Scaffolding memory: themes, taxonomies, puzzles
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Abstract
Through a selective historical, theoretical, and critical survey of the uses of the concept of scaffolding over the past 30 years, this chapter traces the development of the concept across developmental psychology, educational theory, and cognitive anthropology, and its place in the interdisciplinary field of distributed cognition from the 1990s. Offering a big-picture overview of the uses of the notion of scaffolding, it suggests three ways to taxonomise forms of scaffolding, and addresses the possible criticism that the metaphor of scaffolding retains an overly individualist vision of cognition. The chapter is aimed at a broad interdisciplinary audience interested in processes of learning, teaching, and apprenticeship as they apply to the study of memory.

1. Introduction: scaffolding memory

We must learn to remember the particular events and experiences in our past. Infants have capacities to imitate and repeat, to know what to expect and what usually happens in specific contexts, and to remember isolated episodes (Bauer 2007). Building on these capacities, young children gradually gain the ability to locate specific past actions and experiences in time, and to understand them in terms of their causal, emotional, or narrative relations to other events (Nelson & Fivush 2004). Typically, autobiographical remembering of this more sophisticated form does not emerge until the child is 4 or 5 years old, and richer forms continue to develop throughout childhood, to such an extent that it can be seen as a social-cultural skill (Fivush 2011). Longitudinal studies increasingly reveal a range of individual and cultural differences and trajectories through adolescence and early adulthood in the forms and contents of the personal narratives that people spontaneously recall when remembering their past (Markowitsch & Welzer 2009; Reese 2009; Fivush et al 2011; Reese et al 2011).

Like other significant skills, learning to remember the personal past is a challenging and multifaceted process. The child must keep in mind (and forge links between) objects and events that are no longer present and, on some views, must come to grasp the structure of time and the temporal asymmetry of actions and events (Campbell 1997; Hoerl 1999; Sutton 2002). Alongside other components involved in the development of the sense of self in time (Moore & Lemon 2001; Reese 2002; Howe 2011), social interaction may be a vital factor in the development of autobiographical memory as parents or caregivers and children come to achieve together and maintain a form of joint attention to particular past events (Hoerl & McCormack 2005; Sutton 2007). Because children thus learn to remember in specific dynamic contexts, developmental psychologists often use the metaphor of 'scaffolding' to describe the interactive support relations involved. In this essay I critically assess the concept of scaffolding as it applies to human memory, drawing selectively on its applications throughout education and the learning sciences, developmental psychology, and theories of situated and distributed cognition. After a brief, big-picture overview of some central uses and definitions of the notion of scaffolding in historical and contemporary literature, I offer three related taxonomies of forms of scaffolding, seeking to clarify its domains and its dimensions. In sections 4 and 5 I then pick out two sets of puzzles about or problems for contemporary accounts of scaffolding in the philosophy and sciences of memory. The chapter is aimed at a broad interdisciplinary audience interested in processes of learning, teaching, and apprenticeship as they apply to the study of memory. A natural next step would then be the application of these theoretical concerns to empirical work of various kinds in the field, from ethnographic to experimental contexts.

One helpful initial account of scaffolding comes from Patricia Greenfield, who describes the metaphor as 'the basis for a theoretical model of the teacher in informal education' (Greenfield 1984, p.118). Explicitly anchoring her usage in its source domain, Greenfield suggests that the scaffold

> has five characteristics: it provides a support; it functions as a tool; it extends the range of the worker; it allows the worker to accomplish a task not otherwise possible; and it is used selectively to aid the worker where needed. (Greenfield 1984, p.118).

