CONSTRUCTIVE MEMORY AND DISTRIBUTED COGNITION:
TOWARDS AN INTERDISCIPLINARY FRAMEWORK

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1. INTERDISCIPLINARITY IN THE SCIENCES OF MEMORY

Memory is studied at a bewildering number of levels, with a vast array of methods, and in a daunting range of disciplines and subdisciplines. Is there any sense in which these various memory theorists – from neurobiologists to narrative psychologists, from the computational to the cross-cultural – are studying the same phenomena?

In this exploratory position paper, I sketch the bare outline of a positive framework for understanding current work on constructive remembering, both within the various cognitive sciences, and across gulfs between the cognitive and the social sciences. I pinpoint some lines of psychological theory and research which offer promising and compatible ways of thinking about individual memory and shared, social, or collective memory simultaneously. These are obviously ambitious projects, and this paper seeks more to elicit help with forging these connections than to present firm results. The aim is to draw out some consequences of empirical work on social memory and in developmental psychology.

I seek to integrate constructive memory with some broader movements in the cognitive sciences which can be called the 'distributed cognition' framework. 'Distributed cognition' labels a loose coalition of ideas from developmental psychology, cognitive anthropology, dynamical systems theory, robotics, and neuropsychology, ideas which have been influentially synthesized and extended by the philosopher Andy Clark (1997, 2001). As I acknowledge below, various strands of work in the

psychology of memory have long been influenced, directly or indirectly, by theoretical and empirical ancestors of present ideas on distributed cognition, so the possibility of this integrative work should not be too surprising. But current research on constructive remembering has not yet been explicitly linked with this new consensus about distributed cognition. Constructive memory offers a rich domain and a vast fund of data to distributed cognition theorists, while distributed cognition may prove a useful forum through which constructive memory theorists can anchor their work in the broader cognitive sciences.

The mind, on the distributed cognition perspective, is not only embodied (in brain and body) and embedded (in a natural and social world), but is also *extended* beyond the boundaries of skull and skin. Much of our cognitive life depends on our abilities to construct and exploit what Clark calls 'designer environments'. For particular present purposes we characteristically form temporarily coupled systems, both with other agents and with non-biological resources: what's striking about human brains is that they "make the world smart so that we can be dumb in peace" (Clark 1997, p.180; see section 2 below).

In arguing that there are some strikingly convergent ideas in recent work on constructive memory and on distributed cognition, I'm not of course suggesting that every aspect of the cognitive psychology or the neuropsychology of memory can be helpfully recast in these terms. But I do think that both research areas independently encourage work which bridges individual and social memory, again both

within the subdisciplines of psychology, and between psychology and the social sciences.

The idea is not, implausibly, to enforce a *unified* theory of memory along classical reductionist lines, but instead to delineate an integrated framework within which different memory-related phenomena can be understood. This is an exercise in *descriptive* (rather than prescriptive) philosophy of science, intended to systematize and elucidate existing local points of contact between (sub)disciplines, and to clarify key concepts whose empirical and theoretical basis already spans multiple levels of explanation.

Scientists working at 'subpersonal' levels, investigating neural mechanisms of memory, or constructing better models of memory systems, tend to display either a respectful neutrality towards social science, or active disdain at its perceived anti-naturalism. Neuroscientists' rhetoric suggests that bridges between humanities and sciences will come from the bottom up, via "the molecular and cognitive study of memory" (Squire and Kandel 1999, p.215). Some who study 'social' levels, in turn, think of cognitive and neuropsychology as important but irrelevant, or as irretrievably marred by individualism or reductionism. Others puzzle over the unity of the phenomena of memory: Susan Engel notes that "in recent years the topic of memory has become so popular, it seems both ubiquitous and yet oddly invisible. People glide seamlessly from a discussion of childhood recollections to national memories, as if they were part of the same phenomenon" (1999, p.viii). Recent cross-disciplinary gatherings (Schacter 1995; Fara and Patterson 1998; Schacter and Scarry 2000) have succeeded more in helpfully juxtaposing excellent work from different disciplines than in actively fusing concepts, methods, or results.

