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Abstract	This essay homes in on two related aspects of Aristotle's account of memory, one often noted but sometimes discounted, the other of more speculative import. These features may not be the most central, either for Aristotle or for his interpreters, but they matter in their own right, and raise questions of independent historical and conceptual interest.	

Chapter 8
Movements, Memory, and Mixture: Aristotle, Confusion, and the Historicity of Memory

John Sutton

8.1 Introduction: Memory, Mixture, and History

This essay homes in on two related aspects of Aristotle's account of memory, one often noted but sometimes discounted, the other of more speculative import. These features may not be the most central, either for Aristotle or for his interpreters, but they matter in their own right, and raise questions of independent historical and conceptual interest.

The first feature is Aristotle's definite and recurrent attention to the specific material constraints on the processes of memory and recollection. As suggested by his general hylomorphism about *psyche* and body, attention to the biological realization of psychological processes crops up throughout Aristotle's psychology. But the topic concerns him particularly in the *De Memoria* and elsewhere in the *Parva Naturalia,* as is noted both by those modern commentators who lament the fantastical errors of his outdated psychophysiology, and by those who work harder to appreciate its intriguing puzzles and its historical significance.

On a second Aristotelian topic, then, I suggest that there are unnoticed conceptual connections between Aristotle's concerns about the stability of the internal fluid motions which underlie memory processes, on the one hand, and his unique approach to the theory of mixtures, on the other hand. The evidence for such connections between mixture and memory is definite if indirect. My exposition

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below starts from memory and works back to mixture, but the evidence for these conceptual connections can be laid out up front as follows. Aristotle explicitly links his theory of mixture (Sect. 8.5 below) to a number of problems in the psychology and psychophysiology of perception and the senses, canvassing both a range of options and a preferred solution which, he says, he has described 'in the treatise on mixture, where we dealt with this subject generally, in its most comprehensive aspect' (*De Sensu* 3, 439b-440b; compare *De Sensu* 7, 447a, and Sect. 8.4 below). He treats other topics in physiological psychology, including memory and dreams, as raising puzzles about the persistence of specific movements in internal media (Sect. 8.2 below). In particular, Aristotle discusses the psychological roles of vital heat and *pneuma* in terms of problems about the enduring potential or actual presence of the movements by means of which specific impressions or traces persist within dynamic fluid systems (Freudenthal 1995; Sect. 8.3 below). So, I argue, it is reasonable to draw on the conceptual resources of Aristotle's theory of mixture to examine problems in the psychophysiology of memory, or at least to raise the possibility that such relations could be profitably investigated.

Approaching Aristotle on memory and mixture in this way also has three further useful historical or historico-philosophical implications. Even if there remains some gap between memory and mixture in Aristotle's own work, these broader avenues remain worth exploring, as I show in the final section of the essay (Sect. 8.6 below). Firstly and most obviously, scholars of subsequent Aristotelian traditions can keep an eye out for later connections across these two domains: since many commentators on Aristotle in distinct periods cared about both memory and mixture, I predict that sensitivity to possible conceptual links between the two domains among historians of philosophy will bring to light new and interesting material.

Secondly, in relation to the history and historiography of memory, and in line with the ongoing aim of better integrating the history of ideas with broader questions in cultural history and cognitive history, we want to know what kind of history 'memory' has, or what 'memory' is if it really has a cultural and historical nature as well as its biological and neural nature, if it genuinely is – as Ian Hacking (1995) convincingly argued – both a natural and a human kind. I identify and criticise a popular grand historical narrative on which Aristotle is a key precursor to an entrenched and perniciously mechanistic Western vision of memory as a static archive. In sharp contrast, I argue that both Aristotle's own view and many or most dominant Western approaches to memory have been grounded instead in *fluid* dynamics, and as a result have been messier, more open, and more interesting than this grand narrative of archives allows.

Finally, in the perennial re-assessment of the relevance of Aristotle's views, and of their conceptual utility in offering distinct perspectives on our own debates and theories, two related questions stand out to which these links between memory and mixture might speak. In our dramatically different psychologies and neurosciences of memory, we *still* want to understand better how highly dynamic material media and mechanisms can (imperfectly but genuinely) support the stability and persistence of some memories; and we *still* want to know how *distinct* past events or experiences can be retained over time and accessed again.

8.2 Aristotle's Fluid Physiological Psychology of Memory

Both memory and recollection, for Aristotle, rely on bodily changes or movements. Being able to take an 'affection' or an 'imprint' as a likeness or copy, as memory requires, depends on the right physical conditions: 'memory does not occur in those who are subject to a lot of movement, because of some trouble or because of their time of life, just as if the change and the seal were falling on running water' (450a32ff.) Recollection, in turn, 'is a search in something bodily for an image' (453a14). In what follows I can neglect other important aspects of Aristotle's account, and many points of philosophical disagreement among modern commentators (Sorabji 1972; Annas 1986; Bloch 2007), because my aim is to pose some natural and specific questions about this corporeal substrate, about the role of movements in memory, which arise on any interpretation of the psychology of memory which is grounded or realised in these bodily movements.