In his book *Being There,* which brought the concept to wider audiences across the cognitive sciences, Andy Clark identified scaffolding as an external structure used by complex systems like us 'to mold and orchestrate behavior' in adaptive or strategic ways (1997, p.32). In addition to the physical environment, Clark identified public language and culture as particularly 'advanced forms of external scaffolding' by which humans manage 'to squeeze maximum coherence and utility from fundamentally short-sighted, special-purpose, internally fragmented minds' like ours (p.33): in the picture of our mental lives as hybrid or distributed processes spread across brain, body, and world which Clark outlined, the intuitive notion of scaffolding included both social and environmental support, and also the enabling and constraining presence of, for example, 'institutions, the inner economy of emotional response, and the various phenomena relating to group or collective intelligence' (p.33, p.46, and *passim).*

These are deliberately broad accounts of 'scaffolding'. It is natural to ask if they are too inclusive. Roy Pea begins a helpful historical and conceptual survey by wondering if

> the concept of scaffolding has become so broad in its meanings in the field of educational research and the learning sciences that it has become unclear in its significance. Perhaps the field has put too much of a burden on the term, and we need a more differentiated ontology to make progress. Perhaps scaffolding has become a proxy for any cultural practices associated with advancing performance, knowledge, and skills whether social, material, or reproducible patterns of interactivity (as in software systems) are involved. This is surely too much complexity to take on at once. (Pea 2004, p.423; compare Stone 1998)

The small steps towards such a differentiated ontology which I take here do not involve firmly deciding whether the concept of scaffolding remains merely a metaphor or can be constrained sufficiently to be itself a useful theoretical term. In lieu of the systematic exercise in historical epistemology which that project would require, here I suggest only that the concept is still doing productive work across the disciplines. In particular, some natural problems about the ways it is currently applied have important implications that are worth considering afresh.

Consider immediate implications from the source domain. Scaffolding is, in general, not itself part of the building. Rather, it is when operating successfully, merely temporary, to be dispensed with at the appropriate stage of development. Use of the metaphor thus forces us to be clear about our unit of analysis. In studying psychological processes like remembering, can we and should we always identify the single biological organism as the central construction around which scaffolding arises? When we do justice to the extraordinary diversity and complexity of forms of scaffolding which themselves morph and shift at many distinctive timescales, what sorts of individuals or embodied minds will we identify there behind the scaffolds? I suggest that these are apt questions to ask at a time when the need to study interactivity over time in various kinds of collaborative, joint, or situated contexts or situations has never been felt so strongly, or its challenges appeared so glaring.

2. Scaffolding: cultural and developmental psychology

In 1976, building on studies of joint visual attention between mothers and infants (Scaife & Bruner 1975), Jerome Bruner and colleagues described an experiment on joint problem-solving through which they identified a number of 'scaffolding functions' played by a tutor (Wood, Bruner, & Ross 1976). Scaffolding processes in general, they suggested, involve 'the adult "controlling" those elements of the task that are initially beyond the learner's capacity': beyond the immediate completion of the task, this process can over time 'result, eventually, in development of task competence by the learner at a pace that would far outstrip his *[sic]* unassisted efforts' (1976, p.90). In particular, Wood and colleagues catalogued ways that tutors scaffold the young problem solvers' interest and motivation, emotions, attention, and perception of salience. They can channel the learner's cognition and action, reducing the available degrees of freedom or setting specific constraints on task sequencing; focus and direct the child's pursuit of the activity and the goal, often through a timely 'deployment of zest and sympathy'; and also intervene, verbally instruct, or directly model the requisite action, often in an idealized format (1976, p.98).

Bruner's interest in both verbal and non-verbal forms of instruction as cognitive technologies owed much to the work of Soviet psychologist Lev Vygotsky (Boden 2006, p.311). The discovery and creative reinterpretation of Vygotsky's work over the second half of the 20th century would be the central part of a full scholarly history of the idea of scaffolding (see Van der Veer & Valsiner 1992; Wertsch & Tulviste