Psychologists of memory are increasingly aware of the need for empirically-sensitive synoptic overviews of the field. Clarity is to be sought not through detailed armchair evaluation of experimental work, but in careful immersed engagement with selected areas of the contributing sciences. Endel Tulving, recom-

mending new attention to conceptual clarity, recently complained that "our research community as a whole does not perceive much value in conceptual analysis; there is no promise of social reinforcement for any single individual who might be attracted to the enterprise" (2000, p.34). If we see interdisciplinarity and specialization not as competitors but as "mutually reinforcing strategies" for retaining flexibility and diversity in knowledge production (Weingart 2000, p.40; cf. Sperber 2003), then the identification and analysis of concepts which already fall across current disciplinary bounds should provide one minor role for philosophers in the division of research labour on memory.

The subpersonal and the social

More specific needs for new ways of dealing with subpersonal and social aspects of memory at once are identified in two papers in the recent special issue of *Memory* on the functions of autobiographical memory. In his commentary, Martin Conway wonders how the work described in that issue on the self, social, and directive functions of autobiographical memory can be integrated with other highly productive current research on the relevant "cognitive-affective mechanisms and processes" which are "more internal to the entire system" (Conway 2003, p.223): we must seek a "unified account" to deal simultaneously with these subpersonal factors and with issues of the overt "use of memories in everyday life"[1]. So Conway is asking, firstly, for better integration of empirical methods and findings across the relevant subdisciplines of psychology; and, secondly, for better theoretical frameworks for thinking about mixed subpersonal, personal, and social levels of explanation simultaneously.

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[1] This hope for a unified account clearly sets a more productive agenda than any assumption that social and subpersonal work must be in competition. It is equally welcome that Conway dismisses the idea that models of memory must be *either* correspondence *or* coherence theories (2003, p.222).

Meanwhile, in a provocative contribution to this special issue, Katherine Nelson argues that autobiographical memory depends, to a significant extent, on historically and culturally specific practices and assumptions about individuality and the past (Nelson 2003). She makes a start on the difficult process of assessing claims about the nature and structure of memory in developmental psychology against literary-historical analyses of autobiographical genres and other past forms of self-expression, and vice versa. So Nelson is asking, firstly, for better interdisciplinary integration of the psychology of memory with traditionally humanistic disciplines; and, secondly, for better theoretical frameworks for thinking about aspects of autobiographical memory which may only be well understood by working simultaneously at psychological and cultural-historical levels of explanation.

These are yet but wishes, and any institutionally-sanctioned hype about the current success of such interdisciplinary dreams can still be reasonably met with some scepticism. But I hope to argue that Conway's and Nelson's wishes are at least appropriate ones for the sciences of memory, that the quest for such interdisciplinary frameworks, however distant and difficult, is potentially productive. My broader project is beginning to address both institutional and theoretical criteria for successful interdisciplinarity, examining both the place of memory research in cognitive science as a whole (see for example von Eckardt 2001, p.468), and existing philosophical attempts to specify the requisite interdependence between phenomena characterized by different disciplines (Kitcher 1992, pp.6-7; Sutton forthcoming 2003). The psychology and neuroscience of memory already supplies a range of keenly-disputed case studies in philosophical disputes about reduction, levels, and interdisciplinary theory-construction (Stoljar and Gold 1998; Schouten and Looren de Jong 1999; Bechtel 2001). My own sympathies here lie with philosophers of science who prefer to bypass questions of reduction in favour of positive descriptive accounts of the mechanisms and activities actually postulated in the experimen-

tal neuropsychology of (for example) spatial memory (Craver and Darden 2001; Craver 2002). But this important work addresses relations between neural and cognitive sciences of memory, and is not easily applicable to relations between the cognitive and the social sciences. So for current purposes, hoping to touch Conway's and Nelson's concerns, I look here at issues which point to the relevance of factors outside the individual[2].

Constructive remembering

The final preliminary work required here is briefly to pick out, at a decidedly abstract level, some core guiding assumptions which I take to be characteristic of cognitive and developmental psychologists' striking consensus about the constructive nature of remembering[3]. "A variety of conditions exist", notes Daniel Schacter, "in which subjectively compelling memories are grossly inaccurate" (1996, p.22).