Aristotle suggests that weak or poor memory arises when the requisite changes are not 'able to persist within such people and avoid being dispersed, nor during recollecting does the movement easily take a straight course' (453b2-4. So certain changes or movements form the physical basis of the affection or image which we can regard as a copy, thus remembering the distinct thing of which it is a copy, rather than merely as a figure in its own right. How should we think of these movements and their status? Sorabji plausibly argues that Aristotle does not think they exist only intermittently, only at the present moment of remembering, for 'these same changes or images', Aristotle says, 'remain' or 'persist' (450b10-11, 453b2-3): we remember many things dispositionally even when we are not remembering them actively or occurrently. Sorabji goes on:

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> Presumably , the continuous existence which he attributes to the mental image is a merely potential existence, the potential existence which is supplied by the continued actual existence of the physical trace. (Sorabji 1972, p.16)

This motivates our initial questions. This 'continued actual existence' of the physical trace provides the causal continuity between past experience and present remembering: this grounds the difference between an image of memory and a newly acquired or reacquired image (Sorabji 1972, pp.10–11, referring to Martin and Deutscher's [1966] causal theory of memory). But can each distinct physical trace or change or movement really have a 'continued actual existence' as thus required, and if so how?

Such questions are easy to answer for those memory theorists who really do defend an archival model, in which the physical basis of each distinct memory is a discrete and localised single item. For example, the brilliant natural philosopher Robert Hooke contributed to a vibrant debate about memory in seventeenth-century England by developing a detailed vision of separate stored items located on the coils of memory:

> These ideas I will suppose to be material and bulky, that is, to be certain Bodies of determinate Bigness, and impregnated with determinate Motions, and to be in themselves

> distinct; and therefore that not two of them can be in the same space, but that they are actually different and separate one from another. (Hooke 1682/1705, p.142)

Because these distinct stored 'bodies' have no intrinsic dynamics, Hooke argues that at all stages of the memory process they must be directed by a separate soul: 'no Idea can really be formed or stored up in this Repository without the Directive and Architectonical power of the Soul', which deploys its 'power' from 'the Center of the Repository' (p.140, p.147; cf Sutton 1998, pp.129–144; Stevenson 2005; Lewis 2009).

In comparison, Aristotle's picture of memory is much more dynamic: his memory images, as Chappell (2017, 400) puts it, 'clearly have a life, and a liveliness, of their own'. There is no single wax block onto which distinct marks are impressed. Notably, Plato's discussion of a wax block model had pinpointed a concern that impressions might become 'less distinct' through being 'crowded together for lack of space', or might in many conditions 'collapse and get blurred', whereas a good memory needed to keep impressions 'clear and well-spaced', with every item quickly distributed to 'the proper impressions' (*Theaetetus* 194c-195a). For Aristotle, the residual sensory movements which will form the material basis of memory and recollection as well as dreams are always in motion:

> like the little eddies which are ever being formed in rivers, so the sensory movements are each a continuous process, often remaining like what they were when first started, but often, too, broken into other forms by collisions with obstacles. (*De Insom.,* 461a9-11)

If this is the kind of 'continued actual existence' which Sorabji attributes to physical memory traces, then concerns about the stability and persistence of such traces, or their capacity to 'take a straight course' (453b4), seem pressing. How and under what conditions can these dynamic traces avoid problematic kinds of interference which might make them *unlike* what they were when first started? And how can discrete movements be individuated, as seems necessary to ground the capacities to remember and recollect particulars, if the medium of storage and retention is thus entirely fluid?

To probe these concerns more fully, we need to back up to examine broader domains of Aristotle's deeply unified natural philosophy. I first underline the background in his physiological psychology, before opening the enquiry out further to argue that related issues about the persistence of components crop up across a number of other areas of Aristotle's psychology, ethics, and politics. Thinking of some of these problem areas as parallel or analogous to the theory of mixture, an independent part of Aristotle's philosophy, may offer a fruitful and integrative new perspective.

8.3 *Pneuma*, Pathology, and Potentiality

Whether Aristotle's attention is focussed on the formal operations of *psyche,* as in *De Anima,* or also includes more detailed consideration of the biological matter which *psyche* informs, as in many parts of the *Parva Naturalia,* he views the

nutritive and sensitive soul as operating across the whole of living bodies in certain structured physical processes (Beare 1906; Tracy 1969; Webb 1982; Freudenthal 1995; Sisko 1996; van der Eijk 1997). In particular, interconnected systems of concocted bodily fluids have features and movements which are characteristic, both of the species and often of the temperament of the individual animal.

Specifically, vital heat informs matter. Vital heat is not ordinary heat, but formative heat (GA 2.3, 737a1f). Because it is not just hot air, and differs from the elements, it can play formative rather than merely efficient causal roles. With regard, firstly, to reproduction and nutrition, vital heat carried in the semen transmits specific formative movements (Webb 1982; Cooper 1988; Furth 1988; Freudenthal 1995). At a general level, it informs matter so as to perpetuate species. Ontogenetically, the heart is the first part formed, and as the *arche* the heart then generates the body's vital heat. Differences in concocted blood derive from differences in vital heat, and then result in differences in the parts of the body such as flesh and bone as they are formed.