1992; Bakhurst 2007; Caporael, Griesemer, & Wimsatt 2014). The concept of Vygotsky's which most directly fed these movements in developmental psychology and education was the 'zone of proximal development' or ZPD: this is the gap or space between what the learner can do alone, and what she can achieve 'under adult guidance or in collaboration with more capable peers' (Vygotsky 1978, p.86; Cole 1985). Vygotsky had also studied and theorized memory extensively, arguing that more basic memory capacities are entirely transformed over the course of development by our interactions with external psychological tools, those 'mediational means' by which we appropriate culture as we master the social practices of employing technologies and artifacts effectively (1978, pp.38-57; Wertsch 1988). Even simple sociotechnical operations such as tying a knot or marking a stick as a reminder 'change the psychological structure of the memory process' in that they 'extend the operation of memory beyond the biological dimensions of the human nervous system and permit it to incorporate artificial, or self-generated, stimuli' (1978, p. 39; see also Rowlands 1999, Menary 2007). Flourishing multidisciplinary research in the 1980s and 1990s put such ideas to work in ambitious cross-cultural field studies and innovative theory across cultural psychology, education, and anthropology. In traditions deeply attentive to the cognitive and affective effects of power and gender, researchers in these fields came to adopt the labels 'cultural-historical activity theory' and 'situated cognition' (Rogoff & Lave 1984; Rogoff 1990, 2003; Chaikin & Lave 1993; Scribner 1997; Lave 2011). The idea of scaffolding found a particularly productive home in developmental and lifespan psychology: Katherine Nelson, for example, moved from studies of language and narrative development towards a social-interactionist approach to autobiographical memory (Nelson 1993). As I described above, on such views discussions about shared past experiences between parent and child can scaffold joint attention to past events, so that the child gradually comes to think and talk spontaneously about both personal and shared experiences. Specific features of the interaction sculpt the form as well as the content of the child's own developing memory (Reese, Haden, & Fivush 1993; Nelson & Fivush 2000).

In many respects, through to at least the mid-1990s, these lines of work remained at a distance from the individualist mainstream in cognitive science, which still tended to treat contextual influences as mere input or triggers for the real cognitive processing in the head. So both developmental and cultural psychologists in these traditions, for the most part, remained silent on or hostile to mainstream computational and representational theories of mind, which were assumed to be irretrievably individualist. As a result, they did not at that period add to their increasingly mature bodies of empirical work any extensive accounts of the kinds of cognitive architectures which might be best shaped for incorporating or intensively coupling with external and social scaffolding. Nor did they typically delineate potential mechanisms by which the nature and content of interventions by parents and tutors might influence and enduringly transform the child's learning and performance in memory and problem solving (Sutton 2002). Arguably it took the influence of theorists who engaged more overtly and critically with mainstream cognitive science to begin to bridge these gaps. Edwin Hutchins' *Cognition in the Wild* (1995) emerged, in part, out of the meeting of cognitive anthropology with cultural psychology, but critically addressed the individualist assumptions of computational psychology directly: along with work on the dynamic development of motor control, Hutchins' ambitious new vision was a major influence on Clark's *Being There*. By the early years of the 21st century, ideas about embodied and distributed cognition and about extended mind were more visible across cognitive scientific practice and theory. In the case of memory research, they aligned with independent movements towards more ecological studies of autobiographical remembering in context (Michaelian & Sutton 2013). This lightning tour of the recent history of the contextual study of cognition and memory now sets us up for a more focused analysis of the range and application of the contemporary concept of scaffolding.

3. **Scaffolding: domains and dimensions**

Firstly, we can confirm that the picture of scaffolding identified by Bruner and colleagues still clearly animates increasingly mainstream research on many aspects of cognitive development. In a study of executive functioning in preschool children, for example, Bibok and colleagues operationalize scaffolding exactly along the lines suggested by Wood and colleagues (1976): it is 'the process by which tutors help plan and organize the activity of children so that they can execute a task that is beyond their current level of ability' (Bibok et al 2009, p.18). This is the broad consensus which I seek to explicate more precisely in what follows, by offering a series of taxonomies of the concept's domains of application. But first, for

completeness, it is worth briefly mentioning two distinct notions of scaffolding in other recent psychological literature so as to set them aside for current purposes.