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[2] But I stress that this perspective should be compatible with a wide range of views about the internal processes of memory. Where some enthusiasts for the kind of dynamical approaches to cognition draw explicit anti-reductionist morals, I agree with Bechtel (2001) that interactions between coupled components of complex systems can often still be understood by mechanistic decomposition. And where some argue that the radical context-dependence of memory processes rules out principled distinctions between putative memory systems, I see dynamical and distributed views of cognition as in no way intrinsically incompatible with systems thinking, which must be judged directly on the various logics of neuroimaging, neuropsychological, and phenomenological evidence. Generally, the distributed cognition frameworks differ from purely social- and personal-level approaches in explicitly requiring attention to the neuropsychological details of subpersonal memory processes.

[3] One driving factor in the entrenchment of this consensus, after the bitter controversies of the early 1990s over ecological 'versus' laboratory approaches to memory, may have been the political and institutional crises over recovered memories in mid-1990s, which encouraged many academic psychologists to forge some agreement and some clear research programmes in constructive remembering by the late 1990s. Obviously, this speculation on the recent history of the discipline needs careful sociological and historical support.

As Schacter and his colleagues have themselves demonstrated, of course, neither 'accuracy' nor 'reliability' is a transparent notion in this context, and 'truth' in memory, though not forever inaccessible, is neither a single nor a simple thing. I cite two general themes from work of the last ten years which I will then echo in outlining the distributed cognition framework.

Among the multiple causes driving even simple cases of remembering, psychologists increasingly focus on the context of recollection, rather than solely on encoding or on the nature of encoded traces. Contrary to some direct realists' assumptions, representational theories of memory do not have to assume that recall is fully determined by the nature of the stored representation. On Tulving's notion of 'synergistic ecphory', memory traces are "merely potential contributors to recollection": the engram is not the memory, and instead "the [current] cue and the engram conspire" in any act of episodic remembering (Schacter 1996, pp.56-71, 105). As Susan Engel puts it, "one creates the memory at the moment one needs it, rather than merely pulling out an intact item, image, or story", so that specific features of any context of recall may be direct causes of the content and format of the memory-as-retrieved (1999, p.6).

Secondly, cognitive psychologists have come to accept more flexible and dynamic pictures of long-term 'storage'. This is partly due to the influence of connectionist or Parallel Distributed Processing (PDP) models, but also to a rich array of empirical studies on misinformation, bias, and the role of schemas in memory. This internal plasticity is one of the most curious and characteristic features of human memory, and one which clearly differentiates our cognitive systems from current digital computers. It's pretty useful for the contents of our files to remain exactly the same from the moment I close them at night to the moment I open them again in the morning. But various kinds of reorganization and realignment often happen to the information retained in my brain over the same period. And in certain contexts, particular individuals are signifi-

cantly susceptible to suggestion, or to failures of source memory (Mitchell and Johnson 2000), even in relation to autobiographical memory (Hyman and Loftus 1998). Distortion and misattribution, as Schacter firmly argues, is not necessarily unadaptive (1999, p.190): various memory errors sometimes result, for instance, from vital forms of generalization on the basis of similarity and theme which "may give rise to distortions as an inherent byproduct" (McClelland 1995, p.84)[4]. Engel may overstate a little in writing that "it is the norm rather than the exception to be unable to distinguish between what happened, what you feel about what happened, and what others may have said about what happened" (1999, p.16). But the source monitoring framework at least suggests that understanding the conditions in which such confusions occur will require attention to a large range of motivational, social, affective, and temperamental contextual factors which influence the mapping of information to source.

But a psychology which deals with such complex causal webs needs explicit accounts of the relations between inner and outer states and processes. The idea that cognitive psychology studies the individual mind, leaving social processes to be treated by the social sciences, here looks harder to maintain. What are the routes for memory theory to move beyond skull and skin?

2. DISTRIBUTED COGNITION AND THE EXTENDED MIND

Although memory is an obvious example for theorists of distributed cognition and the extended mind, few of them have sought to connect their claims with mainstream psycho-

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[4] This point is relevant to philosophical views on memory's role in maintaining continuity of personal identity over time. Where many theories of identity look at our current contact in memory with *specific* episodes in the personal past, it may be, as Marya Schechtman argues, 'precisely insofar as our memories smooth over the boundaries between the different moments in our lives ... that we are able to produce a coherent life history' (1994:13).

logical discussions (but see Rowlands 1999, chapter 6). Here I describe core claims of the distributed cognition framework in order to show that constructive memory exemplifies the approach. This will set the stage for a better account of relations between individual and shared or social memory phenomena.