In considering the sensitive soul, the heart or perhaps its central chamber functions as the central organ in perception. Sensation, imagination, and memory all involve the same general systems for the reception, transmission, persistence, and reactivation of motions in certain inner media. To the extent that he seeks to show how such motions are transmitted and preserved, and in the absence of an account of the nervous system, Aristotle invokes a theory – or at least 'a research programme' creatively adapted from existing medico-philosophical ideas (Freudenthal 1995, 112) – of *pneuma,* a substance mixed from air and heat. *Pneuma* is a substrate in which the vital heat, as a quality, can inhere. Because blood's function is nutrition alone, the vital heat inheres not in it but in the connate *pneuma* which is carried in both blood and semen. Blood is continually turned into *pneuma* as wet and hot interact producing hot air.

If *pneuma* was ordinary hot air, it would separate off from the blood and rise as vapour. In that case, it could not play a role in the preservation of sensory impressions and sensible forms. But the 'pneumatization' of blood is enduring. Just as semen contains *pneuma* in the form of tiny bubbles (GA 2.2), so in the blood the aeriform *pneuma* remains suffused in the liquid, lasting there out of its natural place, rather as in the action of heat on milk, the bubbles which form throughout the liquid have a continued existence as the liquid's volume increases (Freudenthal 1995, 119–123).

These formative features of *pneuma* as carried in the blood fit it to play the central informational role in the operations of the sensitive soul. Sensations cannot reach the heart through the blood itself, but are conveyed with it, in the *pneuma* (Webb 1982; Freudenthal 1995, 130–134). This is explicit in the cases of smell and hearing, which operate through 'passages (*poroi*) full of connate *pneuma,* connecting with the outer air and terminating at the small blood vessels around the brain which extend thither from the heart' (GA 2.6, 744a2ff). Likewise, in initiating animal motion, the nature of *pneuma* is to expand and contract, such that it is a fitting 'tool of movement' (MA 10, 703a19ff). The mechanics of sensation and motion, then, operate through a kind of fluid hydraulics conceptually not unlike later theories involving the coursing

of fleeting 'animal spirits' through the nervous system (Sutton 1998; Smith et al. 2012). While animal spirits were thought to be derived from blood, whereas *pneuma* was a distinct substance carried in the blood, in each system and through the two fluid media Aristotle's point holds that 'the character of the blood affects the temperament and the sensory faculties of animals in many ways' (PA 2.4, 651a13f).

Most commentators pay less attention to these internal operations of the sensory system than to open questions about the external wing, so to speak, of Aristotle's account of perception, about relations between external objects and the sense organs. But the psychophysiology has intriguing features. The impression left by initial sensory movements is the affection which can survive the end of occurrent sensory stimulation, remaining present 'even when the perceptions have departed'. Aristotle compares the way projectiles continue to move after losing contact with 'that which set up the movement', noting however that in the sensory case we can have qualitative change as well as change of place (459a30ff). Such residual movements may be found 'lurking in the organs of sense', surprising us for example with images at the moment of awakening (462a11-13).

These mechanisms of persistence for sensory impressions are vital psychologically and epistemologically, for understanding requires 'retention of the percept' to take us beyond momentary perceiving (An Po II.19, 99b-100a). But the same mechanisms also operate beyond our control, most notably in sleep, when as blood sinks inwards towards the heart, 'so the internal movements, some potential, others actual, accompany it inwards. They are so related that, if anything move the blood, some one sensory movement will emerge from it, while if this perishes another will take its place' (461b12-14). So here it appears, contrary to Sorabji's interpretation of the *De Memoria,* that not all of the movements or physical traces themselves have a 'continued actual existence'. Aristotle continues by clarifying this: the 'residuary movements … are within the soul potentially, but actualize themselves only when the impediment to their doing so has been relaxed' (461b16-18), sometimes thereby leading to the rapid metamorphoses of movements which give rise to dreams.

Not all of these residual movements, then, are actual all the time: it seems that they can sometimes remain in a potential state. Within the hylomorphic framework, the material constraints on sensing, remembering, and so on involve operations which are successful for the most part, in so far as corporeal conditions remain suitable. But specific factors can destabilize the appropriate regularity of movements, bringing internal confusion, threatening the identity of individual movements or the possibility of their eventual reseparation. In the cases of memory and recollection, as also for dreams, Aristotle works through various kinds of pathology, uncertainty, and failure, some of which are problems of reidentification and reseparation. If the internal conditions are too moist or too frayed or too hard, due either to enduring temperament, specific circumstances, or 'time of life', memory will not function properly. The obliteration, obstruction, blockage, or mixing of movements between the sense organs and the central organ can bring psychological disturbance or confusion (461a10-24; PA III.10, 672a29-30). In contrast, in favourable physiological circumstances the calmness of the blood creates conditions in which movements can be preserved and retain their distinctness

and integrity. What's required is inner discipline – some kind of stability of the movements, the proper blending of the internal mixture. We can push this line of thought further by investigating how Aristotle deploys ideas about mixture in other domains, before then addressing his explicit theory of mixture to test out possible mutual relations across these parts of his scheme.

