ground.[8] It is, however, perfectly possible to think of mindreading and mindshaping as complementary (Peters, 2019). This is the approach adopted here. Irrespective of whether mindshaping provides a satisfactory account of folk psychology, there is no doubt that many human activities aim to shape the

minds of others to match some model. The clearest examples include the inculcation of character traits, teaching, and the expression of reactive attitudes such as anger and blame.

Mindshaping practices are an important plank in the engineering of epistemic niches. These activities include teaching novices to use the artifacts created by previous generations. But they also induct the young into the social norms of the community since social conformity is often a requirement for the success of activities within epistemic niches. For example, as I highlighted above, the practice of queueing simplifies a memory task by means of the intelligent use of space. However, this engineered solution only works if people cooperate by obeying social norms prohibiting jumping the line. When people don't comply, it is impossible to establish the order of arrival.

Conversely, mindshaping activities are often scaffolded by physical elements of epistemic niches. For instance, parents and educators aid children's learning by creating classrooms and play areas that stimulate inquisitiveness. They organise space so that the young are more likely to find the right answers to questions than they would in unbiased environments. The adults themselves might hold the hand of the children, both literally and metaphorically, until they have learnt to avail themselves of the technologies and skills possessed by their teachers.

Broadly speaking minds are shaped by the setting of normative and empirical expectations. Normative expectations generate practical reasons to act in given ways. For example, promising to do something creates an obligation to act that steadies the mind even in the presence of a contrary inclination. The expression of reactive attitudes such as blame, resentment, praise, or guilt also sets normative expectations to act in ways conforming to the standards held by the person whose attitudes these are. The institution of a practice of expressing these attitudes functions as a social niche that scaffolds people's ability to conform to shared social norms by continually supplying reasons and incentives to obey them (McGeer, 2018).

Proleptic or therapeutic attitudes of trust are another example of the power of normative expectations to shape minds. These attitudes are common in pedagogical contexts. Parents convey to their children the trust that they put in them to encourage their offspring to match the expectation and become more trustworthy. At times adults decide to put their trust in others even in the absence of a belief that the trusted person is trustworthy. In these cases, provided that the recipient of the trusting attitude cares about the person who trusts them, being trusted supplies them with a reason to try to live up to the expectation (McGeer, 2008). In the long run being trusted contributes to making one more trustworthy since it incentivises effort to match the trust others invest in one.

In short, some activities such as promising, ordering, warning, trusting, blaming and praising serve the function of changing minds to match what is normatively expected of them. They fulfil this role by creating new practical reasons for the persons they target. The generation and renewal of these reasons creates a social environment that scaffolds individuals' attempts to behave in accordance with common social norms.

Minds are also shaped by means of empirical expectations. These are essentially predictions that become self-fulfilling prophecies. This dynamic is known as an 'expectancy effect' (Snyder, 1984; Snyder & Klein, 2005). It is often observed that when people expect (in the sense of predict) some target person to possess some characteristic, their behaviour toward that target might evince in the target behaviour that matches the expectation. For example, if a person believes that another is hostile, they might be pre-emptily aggressive toward the target who might in turn react with hostility (Peters, 2019). Expectancy effects are mindshaping mechanisms since they function to make a mind match a model.

Psychological research on expectancy effects has highlighted the role they play in the internalisation of social stereotypes (Mameli, 2001). For example, parents treat male and female infants

differently. These differences are grounded in empirical expectations about stereotypical gendered character and behaviours. Because of parental behaviour, male and female babies are nurtured in partially different environments that elicit in them different dispositions. For instance, adults when watching a video of a baby crying after being startled by a jack in the box toy interpret the cry as anger or as fear depending on whether they have been told that the infant is male or female.[9] Children respond to these differential treatments in ways that lead them to match what is expected of them. Hence, they learn to conform to gender stereotypes. Subsequently, they might internalise these stereotypes, and think that these represent who they are, without being aware that they have become that way because of adults' expectations.