Andy Clark writes that "we humans are natural-born cyborgs, factory-tweaked and primed so as to participate in cognitive and computational architecture whose bounds far exceed those of skin and skull" (2001, p.138). Many cognitive processes – writing an academic paper, finding my way around a complex environment, producing an abstract artwork – are hybrids, involving brain processes, bodily dynamics, and external resources such as notes, maps, and sketchpads[5]. Cognition depends on multiple loops between brain, body, and (physical and social) world. Focussing on the embodied skills needed for flexible and appropriate action, theorists of distributed and appropriate action, theorists of distributed cognition suggest that in particular contexts it is essential to lean on the technological or social resources of external symbol systems or other people (Hutchins 1995). So in some circumstances, things can have a cognitive life: notebooks, incised sticks, slide-rules, software devices, fingers, public languages and other symbol systems, rituals and monuments, as well as friends or family members become components in broader coupled systems, with cognitive tasks performed by the brain alone simplified and plugged in to this wider network.

[5] These distributed cognition claims have stronger and weaker readings, and have both metaphysical and methodological strands. Most philosophical discussion so far has focussed on the metaphysical issue of whether cognitive processes 'really' are partly external. But for present purposes the methodological claims defended by Clark, Rowlands, Hutchins and others are sufficient: the best way to investigate and explain many cognitive processes, they suggest, will be to understand the extended hybrid systems in which embodied brains are embedded. The best introduction to the field is Clark 1997, which also analyses relevant work in robotics which I don't mention here. See also Clark and Chalmers 1998.

Even this rough sketch confirms the radical context-sensitivity of distributed or extended cognitive processes. Because we are skilled in locating and exploiting specific external resources for particular action-oriented processing, we do not need to hold full and detailed internal representations of all relevant aspects of the world: much information can be left out in the environment, as long as we are able to find the relevant scaffolding or symbol systems when required. Linked in various forms of 'continuous reciprocal causation', brain and world are often engaged in an ongoing interactive dance from which adaptive action results (Clark 1997, pp.163-6). Tim van Gelder explains the motivation for seeing genuinely cognitive processing as extending out of the skull: "since the nervous system, body, and environment are all constantly changing and simultaneously influencing each other, the true cognitive system is a single unified system embracing all three. Interaction between the inner and the outer is ... a matter of coupling, such that both sets of processes continually influence each other's direction of change" (van Gelder 1995, p.373). Further, the same stress on the plasticity of internal representation as we saw in the constructive memory framework is relevant here. It's just *because*, as the connectionist maintains, isolated items are not stored distinctly and permanently in the brain that our relatively unstable biological memories are supplemented by more stable external scaffolding and props.

The idea that 'external memory' is neither merely metaphorical, nor a straightforward expression of more fundamental mental representations, does not rest on the idea that some external 'representations' - information in notebooks, for example, which meets certain criteria of accessibility and reliability - are *identical* to internal mental representations. Instead, the core idea is that quite disparate internal and external elements are simultaneously coopted into larger integrated systems, which have capacities distinct from those of either inner or outer elements alone. The external media on which we rely as cognitive scaffolding are, as Clark argues, "best seen as

alien but *complementary* to the brain's style of storage and computation. The brain need not waste its time *replicating* such capacities. Rather, it must learn to interface with the external media in ways that maximally exploit their peculiar virtues" (1997, p.220). For example, our internal working memory, with its limited capacity and unreliability, is not duplicated in the various systems of 'exograms' which humans have produced: "unlike the constantly-moving and fading contents of biological working memory, the contents of this externally-driven processor can be frozen in time, reviewed, refined, and reformatted" (Donald 1991, p.316).

This 'complementarity' argument opens the way to the idea that cognition is (at least) doubly distributed, across internal neural networks and across external artefacts and social groups. As sciences of the interface, theories of memory won't legitimately stop at the boundaries of the individual. A general metaphysics of traces inside and outside the brain would not *collapse* the differences between internal and external representation and processing, but would offer a framework for investigating how our interactions with different forms of external social and information systems might in turn affect the format and processing of individual memories.