8.4 Mixture in Philosophy and Psychology

In rejecting the view of some of his predecessors that 'the soul is a kind of harmony', Aristotle firmly denies that the soul is the 'composition of the ingredients in the mixture', and in particular argues against Empedocles that 'the soul is a different thing from the mixture'. But he says it *is* appropriate to use the term 'harmony' in connection with health, and to characterize 'the successful performance of bodily functions in general': there are many different kinds of composition and ratios of ingredients in the mixtures making up the different parts of the body. He refers again here to the distinctive mixtures of elements that yield flesh and bone respectively (DA 1.4, 407b-408a). With *psyche* as form thus distinguished from any such harmony or ratio of ingredients, Aristotle is free to deploy concepts of mixture elsewhere. He does so widely, in some cases drawing on or explicitly referring to his metaphysical treatment of mixture in *On Generation and Corruption,* which I discuss in Sect. 8.5 below.

Firstly it is worth briefly noting just how widely concepts of mixture extend within and outside natural philosophy in Aristotle. As shown in detail in T.J. Tracy's magnificent study *Physiological Theory and the Doctrine of the Mean in Plato and Aristotle* (Tracy 1969), the language and frameworks of Aristotle's physiology recur, and are both explicitly and implicitly applied, across a dizzying array of contexts. The same holds for mixture and related notions: the semantic fields of Aristotle's key terms are not neatly divided or bounded. His views on marriage and on friendship, for example, include and can be partly understood in terms of ideas of proper blending. Likewise in key chapters of *Politics* Book IV, Aristotle applies this same framework to think about the range of possible relations between the poor and the rich, and also between democracy and oligarchy. Various forms of admixture of rich and poor can form a *politeia.* In a true union of oligarchy and democracy, both labels can reasonably be used when 'the fusion is complete. Such a fusion there is also in the mean; for both extremes appear in it' (*Politics* IV.8, b14-19): while a true mixture will integrate both ingredients fully, those ingredients still somehow remain present. So, 'in a well-tempered polity there should appear to be both elements and yet neither . . . ' (1294b35; see also Phillips 1992). Turning back to natural philosophy, we can move past questions about the persistence of compounds in physics (Freudenthal 1995) and further references to mixtures and ratios of ingredients elsewhere in biology (334b-335a, 389b27, 642a17-24, 734b36), to work a way back to the links between mixture and memory by an alternate path through the senses.

In chapter 3 of *De Sensu,* reacting to theories of colour perception based on mixture offered by his predecessors, Aristotle considers three theories. Colours might appear, firstly, through *juxtaposition,* when minute quantities of black and white are combined, with the appearance of other colours resulting from the limitations of our perceptual ability to see the minimal parts. Or, secondly, colours might result from the layering or 'superposition' of white and black parts in different ratios. In each case, Aristotle complains that the components would be unaffected, and that as a result the perception of colour would depend on the position of the observer. In contrast, on his own view, the genuine mixture of colours which necessarily occurs when bodies are mixed requires the ingredients to be 'wholly blent together, as we have described it in the treatise on mixture, where we dealt with this subject generally, in its most comprehensive aspect': this is why 'when bodies are thus mixed, their resultant colour presents itself as one and the same at all distances alike; not varying as it is seen nearer or farther away', independent of visual capacities. Such 'complete interpenetration' is the 'most perfect form' of 'natural mixture'. The different ratios of ingredients in combination then explains the diversity of colours (439b-440b; see Beare 1906; Sorabji 1991). Aristotle also refers to mixture in his accounts of other senses.

A different danger in ways of thinking and applying mixture theory comes up in considering the distinctness of the objects of perception in chapter 7 . 'It is easier', Aristotle suggests, 'to perceive each object of sense when in its simple form than when an ingredient in a mixture ... the reason being that component elements tend to efface each other'. He is again referring to his own theory of mixture, in which 'some one thing is formed': either one or both of the ingredients, depending on the specifics of the mix, will have had 'some of its individuality removed' (447a). So when we perceive two 'equal but heterogeneous' stimuli, we tend to perceive only the compound and neither of its constituents because 'they will alike efface one another's characteristics' (447a26).

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In this perceptual context, then, Aristotle himself links the psychology with the metaphysics of mixture. My suggestion is that the same issues operate in the background in his works on the internal senses, especially in relation to memory, sleep, and dreams, and that the requirements of his theory of true mixture pose significant challenges in these psychological realms. The final step in building this case takes us to a direct consideration of the account offered in *On Generation and Corruption.*

8.5 General Theory of Mixture

So the theory of mixture exemplifies the unity of natural philosophy: in a typically looping Aristotelian theory-structure, common macroscopic examples illustrate and support an analysis in physics or metaphysics which then plays a role in return in explaining a range of everyday phenomena. Though Aristotle does not link mixtures quite so directly to morality as some of his predecessors and his successors, despite

the range of applications which I have just noted, there are ethical undertones to the task of characterizing the right form of blending for Aristotle too. Showing how true mixture or fusion, *krasis,* differs from other ways in which ingredients can or could combine is an important goal. In particular, Greek philosophers cared about distinguishing true mixture from cases in which ingredients are entirely destroyed and confused. Plato had articulated both the tainted morality of confusion and the tendency for all natural mixtures to slip into such confusion: this is arguably an important strand in the history of dualism, in that it seemed across contexts for Plato that only an entirely external designer or source of order can effectively 'combine many things into one and again resolve the one into many' (*Timaeus* 68b-d; compare *Laws* 10, 886–892).