In the context of 'the scaffolding theory of aging and cognition' (Goh & Park 2009; Reuter-Lorenz & Park 2014), scaffolding is a form of *neural* compensation, specifically 'the recruitment of additional circuitry that shores up declining [brain] structures whose functioning has become noisy, inefficient, or both' (Park & Reuter-Lorenz 2009, p.183). The use of 'scaffolding' in this framework has interesting relations to the mainstream developmental concept, and raises important questions in its own right: on another occasion, puzzles related to those I discuss below might productively recur in connection with the notions of cognitive reserve and compensation in work on aging and memory (Harris et al 2014). In contrast, a different account of scaffolding has been offered by researchers in the psychology of automaticity and the 'new unconscious': for Williams, Huang, and Bargh, 'scaffolding' is 'the passive, natural process through which new concepts are formed, especially in early childhood': distinct ontogenetic and phylogenetic scaffolding processes link or blend our concepts and goals, 'tethering' our thoughts 'to the physical environment in which they occur' (2009, pp.1257-8). Whatever the merits of the particular version of 'embodied cognition' which Williams and colleagues defend, their borrowing of the concept of 'scaffolding' is unhelpful: Niedenthal and Alibali (2009) rightly argue that it should not be taken to displace the 'quite different' and much more active notion of scaffolding available in the Vygotskyan developmental tradition.

With the relevant notion of scaffolding in mind, we can taxonomise its forms in at least three ways – by domain, by resource, and by timescale: roughly, by asking in turn what capacity is scaffolded, what is scaffolding it, and at what rate the resulting learning and transformation occurs. There are of course other ways to categorize the relevant phenomena, for example by examining variations in the nature of the learner, and extending the study of the scaffolding of individuals to the case of teams and groups. The point of all such taxonomies is to seek more differentiated ontologies, or to be in a position then to study the particular ways the notion might apply in specific contexts. Firstly, while my focus here is on scaffolding memory, many other cognitive and affective capacities and processes can be supported in relevantly similar ways. Current research addresses scaffolding, for example, in the development of motor control, language and narrative abilities, problem-solving, or skills involving executive control such as planning and attention-switching. This taxonomy by cognitive domain is perhaps the least theoretically significant: but making it explicit allows us to ask how distinctive forms of scaffolding operate in the development of such different cognitive processes. It can also remind us that in practice remembering is rarely isolated or neatly encapsulated, and also to examine its links with forms of scaffolding in other domains. Memory is involved in various ways, for example, in the operation of the various forms of 'visual scaffolding' which can assist design processes such as sketching or modelling in art, graphics, or architecture (Clark 2005; Murphy 2005; Schmidt et al 2007). Socially- or materially-supported techniques, strategies, or technologies in such areas of course rely on skilled expert use, which shows up in the ability swiftly to access appropriate information from long-term memory (Ericsson & Kintsch 1995; Geeves et al 2008). And some of the most important and under-studied forms of scaffolding occur in affective domains: our moods and emotions are constantly shaped, given precision or flavor, by way of social uptake, culturally-specific caring practices, or self-induced rituals and habits such as listening to music, going to a particular place, or just having another coffee (Griffiths & Scarantino 2009; Greenwood 2013; Colombetti & Krueger 2015). Such scaffolded forms of emotion regulation also involve memory of various kinds, including embodied memories of action as well as explicit autobiographical memories (Sutton & Williamson 2014).

A second way to taxonomise forms of scaffolding is to look at its agents or mediators, at the particular kinds of construction which support growth and development. Vygotsky rightly sought to look at social and material or technical forms of scaffolding together, and as our modern disciplines catch up with the possibilities for interaction studies we need to knit these projects together again (Enfield & Levinson 2006; Streeck, Goodwin, & LeBaron 2011). At the broadest level, we can distinguish scaffolding by other people and scaffolding by the inanimate world (Sutton 2006): but each category of course includes, at a finer grain, a range of quite distinct resources which can extend, assist, and transform cognitive and memory capacities.

Social scaffolding, first, includes parent-child or caregiver-child interaction: but even within families, the relevant support often spreads across siblings and across generations (Halbwachs 1950/ 1980; Bohanek et al 2006; Shore 2009, Miller & Fung 2012). The category of collaborative remembering includes many cases beyond the more asymmetric adult-child contexts typically studied in developmental psychology: friends and couples, work colleagues and team-mates, people with shared enthusiasms or experiences constantly exchange and renegotiate the meanings of past events (Sutton 2008a; Barnier et al 2008).