But different external media for the storage, transmission, and transformation of information have their own peculiar virtues. The various kinds of memory scaffolding which humans have used, from knots, rhymes, codes, and sketches to artificial memory techniques, photographs, books, and computers each have different properties. The resources of the historian and social scientist may again be included in cognitive science (Sutton 1998). While the enduring and expandable nature of many external symbol systems has indeed altered the informational environment in which brains develop, media theorists and cognitive anthropologists remind us that not all such systems are designed to hold information permanently in context- or medium-independent fashions, and that not all those systems which are de-

signed to do so actually succeed (Kwint 1999; Renfrew and Scarre 1999).

Yet the communal, transmissable bodies of knowledge which do pervade human culture are not merely convenient holding-pens for information too unwieldy to store internally. Instead, they are essential tools for thinking which often alter the cognitive processes in which brains, bodies, and external symbol systems are all entangled. As Clark argues, the internalizing of relatively context-free representational formats brings new cognitive possibilities and burdens: "by 'freezing' our own thoughts in the memorable, context-resistant, modality-transcending format of a sentence, we create a special kind of mental object - an object that is amenable to scrutiny from multiple cognitive angles, is not doomed to alter or change every time we are exposed to new inputs or information, and fixes the ideas at a high level of abstraction from the idiosyncratic details of their proximal origins in sensory input". (Clark 1997, p.210). By thus assimilating particular kinds of props and pivots over the course of cognitive development, we regulate our own minds, imposing an approximation of rigidity and inflexibility on our mental representations.

These broadly Vygotskian considerations, again, should not be too surprising to the many psychologists of memory influenced by the rich ecological and developmental work of the past twenty years. The shared intellectual heritage is perhaps most apparent in discourse-analytic work on collective remembering (Middleton and Edwards 1990) and in the psychology of conversational remembering (Hirst, Manier, and Apetroaia 1997; Hirst and Gluck 1999), as well as in the social-interactionist tradition in the development of autobiographical memory which I examine briefly in section 4. But first I suggest that the overarching distributed cognition framework offers fruitful ways to characterize the links between the psychology of individual memory and cross-disciplinary research on social and collective memory.

3. CONSTRUCTIVE MEMORY AND COLLECTIVE MEMORY

In connectionist work on constructive memory, different contexts of reconstruction condition the constructed internal representation (McClelland and Rumelhart 1986, p.193; McClelland 1995, pp.69-70). How can the connectionist mechanisms of transformation and distortion on internal representations be set into a broader picture of the operation of personal memory in an intricate interpersonal and cultural world? Experience attunes us to certain information or regularities or artefacts which we can exploit for particular present purposes (Rumelhart, Smolensky, McClelland, and Hinton 1986). This is not to deny, **as earlier** Gibsonian realists about memory often did (Wilcox and Katz 1981; see Sutton 1998, pp.283-290), the importance of our capacity sometimes to remember experiences which are *not* retained in some external medium, but to suggest that we may only understand such capacities fully by attending also to our habitual uses of present resources on which to anchor our versions of the past[6]. Cognitive scientists will not always be able legitimately to ignore the transmission and transformation of external representations, while (conversely) some explanations in the social sciences of memory will refer to appropriately flexible internal processes of schematization or reconstruction

(for a compatible general proposal about the role of cognitive science in a naturalistic social science, see Sperber 2000).

There's widespread scepticism about the very idea of "collective memory". Materialists are uneasy about the taint of Jungian archetypes, or morphic resonance. And even sociologists and historians who work on what seem to be social memory phenomena try to disclaim the notion. James Young, working on memories of the Holocaust, prefers to use the term 'collected memory' instead of 'collective memory', because "societies cannot remember in any other way than through their constituents' memories" (1993, p.xi; compare Gedi and Elam 1996; Winter and Sivan 2000, p.1; Klein 2000). Discussing the great sociological theorist of collective memory, Maurice Halbwachs, Fentress and Wickham worry that his concept of collective consciousness was "curiously disconnected from the actual thought processes of any particular person", leaving later sociological accounts with the danger of treating the individual as "a sort of automaton, passively obeying the interiorized collective will" (1992, pp.ix-x). This widespread embarrassment is understandable among sociologists and historians seeking explanatory models which are both flexible and naturalistic. But it isn't necessary.