In contrast, in their different ways Aristotle and the Stoics would both aim to identify immanent forms of true mixture or proper blending in nature. But this is not an easy task. Aristotle's theory of mixtures has received rich and ingenious treatments both from his historical commentators and from contemporary interpreters (Joachim 1904; Sharvy 1983; Mansfeld 1983; Sorabji 1988; Bogen 1996; Fine 1996, 1999; de Haas 1999; Cooper 2004; Frede 2004), in work on which my discussion relies. There is no definite consensus on how or whether Aristotle successfully distinguishes true blending from confusion, and the key issues in assessing this puzzle and interpreting his approach are, I suggest, closely related to the issues that crop up in understanding the psychophysiology of memory. The core problems concern the ontology of movements – actual and/or potential – in the mixture. My suggestion is that the way some movements endure in *pneuma,* in ways that support both memory and recollection as well as imagining and dreaming, are analogous to – or just one form of – the ways that ingredients endure in potentiality in a true mixture. Aristotle does not make these links as explicit as he did for colour perception in *De Sensu,* so there remains a speculative element to this suggestion. But in each domain, potential instability or confusion may derive from the peculiarities of matter and movement.

Aristotle first argues, again, that true mixture or blending differs from, and is not explained by or analyzed in terms of, the juxtaposition of unaltered ingredients, like beans or grains in a heap or a troop of cavalry seen from a distance, as in atomist accounts. These ingredients are mixed only metaphorically, forming a mosaic rather than a uniform mixture, and leaving the ingredients in themselves unaltered. In contrast, Aristotle will demand total homogeneity in a true mixture (GC 327 b34-328a18).

So it is much more of a challenge for Aristotle to distinguish genuine mixture from cases of full-scale generation and destruction, of two forms (GC 327b3-8). There is no true mixture, first, when one ingredient dominates, destroying the other or subsuming it, as when a large body of water receives a drop of wine. But there is also no true mixture when *both* ingredients are entirely destroyed or obliterated, losing their identity, and unavailable for recovery. In contrast to this latter case of confusion, genuine mixture for Aristotle requires the persistent existence of all ingredients, in some sense to be explained which differs from that of the atomist account. Each ingredient must retain its power (*dunamis),* and be

recoverable or reseparable from the mixture, otherwise it has been destroyed and something entirely new generated from the confusion of prior ingredients. Before homing in on Aristotle's positive account, we can pause to evaluate this particular kind of generation, in which ingredients are confused. The original ingredients are annihilated, their identity lost in the mix in a non-reversible process: they 'have no existence at all' (GC 327b7). Perhaps an analogous process can happen in the context of psychophysiology, when unfavourable conditions lead to the interference or confusion of the residuary physical movements which should link past experience to memory.

So, for Aristotle, the state of the ingredients in the mixture must be both the same as it was before the combination (so as retain their powers and avoid confusion), and not the same as it was (so as to avoid mere juxtaposition, and genuinely to *mix*). He explains this proper blending by way of his metaphysics of potentiality. The ingredients can both '"be" in one sense and "not-be" in another' (GC 327b24-27). While in the mix, they are potentially what they are not now actually. We are justified in saying that they persist and are not destroyed, as they would be in a case of confusion, because their powers are preserved (GC 327 b31-32; on '*dunamis*' here see Sorabji 1988, pp.67–68; Cooper 2004). There is a new compound which is actually different from the ingredients (in their altered states) which form it (328b18, b23): but it is (potentially) decomposable again into those ingredients.

Is this 'a very nice balancing act', as Sorabji calls it (1988, p.67)? Aristotle's account has certainly proved fruitful, spawning criticism, interpretation, and alternatives from the Stoics and the Peripatetics through the Renaissance naturalists and on into modern discussions of chemical combination (Long and Sedley 1987; Todd 1976; Joachim 1904). My discussion again centres on puzzles about issues close to those arising in the psychophysiology. The problems for Aristotle result from the different demands on his theory of mixture. The fact that ingredients can be reseparated out, rather than for example being reconstituted, means that they must be there all along: this is precisely parallel to the requirement in the theory of memory that there must be a causal connection between past experience and present memory, rather than for example the knowledge of the past being relearned or freshly acquired, as would have happened if the relevant movements had been destroyed and had their existence interrupted. Without recovery of the distinct movement that is a sensory residue, memory will lose its grip on the past.