But because people share memories in specific contexts, secondly, we need to address the worldly aspects of the interconnected systems which compose ecologies of remembering. These include natural environmental resources such as the regularities of the physical world, the geographical and ecological structures of space and place, and of landscape and architecture, and the material properties of objects (Ingold 2000). Together such ecological resources can form unique topographies of remembrance for particular communities (Basso 1996; White 2009; Wood 2013). Over the last 100 thousand years or so, as a species we have also increasingly relied on more sophisticated and varied artifacts and technologies which we construct and recruit for cognitive, mnemonic, and social purposes (Donald 1990; Malafouris 2013). The capacity more reliably to transmit complex skills such as those required for making and deploying a flexible array of technologies was a central development in the evolution of cognition, occurring not because of any dramatic changes in our neural resources but because of gradual, interconnected changes in the structures of our environments and the organization of our social life (Sterelny 2012; Sutton 2013). Apprenticeship in skilled, characteristically human expert activities was and remains a hybrid process involving both supervised and unsupervised learning regimes, both direct instruction and the gradual pickup of lore, both formal demonstration and playful trial-and-error experiment (Sterelny 2012). The properties of linguistic and other tags and labels offer us further capacities, when necessary, to stabilize our thoughts and tools, and to collectively reflect on and improve our props and scaffolds, sharing or negotiating ideas and narrating possibilities, linking current concerns to events long in the past or plans for increasingly distant futures (Clark 1996, 1998; Jackendoff 1996; Sutton 2002). As cultural and institutional scaffolding systems expand, with an exponentially increasing array of larger, more hybrid social forms involving distinctive distributions of labour and of cognitive profile, we then create vast and interconnected forms of organizational scaffolding within which a range of distinct coordination practices emerge (Christensen 2013; Gordon & Theiner 2015). Finally, many resources to support memory and cognition which start out as external or technological can be transformed into internalized systems of self-scaffolding. We co-opt architectures and strategies from the external world which then allow us to carry out tasks without present assistance, or to learn to learn better (Vygotsky 1978; Clark 1997, 1998; Bickhard 2005; Mascolo 2005; Sutton 2006, 2010). As I discuss further below, it may then look like the scaffolding has been wholly dismantled as the individual operates unaided when, in fact, it has become internalized.

Note that even in listing these varied resources, it is clear that the scaffolding for cognition and memory does not come in neatly separable natural and cultural forms. Rather, both individually and collectively we create or at least mould many of the most significant features of the world on which we then rely: as a species, we have long adopted and adapted all kinds of natural resources which are thereby transformed as we incorporate them into our cognitive and social systems and practices (Clark 2003; Sutton 2008b). As Andy Clark puts it, we humans create whole cascades of props and 'surrogate situations' which allow us to 'routinely exceed the apparent limits of our basic modes of animal reason': these systems of 'technological and cultural props and scaffolds' can be seen as 'extended cognitive physiologies' reaching far 'beyond the flesh' (2005, pp.241-2). Typically we now remember past events, or simply re-enact well-remembered practices, in settings which inextricably link social, ecological, and technical resources alongside our neural and bodily capacities. The arrangements of utensils and environmental supports for cooking, for example, involves both 'the intelligent use of space' (Kirsh 1995) and complex, socially- and culturally-embedded practices for working together with other people (D. Sutton 2006). Likewise, when long-married couples remember their first meetings or the holidays they have taken together, or employ their shared memory skills to remember when and where they should be in daily life, they typically rely on a range of artifacts – diaries, notes, or new digital technologies – to support their collaborative recall (Harris et al. 2014).

Having sketched taxonomies of the domains in which scaffolding operates, the forms it takes, and the resources it involves, we can finally point to the range of timescales on which these processes operate (compare Gauvain 2005; van Geert & Steenbeek 2005). We have already seen that scaffoldings for memory and cognition developed over an evolutionary or phylogenetic timescale, as we collectively constructed unique kinds of cognitive niches (see also Menary 2014, Wimsatt 2014). Then there are a range of cultural-historical timeframes, as addressed by both archaeologists and historians, within which certain variations and developments in technology and institutional practices are themselves best seen as changes in human memory, rather than merely external influences on basic or constant internal cognitive processes (Smail 2008; Sutton 2010; Tribble & Keene 2011; Sutton & Keene forthcoming). Next, at the ontogenetic timescale, the central place of scaffolding in the child's development of the abilities to remember, imagine, and plan has been discussed above. These processes do not stop when childhood ends, and as I will argue further below scaffolding should be seen in the context of the lifespan. Finally, at more compressed timescales, much cognitive scientific practice is devoted to the study of richly interactive systems of scaffolding at the timescale of occurrent cognitive processes, as the interanimating array of resources I have just sketched takes unique forms to shape the content and form of specific cases of remembering.