Although not my aim here, it's possible to find a more subtle, and more plausible, account of the relations between individual and collective representations in Halbwachs' own work[7]. It's true that he was highly critical of the individualism of psychological theory between the wars, but his positive, anti-individualist views do not rest on mystery. For Halbwachs, briefly, "there is no point in seeking where memories are preserved in my brain or in some nook of my mind to which I alone have access: for they are recalled to me exter-

nally" (1925/1992, p.38)[8]. The people and groups around me normally "give me the means to reconstruct them". Collective frameworks of memory are not the simple product of isolated individual memories, constructed after the fact by combinations of separate reminiscences, but are rather, in part, their source, the instruments used in the particular acts of recall. There's a sharp contrast, argues Halbwachs in an intriguing chapter on dreams, between remembering and the actual "state of isolation" of the dreamer, who isn't capable directly of reliance on the frameworks of collective memory: "it is not in memory but in the dream that the mind is most removed from society" (1925/1992, p.42). So in ordinary remembering, which is either actually or potentially shared, it is the public scaffolding of various forms, in the physical, symbolic, and mnemonic environment, which triggers the specific form and content of individual memory. The contemporary sociologist Paul Connerton puts the point strongly: "it's not because thoughts are similar that we can evoke them; it is rather because the same group is interested in those memories, and is able to evoke them, that they are assembled together in our minds" (1989, p.37).

Blunt claims like these no doubt strike many psychologists as not simply anti-individualist, but as anti-cognitivist: how can there be a cognitive science of memory which includes or even allows for such a displacement of explanatory relevance from the individual mind/brain to the natural or cultural world? But what should be questioned in this reaction is the assumption that information-processing commitments automatically rule out notions of external or collective memory. Some flagship work in distributed cognition explicitly *requires* broadly computationalist/representationalist assumptions: Edwin Hut-

chins' influential analyses of the distributed processes of navigation on a modern ship, for example, rely on the possibility of tracing the flow and transformation of representations over a series of machines, media, and human agents (Hutchins 1995). Mainstream cognitive-scientific investigation into representational distortion and transmission is here simply being extended outwards.

Currently engaged in a detailed review of applications of notions of social and collective memory in history, sociology, and anthropology, I find much work which is entirely compatible with cognitive science, even if it might sometimes be improved by analysis in terms of memory systems or constructive remembering. Michael Schudson has classified forms of collective memory, arguing for distinctions between three kinds: socially mediated individual memories, cultural forms and artifacts which hold and interpret the past for social mediation, and individual memories which are in turn constructed from the cultural forms (1995; compare Zelizer 1995, and the review by Olick and Robbins 1998). The main concern for a naturalist about this social-scientific work should not, I suggest, be the danger of seeing collective memory as floating free of individuals, but rather the temptation to overlinguisticize the form of the internal representations which construct and are permeated by collective memories. Halbwachs sometimes wrote like this, arguing for instance that "one cannot think about the events of one's past without discoursing upon them" (1925/1992, p.53), and the powerful influence of Russian psychology on Anglophone developmental theory often has the same result (Bakhurst 1990). This is to project too quickly the format of external, expressed memories back inwards onto internal memory. But this linguistic-constructivist conception of mental representation, which *is* at odds with the post-connectionist cognitive science I've described, is not necessary: my memories can be called forth socially, moulded and formed by external influences, without having themselves to be, in their internal aspect, linguaform.

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[6] Autobiographical memory is thus a key domain for distributed cognition theorists. Our abilities to think about events which are not current, or the people and objects of long ago, show that mental life isn't wholly determined by the current environment and the immediate needs of the organism. 'Representation-hungry' abilities like this give us a general motivation for postulating mental representations, with which to counter anti-representationist proposals by radical enthusiasts of dynamical and distributed cognition. But the increasingly sophisticated analyses of the context of recollection in the psychology of autobiographical memory do hint at the variety and significance of environmental and social framing triggers with which partial and action-oriented internal traces must conspire. For a synthetic critical analysis of philosophical objections to memory representations see Sutton 2003a, section 2.

[7] Another compatible project is the application to memory of promising philosophical work in social ontology, which seeks to naturalize notions like "joint action" and "mutual knowledge". See for example Gilbert 1989.