Yet it is not clear what kind of potentiality is retained by the ingredients. What is present only potentially must still have effects while in the mix, before reseparation. As commentators have remarked, the kind of potentiality required seems different from those Aristotle allows elsewhere (Joachim 1922, pp.180–181, discussing Philoponus and Zabarella). The potentiality of ingredients in a true mixture can't be like the potentiality of a person's knowledge of geometry before actually studying the subject, for unlike that knowledge the ingredients have previously existed in actuality, just as the sensory movements resulting from experience were once actual and distinct. Nor can it be like the potentiality of the geometer's knowledge when it is not in use, for the ingredients have been altered in the process of combination and do not remain distinct as they were when in actual existence, just as sometimes the

sensory movements do not remain distinct when not in use. A suggestion made by Philoponus has remained popular: the ingredients have been tempered or changed, so their existence in the mixture is like the knowledge of a drunken geometer when trying to solve a problem (Joachim 1922, p.181). Potentiality here is perhaps relative, or a matter of degree, as at GA II.1, 735a10-12, where the differences between a geometer asleep, awake, and studying are picked out as points on a spectrum of potentiality.

If potentiality is thus a matter of degree, then the boundary between true mixture on the one hand, in which recovery of the original ingredients is possible, and cases of confusion on the other hand may not be sharp. As the degree of potentiality of the ingredients in mixtures becomes gradually smaller, so we come closer to cases in which they are destroyed. There are clear cases at both extremes, but there will also be cases in which it is hard to say whether ingredients retain their distinct existence and their power after the alteration undergone in combination.

Aristotle appears to be aware of this tendency of mixtures to slip towards confusion. Towards the end of the chapter on mixture, he discusses material constraints. Some materials, like liquids, are most easily mixed because they are divisible, susceptible, and most easily modified (GC 328b3-5). We can think again here of the effects of any non-standard physical and physiological conditions on the residuary movements which need to be recovered in memory and recollection. In the context of physics, not all ingredients are equally susceptible: ‘some things adopt a hesitant and wavering attitude towards one another, for they appear somehow to be only slightly “mixable”, one, as it were, acting in a “receptive” manner, the other as a “form”’ (328b9-12). So when, for example, tin and bronze are mixed, ‘the tin almost vanishes, behaving as if it were an immaterial property of the bronze: having been combined, it disappears, leaving no trace except the colour it has imparted to the bronze’ (328 b12-14). In a number of cases, then, ingredients can all but vanish, leaving only vestigial traces which barely amount to a persistent power.

So on Aristotle’s approach, the specific way that the ingredients remain potentially in a true mixture will have to be identified afresh in each particular case. This is perhaps appropriate, directing our attention to specific techniques of reseparation and the particular ways in which potentially existing ingredients have effects in individual compounds composed of different materials. What matters is the kind of assistance or addition required for the ingredients to retreat to their own nature, to change into actuality in a way quite different from coming to be anew. Reseparation may require assistance. For example, a sponge dipped into wine alters and actualizes the water which had been mixed: this catalyst assists in the return of the ingredient to an actuality which had been merely potential in the blend. Alexander of Aphrodisias discussed a number of examples in which such assistance is required for ingredients (once mixed) to return or recede to their own nature. This backed his criticism of the Stoic theory of total blending, according to which the ingredients retain their *actual* existence throughout a homogeneous blend: for Alexander, the Aristotelian approach is the only middle ground between an atomist approach in which no real mixture has occurred, and the Stoic confusion in which (he argues) no reseparation would be possible if actual ingredients were totally blended.

8.6 Mixture and Memory in History and Historiography

As I noted above, for Aristotle the quality of psychic life depends on the state of the internal environment and the particular qualities and motions of the soul's material substrate. In considering memory and recollection, the key supporting internal systems are fluid – the movements which are the residues of sense, and which should remain distinct and clear to ground memory, are movements of the *pneuma* carried in the blood. There is always a possibility that, at the level of these material constraints on or conditions for memory, specific movements may be blurred or obliterated, difficult or impossible to reseparate out within the fluid medium which carries them all, thus leading to instability or pathology in psychology.

Though in *De Memoria* Aristotle does not cross-reference his general theory of mixture as he does in *De Sensu,* the parallels between problems arising in the cases of memory and mixture are striking. In the absence of a more explicit account of the status of the many residual movements carried in the same fluid substrate, it is reasonable to consider the theory of mixture as offering at least a model for a way in which each might retain its powers and be reseparated. In the case of memory as opposed to recollection, we can only rely on the general state of our bodies and our fluids to create conditions in which we can remember accurately and distinctly, attributing all and only the right images to the past, and warding off the various pathologies which Aristotle describes. But in active recollection, there is at least the possibility of indirect intervention in and control of the reseparation of movements, in some cases acting as our own catalysts. Recollection exploits the patterns of motions, in which 'one change is of a nature to occur after another' (451b10), in sequences which have often been established not by necessity but by habit. This opens up the possibility of method and self-regulation in recollection: we can actively hunt for the successor change (451b16ff), seeking to exploit the associative relations between motions, some of which sequences have more order than others (451b-452a). In recollection, control is at least possible as we move ourselves, dealing with our own images as we engage in the search or hunt 'in something bodily' (453a14).