A science of the scaffolded mind (Sterelny 2010) will operate across all of these levels, types, and timescales of scaffolding, identifying the key dimensions of variation in the ways that they relate and interact in distinctive contexts for specific tasks. With this framework in mind, I move on to address, in Sections 4 and 5 in turn, two related puzzles about the way that the notion of scaffolding is deployed in contemporary memory theory.

4. Puzzle #1. Must Scaffolding Fade? Internalization and Individualism

Because discussions of scaffolding have been anchored in developmental psychology, there has naturally been a focus on what Vygotsky saw as 'the distinguishing feature of human psychology': 'the internalization of socially rooted and historically developed activities' (1978, p.57). What must first be achieved interpersonally, as a child plays or works with an adult, or employs a culturally-embedded sign or tool, is reconstructed and 'transformed into an intrapersonal' process. After being unable to walk unaided, the child takes her first steps alone; after long needing adult assistance to read, she will one day manage to do so on her own; after talking about today's shared events, she will later come spontaneously to recall her past experiences in narrative sequence. Cognitive functions thus appear 'first, on the social level, and later, on the individual level' (p.57). Vygotsky himself was clear that these processes of internalization are complex and gradual, and that the external form of activity often continues or 'lasts forever.' But there is a temptation, in noting the pervasive nature of internalization in development, to think of scaffolding as temporary, and the developmental notion of 'fading' sometimes encourages us to think in terms of interpersonal capacities being at some stage transferred complete, once and for all, into the learner's head. For example, Collins, Brown, and Newman argue that

> Once the learner has a grasp of the target skill, the master reduces (or fades) his *[sic]* participation, providing only limited hints, refinements, and feedback to the learner, who practices successively approximating smooth execution of the skill (1989, p.456)

Discussing this use of the term 'fading', Roy Pea goes so far as to say that 'such a dismantling mechanism' is 'an intrinsic component of the scaffolding framework' (2004, p.431). His reasoning is that if a scaffold does not fade in this way, there would be no clear distinction between scaffolding and the 'much more pervasive form of cognitive support' that enables distributed cognition or distributed intelligence. Wondering whether a calculator which remains a fixed component of problem-solving activity can still be called a scaffold, Pea suggests that we need to distinguish the many activities enabled by new technologies which simply could not be performed without ongoing computing support from the kind of scaffolding that occurs in educational interactions between teacher and learner. Some forms of cognitive support are 'scaffolds-with-fading to be pulled down and whisked away once the learner is able to perform as expected without their use', whereas others 'serve in an ongoing way as part of a distributed intelligence scientific workbench and as fundamental aides to the doing of science whose fading is unnecessary and unproductive' (2004, p.442). These are interesting suggestions, but I will argue that we do not need the sharp distinctions towards which Pea is working here: neither between social scaffolding and

technological scaffolding, nor between tasks that require ongoing support and those which do not, nor at a theoretical level between scaffolding and distributed cognition.