[8] The view that Halbwachs simply neglects psychology is unfortunately and erroneously supported by this translation, which simply omits the bulk of the early chapters of Halbwachs' work, which cover dreams, language, constructive memory, and the localization of memories.

One way to confirm this point is through an examination of the history of the concept of 'schema' in 20th-century psychology of memory. This reveals cognitive anthropologists and psychologists struggling to find a vocabulary for relations between internal and external memories which neither collapses the distinction nor sees the internal as simply the reflection of the social. When Bartlett imported the term into the field from neurophysiology, he worried about its implications of stasis: "I strongly dislike the term 'schema'. It is at once too definite and too sketchy. ... It suggests some persistent, but fragmentary 'form of arrangement', and it does not indicate what is very essential to the notion, that the organised mass results of past changes ... are actively *doing* something all the time" (1932, p.201; compare chapter 18 on Halbwachs). So a 'schema' is not, in one sense, a definite cognitive structure at all. For Bartlett, a schema has both a conservative and a creative aspect, tending both to homogenize or conventionalize the new, and to support innovations around established themes.

The concept of a schema need not imply a settled structure in order for it to play its required explanatory roles. As an enduring but modifiable set of tendencies or dispositions, a schema may usefully be invoked to explain, for example, the way a story may be normalized in the remembering and retelling, with the schema driving easy inferences to uncertain or untold parts of the story. Cognitive-psychological accounts of the schema were implemented in connectionist models in the 1980s. The history of past processing is 'stored' in the (enduring but modifiable) matrix of connection weights of the neural network, and thus influences the processing of new and related input (Rumelhart, Smolensky, McClelland, and Hinton 1986). Cognitive anthropologists have found this a useful way to model, simultaneously, both the 'centripetal' forces of cultural reproduction and the competing 'centrifugal' processes of variation and inconsistency. Claudia Strauss and Naomi Quinn, for example, employ the connectionist version of schema theory to show how cultural

learning produces responses which are permeated by tradition and yet not rigidly repetitive. Remembering occurs on the spot, in a context, and yet can be guided (without being determined) by cultural norms: because connectionism emphatically rejects a linguistic model of internal memory, it's easier to see that the traces culture leaves on and in individual brains and bodies are not downloaded *copies* of any specific cultural instructions, but rather flexible and particular action-oriented responses (Strauss and Quinn 1997, chapter 3). The dynamics of intrapersonal thoughts, feelings, and motives may be quite different from those of extrapersonal messages and practices, even if we deliberately focus attention on cases in which the boundaries between the two realms are permeable.

DISTRIBUTED COGNITION AND THE DEVELOPMENT OF AUTOBIOGRAPHICAL MEMORY

I address, finally, a body of research closer to the heart of the constructive memory framework. The developmental psychology of memory, especially the social-interactionist tradition on which my brief remarks here focus, should be of great interest to theorists of distributed cognition; and in turn, the distributed cognition framework may offer developmentalists some useful pluralist tools for embedding their research in a broader cognitive-scientific context[9].

Social-interactionists argue, in the extreme, that "early reminiscing begins as an interpersonal process and only becomes intrapersonal over time" (Engel 1999, p.27). They thus set the study of interpersonal dynamics, culture, and narrative genre in the child's linguistic environment at the heart of the study of the origins of autobiographical memory. Children develop from using generic event memories implicitly, like scripts, to understand regular routines and generate expectations, to commanding perspectival temporal

[9] I discuss this topic more fully in Sutton 2002, from which parts of this section are drawn.

frameworks in which to locate memories of idiosyncratic events. Memory sharing practices initiated by adults encourage the idea of different perspectives on the same once-occupied time, until children can take memories as objects for shared attention and negotiation (McCormack and Hoerl 1999, pp.173-4). Following the Vygotskian inspiration for the distributed cognition framework, developmentalists look for traces left in more mature cognitive capacities by the idiosyncrasies of the particular trajectory across interpersonal scaffolding which has been gradually internalised in development (Clark 1997, chapter 2). This is an enabling cultural sculpting of the child's mind, which runs alongside and is intimately tangled with the productive cultural shaping of their body, skills, and behaviour. In the case of memory, children start to talk and then think autobiographically in ways which are shot through with their local narrative conventions (Fivush 1991; Nelson 1993; Nelson and Fivush 2000). Impressive empirical research, including recent cross-cultural work, shows how variations in narrative practices reappear in subjective idiosyncrasies of early remembering, as children begin to be able to tell others about their past, and to develop a life history (Engel 1999; Macdonald, Uesiliana, & Hayne 2000; Wang 2001; Reese 2002a).