Mindshaping plays at least three epistemically significant functions in human communities. First, it scaffolds the development of positive intellectual and moral character traits, including trustworthiness. Second, it facilitates mutual intelligibility. Third, it makes minds more trusting and thus receptive to teaching. In what follows I elaborate briefly on each of these three functions and illustrate their importance in individual and collective epistemic activities.

The development of character including intellectual and moral character virtues in children is largely the product of the mindshaping activities of adults in the community. These activities are heterogeneous. They include presenting the young with models of virtue that they are encouraged to emulate (Zagzebski, 2015, 2017). The social practices of praising people for some of their behaviours, and blaming them for others, also supply children with incentives to match the conduct that is normatively expected of them. In addition, adults rely on the self-fulfilling qualities of attributing labels to people, when the targets do not judge the labels to be wholly inappropriate. Thus, for example, children exhibit more behaviours characteristic of tidiness, when they are told by adults that they already are tidy (Alfano, 2013, pp. 88–91).

The inculcation of positive character traits has significant epistemic advantages for the individuals themselves and for the communities to which they belong. First, some of the character traits acquired in this fashion are conducive to carrying out inquiries effectively and responsibly. That is, these traits promote the reliable acquisition of true beliefs in a careful manner that is appropriately sensitive to the evidence. The intellectual traits that adults inculcate into children include resilience, courage, carefulness, open-mindedness. In contemporary Western societies, they also include curiosity and intellectual self-reliance.

The possession of these character traits is also beneficial for joint intellectual activities, since individuals who are curious, resilient and open-minded are better inquirers. In addition, some of the positive character traits that children are expected to exhibit are constitutive of cooperative behaviour: these include a disposition to be trustworthy, and generous. Having these traits is a great enabler of joint activities, including joint epistemic activities. Thus, mindshaping as the process of constructing cooperative social environments is an important aspect of the epistemic success of human cultures. Without it, humans could not successfully distribute the cognitive load of carrying out complex tasks to several individuals who together can perform them successfully, but who individually would be doomed to failure.

Successful coordination, however, does not only require mutual trust and trustworthiness. Mutual intelligibility is also necessary. Unless people are able to predict others' behaviour, they will not be able to coordinate their activities even though they trust each to be cooperative (Sterelny, 2014). Mindshaping activities are also instrumental to scaffolding the ability to read the minds of others because they promote the adoption and internalisation of shared social norms.

Essentially, mindshaping secures that people within a community tend to play by the same rules and engage in the same practices. This convergence in dispositions gives community members what McGeer (2015) has labelled practice-dependent epistemic advantages. They are better able to understand and predict what others might think or do because they have all learnt to conform

to the same rules. For example, it is easier to know what others believe about the current situation, if they obey some norm of belief formation, rather than make their minds up in some arbitrary fashion. Mutual understanding is made even easier if the norms that govern one's thinking are shared.

Mindshaping activities would be crucial in moulding young minds to model the norms that are prevalent in their group. The inculcation of character traits is also instrumental in the process since it steadies the mind providing the inclination and motivation to stick to the rules stably and consistently across situations even in the presence of incentives to ignore them. Mutual intelligibility is clearly epistemically beneficial to individuals and their communities since it is a necessary pre-condition for any kind of genuine teamwork.

Finally, mindshaping activities also mould the young into being more receptive to having their minds shaped by other people by inculcating in children dispositions to trust members of their community. The adoption of an unquestioning trusting attitude to their teachers makes the young more susceptible to being influenced by those from whom they are meant to learn. That is, it makes them more receptive to mindshaping activities.

However, there is wide social variation in the norms governing trust and distrust in different societies. In many groups trust is only extended to members of one's kin and is reserved to elders and selected others. Hence, children are often taught not to trust strangers (Henrich, 2020; Henrich et al., 2022). Partly because of increased dependence on strangers, modern Western societies are characterised by the novel creation of structures and tools designed to reduce the need for trust (O'Neill, 2002). This development has several facets. It includes the creation of standard units of measurement that could be easily independently verified so that a buyer does not need to trust the seller to know the quality and the quantity of goods that they are purchasing (Porter, 1995). It also involves the creation of indicators, ratings, and rankings so that individuals with no expertise of the subject matter can evaluate the performance of a person or organisation without needing to trust the judgment of experts on the matter (Espeland & Sauder, 2016; Nguyen, 2021b). There are many economic and political causes behind the rise of the so-called metric society (Mau, 2019). But some epistemic considerations might also have played a part.