The danger of enforcing such sharp distinctions and, in particular, of taking the fading or dismantling of scaffolding to be essential, is that we end up with what might be called a deficit model of scaffolding in which scaffolds are only or primarily needed and used when there is something missing in the learner. On that picture, external resources are required when or as long there is something lacking in the basic natural capacities, when the unsupported or naked system cannot perform specific activities, perhaps because the autonomous capacity has not yet developed, or because of some temporary obstacle or damage, or (at the other end of the lifespan, for example) because of irremediable decline. Certainly, on some occasions and in some contexts individuals perform tasks alone. In the case of memory, we are all aware of the richly sensory, emotionally significant, often viscerally engaging phenomenology of remembering, which can occur out of the blue in ways that do not seem to have a specific environmental trigger (Berntsen 2009). Some people are perhaps relatively more 'shielded', as we might say, from current stimuli and from social or ecological scaffolding, and in many contexts will pursue their own train of thought or focus on a path of deliberate recollection quite independently. Their cognitive capacities of course developed in specific contexts, but the impact of the developmental trajectory may be quite idiosyncratic. Yet no mature human memory system operates in isolation, and it is more productive for explanatory purposes to think not of a sharp distinction, but of a continuum between cases where scaffolding has been wholly dismantled and cases where forms of scaffolding remain actively integrated into ongoing processing. Or rather, cases of remembering may differ from each other in many distinctive ways, along many distinct dimensions. The nature of the scaffolding may differ, involving unique balances of social, technological, and environmental support. Variations in the mode and intensity of instruction shape the pace and nature of learning. Support may differ in its duration, forming more fleeting or more enduring systems, and in its reliability and the level or nature of trust invested in it. It may be more or less easy to adapt to and use certain forms of scaffolding in certain contexts, with some well-entrenched resources being fully integrated into a well-practised set of cognitive activities, while others remain more opaque in use and require more explicit attention. By locating specific cases in this kind of multidimensional space, we can turn an unproductive dispute about the boundary between scaffolding and distributed cognition into an empirically tractable set of projects, describing and exploring the characteristic features and patterns of different kinds of scaffolded systems (Wilson & Clark 2009; Sterelny 2010; Sutton et al 2010; Heersmink 2014).

From this alternative point of view, an exclusive focus on the fading of supports may then appear, as Pea later suspects, 'as a somewhat Puritanical concept' that is inappropriate not only 'for modern times' (Pea 2004, p.443) but for any full account of human cognition and memory. Looking for the independent autonomous agent behind the scaffolding would be a residue of individualism. In contrast, analyses of scaffolding can be productively allied (rather than contrasted) with work in the distributed cognition framework, in which mind and memory *remain* hybrid across the lifespan (Sutton 2014). Just as there is often a building or edifice that scaffolding supports, and which can be identified to some extent by its physical boundaries, so there is a biological entity, the organism, with its own characteristic patterns of activity which remain central across many distinctive interactions: but while the organism's *brain* traces one clearly located spatiotemporal path, its *mind* is not bound within the skull.

A person who continues to need and employ scaffolding is not thereby incomplete or deficient, although of course there are characteristic trajectories and transformations in the nature and use of distinct supporting resources over the lifespan. An initial reading of the developmental literature on autobiographical memory which I summarized earlier might suggest that once discussion about the past between parent and child has given the child the capacity spontaneously to recall events in the personal past, the interactive scaffolding comes to an end. This is not the right lesson: instead, we should see adult memory capacities and processes too as not only enabled by the mechanisms of our neural systems but also fundamentally entangled with and reliant on social, environmental, and cultural resources.

To sum up, it is true that certain forms of scaffolding are sometimes dismantled, for certain individual learners or groups, and for certain tasks. But such fading or dismantling is a cultural and/or individual achievement rather than the revelation of our deepest, most basic or primitive cognitive capacities. For the sciences of mind there is no reason to think that the essential level of analysis should be the

performance of the naked brain or the unscaffolded mind. Rather, human psychology is most characteristically seen and experienced in our tangled, dynamic interrelations with social, environmental, and technological systems. Instead of stripping away the scaffolding and the multiple influences in search of something pristine beneath, the explanatory task is to document and trace the many forms of scaffolding and the shifting cognitive constructions they support.

5. Puzzle #2. The Cultural Politics of Elaboration

Examining potential implications of the concept of scaffolding, I have suggested that the natural or biological capacities which underlie our rich mental lives are, in the case of human psychology, already thoroughly scaffolded and culturally-mediated. In modern Western society, we can easily over-invest in more extreme ideals by which self-sufficient and relatively detached individual minds are the norm: we can push this thought further by wondering whether the ideal of autonomous remembering by a solitary agent is something of a culturally specific liberal imposition, one result of the fact that most research in scientific psychology is done both with Western Educated Industrialized Rich Democratic or WEIRD subjects and participants (Henrich et al 2010). Other attitudes to and practices of cultural scaffolding for remembering, involving different attitudes to biographical coherence and to the centrality of the autonomous self, are possible and have been studied in detail in outstanding cross-cultural research (Leichtman et al 2003; Reese 2013; Wang 2013).