Intricate issues in interpreting this flourishing research tradition arise in working out how to study longer-term effects of these individual and cultural variations on later autobiographical memory; and in understanding the precise role of language in shaping internal representations. Although Fivush, for example, occasionally writes as if the format of autobiographical memory is *itself* linguistic or language-like (1994, p.138), this is not essential to the social-interactionist tradition. The tradition might be better served by the distributed cognition theorists' idea of language as a public artifact which shapes and transforms quite different kinds of internal representations and computations (Clark 1997, chapter 10). The potential utility of this perspective is apparent when we ask how language, culture, and narrative genre interact with other relevant factors

such as the development of a 'self-schema' and of meta-representational capacities. Some who stress these alternative perspectives see their work as in direct competition with the social-interactionist framework (Howe and Courage 1997, Perner 2000): Howe and Courage, for example, argue that the individual differences in autobiographical memory studied by social-interactionists are likely to be "related to maturational, not social or experiential, factors" (1997, p.515). Although other proponents of more 'internal' factors have taken a more pluralist line (Conway and Pleydell-Pearce 2000, p.279), and although some integrative models have been developed from within the social-interactionist tradition (Welch-Ross 1995; Reese 2002b), there is a need for positive unified accounts to show just *how* social and subpersonal factors might be entangled.

A key idea here from the distributed cognition literature is that regular outcomes often result from reciprocal interaction between different elements of extended developmental systems. Any 'inheritance' of cognitive capacities would thus itself be extended (Griffiths and Stotz 2000). Like the physical and social environments, narrative environments are usually reliably recurrent, within certain ranges, under normal conditions: the major cultural shifts in norms relating to autobiographical memory hinted at in Nelson's programmatic grand historical narrative (2003) are then periods where, unusually, there have been sharper alterations in these narrative environments. So the idiosyncratic features of individual autobiographical memory are constructed anew in each generation, through complex interactions of many inner and external parameters. Reference to 'innate' or 'maturational' processes in the study of cognitive development is then little more than a promissory note for the future progress of developmental sciences of the interface (compare Griffiths 2001).

And an intriguing specific empirical application of this developmental systems framework to the case of autobiographical memory is suggested by some recent longitudinal studies. Harley and Reese (1999; compare Reese 2002b) claim that their evidence

shows the existence of different pathways to early autobiographical memory. Children who are early self-recognizers (according to the self-recognition tests described by Howe and Courage) may find their way to autobiographical memory in a fashion that is rather more independent of the linguistic environment. Late self-recognizers, in contrast, may need to use linguistic and narrative scaffolding more extensively to achieve similar autobiographical memory capacities. Self-recognition and parental reminiscence style, then, may predict different aspects of children's talk about the past (Harley and Reese 1999, p.l345).

Whatever the empirical fate of this particular pluralist idea, the general line of thought is highly suggestive. For some children more than others, early talk about the past shapes the particular ways in which thoughts about the past are gradually stabilized, rendered less dependent on context, and opened up for repeated inspection and manipulation. For them, the verbalization of thoughts about the past, either in family recounting or (later) in private inner speech, may change their content, as locally-available cognitive props and pivots come to anchor and structure the representational system. Integrative options for investigating such proposals might in future include neuroimaging studies to test specific developmental hypotheses about the causal pathways of autobiographical memory acquisition; and cognitive neuropsychological case studies of specific patterns of breakdown in the relation between individual brains and the narrative environment.

While these proposals are as yet loose and over-general, they do at least illustrate how the two aims of this paper might be put into practice. Like the case of social and collective memory, the example of the development of autobiographical memory, firstly, suggests how constructive memory and distributed cognition share a range of theoretical commitments which can usefully be rendered more explicit. Secondly it offers hints that, even if neurobiologists and narrative theorists are not studying the same phenomena, the idea of constructing a positive framework in which their

different investigations into memory might be located could one day look a little less hopeless[10].

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