I can use the fact that Aristotle ends *De Memoria* with further consideration of the pathologies and idiosyncrasies of fluid material movements as a bridge to a final set of historical and historiographic remarks about mixture and memory. Many scholars note that Aristotle's remarks on identifying or reseparating images in recollection influenced later practices and techniques of artificial memory (Rossi 2000; Beecher and Williams 2009). Not so common is an acknowledgement that the arts of memory were often in part an attempt to discipline and direct internal physiological movements. In seeking to control or bypass 'natural memory' with the 'artificial memory', adepts across a range of historical contexts and traditions internalized rich and complex external resources in order to reshape and order their recollective capacities. In a sense, this is to acknowledge that there is no easy immanent principle of proper blending in psychophysiology. Externally-derived

physical or cultural scaffolding is a more reliable source of order than was likely to emerge from the intrinsic dynamics of bodily fluids (Sutton 2000a, 2010).

More generally, then, historians of the Aristotelian traditions investigating memory and the internal senses may find interesting connections to theories of mixture. Changing interpretations of Aristotle's physics and metaphysics of mixture from medieval philosophy through the Renaissance (Weisberg and Wood 2003; Wood and Weisberg 2004) might be fruitfully combined with attention to memory and its bodily aspects. Just mapping parallels in later commentaries across *De Memoria* and *De Insomniis* on the one hand, and the material on mixture in *De Generatione et Corruptione* on the other hand may turn up points of conceptual contact.

More broadly, the history of medical psychology in the mixed Aristotelian-Hippocratic-Galenic traditions of humoral theory which dominated Western theory and practice for so long involved practices of regimen and self-regulation which had central psychophysiological elements, because the humors and especially the fleeting animal spirits did not easily retain distinct traces (Sutton 1998, chapter 2). The state of the nervous fluids and spirits depended, in ongoing interaction, on the state of the blood and by way of the blood on a range of environmental and emotional factors. Discourses and practices of the animal spirits, through into the eighteenth century, exhibited the same rich unity of natural philosophy that we saw in Aristotle. Medical psychology and moral physiology were heavily anchored around monitoring of the 'non-naturals': air or climate, food and drink, sleep and wake, motion and rest, evacuation and repletion, and passions or perturbations of mind (Rather 1968; Niebyl 1971). In continual interaction with the blending of internal fluids, the non-naturals combined not only to produce an individual's current, fragile balance against imminent physiological stagnation or excess, but also to ground ongoing psychological stability. Contrary to much mythologizing by modern philosophers, these views did not disappear with the 'scientific revolution' or with the 'mechanical philosophy', but were newly entrenched or implemented in Descartes' highly dynamic picture of brain, memory, and the passions (Sutton 1998, 2000b; Hutchins et al. 2016). In this long-standing ecological framework, the material basis of human psychology was mixed or porous, open to a variety of worldly influences. It is in language reminiscent of Aristotle's psychophysiology of inner mixture that Nicolas Malebranche, for example, develops Descartes account of the 'crossing' of traces in the brain, lamenting that it is 'nearly impossible for so many traces, formed without order, to avoid becoming mixed up and bringing confusion into the ideas': this is why remembering many things is often incompatible with ordered reason and judgement (1674/1980, II.II.4, p.141; Sutton 1998, 111). Medical historians convincingly show that despite the rhetoric of revolution and discontinuity in some seventeenth century natural philosophy and medicine, the non-naturals, the animal spirits, and associated practices of regimen, 'which provided a medically useful classification of man, and a somatic theory of human behavior, were preserved into the nineteenth century' (Temkin 1973, 181; compare Wear 1995: 360).

One way to trace the further influence of these links between memory and mixture would be to return to the history of dualisms, and to the modern urge to impose control over these inner processes and mixtures, to find transcendental ways of warding off confusion (Stafford 1991; Latour 1993; Schmidgen 2012). But here I want to conclude by considering a different historiographical tradition, in which Aristotle is firmly entrenched as a key source of a foundational Western metaphor or model of memory as an archive. Representative of what we might call this 'grand archive narrative' of theories of memory is Jens Brockmeier's book *Beyond the Archive: memory, narrative, and the autobiographical process*, a sustained attack on 'the venerable notion of memory as a storehouse, an archive of the past' (Brockmeier 2015, viii). Brockmeier gives Aristotle a central role, at the origin of the narrative, in the establishment of the archive:

> Despite their differences, both the Platonic and the Aristotelian tradition shared the same basic assumption of human memory as a storehouse of experience and knowledge, the archival model. Authorized by the two towering founding fathers of Western philosophy, the archival metaphor indisputably turned into the 'governing model' for all subsequent thinking on remembering. It became the 'cognitive archetype' of memory. (Brockmeier 2015, 72)

Across 'Western common sense', philosophy, and science alike, we have been condemned ever since to what Brockmeier sees as a deeply problematic archival assumption 'that there *is* a specific material, biological, neurological, and spatial reality to memory – something manifest – in the world' (Brockmeier 2010, 6; cf 2015, 1–5). Aristotle allegedly helped to create this extraordinarily tenacious and widespread homogenizing picture of memory as an archive: 'over long periods in the cultural history of the West, people's thoughts and ideas about their memory and the nature of their memories were amazingly stable and uncontested' (Brockmeier 2017, 41). This is both a pernicious and an outdated vision of memory, which has unfortunately led to the 'exclusion of people's cultural life worlds' from philosophy and psychology alike (Brockmeier 2015, 9). Though it is 'astonishing' that researchers in the modern cognitive and neurosciences have not realised that the archival model has had its day (2010, 20), with Brockmeier's help we can now finally develop 'a postarchival approach to remembering' (2015, *passim*). Only at last now 'the idea of memory's continuity, stability, coherence, and — based on these — its moral weight and ethical status as an unassailable authority of truth and authenticity' is 'about to be dismantled' (2010, 9–10, 2015, 307).