This very abstract concern can be put to work in a concrete research context. A key distinction in developmental work on parental scaffolding of children's memory is that between more elaborative or generative interaction, when parents talk about the past more richly and emotionally, and more repetitive, directive, or pragmatic interaction in which parents for example simply continue to seek a particular fact from the child (Reese, Haden, & Fivush, 1993). 'Elaborative' talk about the past on the part of parents – which, in most studies, both mothers and fathers tend to engage in with girls more than with boys – is in turn associated with earlier and richer spontaneous autobiographical remembering on the part of the child (Fivush 1994). This robust result is just one achievement of the social-interactionist tradition which, as noted above, sees the emergence of autobiographical memory as 'the outcome of a social cultural cognitive *system*, wherein different components are being opened to experiences over time, wherein experiences vary over time and context, and wherein individual histories determine how social and cognitive sources are combined in varying ways" (Nelson & Fivush 2004, p.487). Cultural as well as gender differences have been carefully tracked in these interactions: for example, Caucasian American children's spontaneous memories highlight the self more, in general, than do those of Korean children (Mullen & Yi, 1995).

There are conceptual connections here to our first puzzle about the implications of the concept of scaffolding. It may appear as if these results suggest that parental reminiscence style is the primary driving force behind the emergence of autobiographical memory, in that the structure and content of the child's early thought and talk about the past is provided to a large degree by adults, whose communicative actions simply form the scaffolding for such early memories. Perhaps the scaffolding metaphor itself encourages the thought that the direction of influence is one-way, from social and narrative context to the child's autobiographical memory capacities. But this may be a misleading interpretation of the results. Interactions coded as elaborative in this research perhaps include at least two distinct kinds. Sometimes the parent is primarily just offering or even imposing detail and vivid content about a particular aspect of the past event. But this is a distinct phenomenon from the related feature of contingency in conversation; a contingent utterance is related in content to the conversational partner's prior utterance, whereas some elaborations may not be directly relevant to the specific conversational context and thus not genuinely dialogical (Petra, Benga, & Țincaș, 2005). A better metaphor to catch the reciprocal and dynamic nature of these interactions might be that of a spiral process, in which the child's changing competence in dialogue about the past itself in turn directly influences the parent's reminiscence style, encouraging the dynamic co-construction of richer narratives (Haden, Haine, & Fivush 1997). It is as yet unclear how much the appropriate timing of responses and turns matters in comparison with matching or linkage of appropriate content between parent and child. If contingency of response is a distinctive factor in scaffolding the child's capacities, artificial agents might be a useful comparison. We want to allow for *mutual* influence between child and parent or between building and scaffold, in which a dynamic co-construction of memories involves an *active* child or learner. Again, there is an empirical spectrum of

possibilities here, since the relative influence of multiple concurrent processes can vary across cases cases (cf. Griffiths & Stotz 2000; Sutton 2009). Both individual and cultural differences are now being teased out in longitudinal research on memory development over time by many leading researchers in these areas. The nature of emotional interaction within collaborative memory will vary across cultures: while we know that trust and attachment are vital mediating factors, there is, as yet, little research connecting non-verbal and paralinguistic interaction between parent and child with the analysis of conversations about the past (Larkina & Bauer 2010).

To conclude, I have not suggested that we should jettison the metaphor of scaffolding, despite certain problematic tendencies or potential misinterpretations of its standard uses in the sciences of learning and memory. Rather, I have argued that sensitivity to the historical background of the concept can assist us in developing and sustaining rich, mixed-method studies of the diverse resources involved in most real-life practices of remembering. Integrating the methods of experimental psychology with immersive ethnographic projects, seeking to bridge the gaps between the lab and the rest of the sociocultural world from both ends at once, we can imagine research projects which address the interactions of distinct forms and timescales of scaffolding all at once.

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