We live in societies where we have become dependent for information on vast numbers of people several of whom have been educated in different cultures. We also need to engage in collaborative activities to solve complex cognitive tasks with individuals with whom we have little or no familiarity. These cultural differences and the absence of personal connections are obstacles to mutual intelligibility. These difficulties can be overcome in more than one way. One strategy is to enlarge the size of the cooperative niche by engaging in mindshaping activities aiming to scaffold trustworthiness and trusting attitudes. These strategies have their place, but they are of limited value among relative strangers with competing interests that need nevertheless to rely on each other to achieve some goal. It is in these contexts that the creation of metric and common standards can scaffold collective epistemic endeavours even in the absence of trusting attitudes.

However, as is well documented (Merry, 2016; Nguyen, 2021a; Scott, 1998), these instruments only work when the social realities they measure are modified to suit their measurement. As our societies evolve to become more dependent on technologies and more global, the increased epistemic powers of human beings are predicated on the scaffolding of their abilities within engineered niches which, because they rely on standardisation and simplification, might obstruct our understanding of other aspects of social reality. Equally worryingly, these processes of niche construction might eradicate some otherwise valuable aspects of social reality. Such developments are apparent, for instance, in Higher Education Institutions that have somewhat lost sight of some of the values animating teaching, research, and scholarship in the pursuit of positional success on league tables such as the QS World University Rankings (Espeland & Sauder, 2016; Moore et al.,

2017). A final advantage of adopting the scaffolded knowledge framework advocated in this article is its suitability to the study of these important novel social epistemic cultural phenomena.[10]

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ENDNOTES

[1] Thus, for instance, I stay clear of disputes between the so-called French and Californian schools about the role of imitation in human cultural evolution. See Sterelny (2017) for a comparison. I also avoid debates as to whether mindshaping presupposes mindreading or predates it (cf., Peters, 2019). What I say in this article does not depend on how these issues will be eventually resolved.

[2] In the philosophical literature there are several subtly different definitions of cognitive niche. See for instance Clark (2008); Sterelny (2003, 2010, 2014); and Stotz (2010).

[3] Niches can also be created by serendipity. For example, the creation of a path by the footfall of travellers greatly simplifies navigational tasks (cf., Marsh & Onof, 2008, p. 137).

[4] On cumulative effects see Tomasello et al. (1993) and Sterelny (2003, ch. 8). See Levy and Alfano (2020) on cumulative effects in the transmission of cultural knowledge.

[5] One may object that socially extended epistemology also provides a framework that is friendly to this approach. I present some reservations about the extended mind framework in section 3 below.

[6] That said, humans have also developed new skills necessary to acquire knowledge using complex equipment. In these cases, as exemplified by the refined observational skills required of radiographers, the use of tools has led to increasingly sophisticated abilities, intelligence, and expertise. Interestingly, these are skills that are very specific to narrow domains and do not easily transfer even to adjacent areas. This observation offers support for Millgram's (2015) claims about hyper-specialisation. Thanks to Rachel Fraser for pressing this point.

[7] Roughly speaking, the proper function of an activity or a mechanism is what explains its continued presence.

[8] See Westra (2020) for an argument that some mindreading capacities predate mindshaping. Mameli (2001) also appears to presuppose this.

[9] See Mameli (2001, pp. 612–613) for a review of the empirical evidence.

[10] Thanks to John Greco, and to the audiences of the Greco Feast organised by CONCEPT in Cologne and of the Aesthetics and Social Epistemology workshop organised by the Scottish Aesthetic Forum for their helpful comments and suggestions.

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