Brockmeier couples these historical claims about the homogeneity and universality of the 'archival model' of memory with an 'epistemological nominalism' about memory's ontology: our concepts of memory do and should not 'reflect ontologically the true nature or essence of "memory", but serve as useful instruments' (2015, 26). Here he is in line with other critical historians of psychology who argue that 'basic psychological categories refer to historical and social entities, and not to natural kinds' (Smith 2005). Kurt Danziger, author of a history of theories of memory, complains that mainstream psychology has 'too easily assumed that psychological objects, like memory for example, have essential qualities forever fixed by nature' (2001, cf 2008). Anna Wierzbicka argues that 'memory' is 'a

twentieth-century invention', and not 'something that "exists" independently of the English language' (2007).

I have responded previously to the theoretical or conceptual aspects of this 'grand archive narrative' (Sutton 2007). One striking implication is that, for Brockmeier and colleagues, memory actually *was* archival when (or if) 'we' thought it was: 'with its written conceptualization in Plato's dialogues . . . a shift occurred: memory activities changed their location and took up their abode in the individual mind' (Brockmeier 2015, 67). Rather than trying to tease apart what's right about the historicity of memory from this overly strong articulation, which gives words and theories too much immediate causal power, here instead I query the first-order history behind this narrative, building on the account of memory and mixture in Aristotle offered above to contest its basic historical claims. Brockmeier claims that there has been, since Plato and Aristotle, a homogeneous Western picture of memory as an archive, in both everyday and elite conceptions, a vision of memory as a unified, distinct, reified, fixed, individual, internal, universal, archival *thing*. But this historical claim is in severe tension with the real history of memory and mixture in Western thought, in which as I have shown a central role is played by dynamic and interconnected bodily fluids, from *pneuma* to animal spirits. It's not only that Western views have been much more diverse, dynamic, contested, and fragmentary than this grand narrative allows, but that in many contexts memory has been understood in the West to be grounded in fleeting and fluid inner processes rather than a static archive. In contrast to the fixity of the archive model, there has been a persisting and rich holism in Western ideas about the psychophysiology of remembering. And, thus, it has often been precisely through memory and the body that we have been seen as deeply connected to or embedded in our cultures and our world. Neither Aristotle nor Descartes can rightly be convicted of entrenching a vision of memories as separate, static inner items, because both saw remembering as the fragile achievement of dynamic, open, interactive, fluid systems which spanned body and world. There are much richer, messier, and more interesting histories to Western theories of memory than the grand archive narrative allows.

As a final frame for our topics, I conclude with a note on the enduring interest of the problems about memory and mixture we have addressed. Both philosophers and scientists still feel the attraction of seeing memory as mixture, but both still have to face the consequent challenges of understanding how dynamic material media and mechanisms can (imperfectly but genuinely) support the stability and persistence of some memories, and how *distinct* past events or experiences can be retained over time and accessed again. Stuart Hampshire compared human memory to a compost heap, in which 'all the organic elements, one after another as they are added, interpenetrate each other and help to form a mixture in which the original ingredients are scarcely distinguishable, each ingredient being at least modified, even transformed, by later ingredients' (1989, 121). In the influential connectionist approaches to memory of the late twentieth century, the idea of superpositional storage gives rise to concerns which, at an abstract level, would be entirely recognizable to Aristotle. For Jeff Elman, for example,

> Once a given pattern has been processed and the network has been updated, the data disappear. Their effect is immediate and results in a modification of the knowledge state of the network. The data persist only implicitly by virtue of the effect they have on what the network knows. (1993, 89)

In Hinton et al.'s (1986, 80) blunt statement, 'patterns which are not active do not exist anywhere'. It is partly in response to such constructivist approaches to memory in mainstream psychology that in recent years the dominant causal theory of memory in philosophy (Martin and Deutscher 1966) has been challenged (Michaelian 2016, Robins 2016). If the physical traces which ground dispositions to remember are *so* implicit or potential, if the ingredients and distinct components of the past are so thoroughly blended, it is not clear that traces of *particular* past events can retain and continue to exert their distinctive powers (Ramsey et al. 1990; O'Brien 1991). As in Aristotle's psychophysiology, the presence of the before in the after can come to seem too minimal. Some philosophers argue therefore that memory is only incidentally about the past, and has at least as much to do with future thinking or episodic simulation (De Brigard 2014, Michaelian 2016). Although it is a topic for another occasion, in my view something like Aristotle's picture of potentiality as a matter of degree is a useful tool for responding to these lines of thought, and for retaining the idea that the past can still in one way be present in the mix.

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