Developing the Fission-Fusion Concept:
A Journey through the Arts, Humanities, Social Sciences and Natural Sciences

Dr Miranda Anderson is an Honorary Fellow in History, Classics and Archaeology at the University of Edinburgh and an Associate Lecturer at the Open University. She has held several prestigious fellowships and was principal investigator of an AHRC-funded project, titled 'The Art of Distributed Cognition', which involved collaboration with the Talbot Rice Gallery. Her work has investigated the relations between cognition and culture, particularly literary works, challenging the boundaries between disciplines and engaging with numerous contemporary science, technology and society (STS) questions. In this perspective article, she evokes the 'fission-fusion' concept on which she has been working for some years now – a concept that contributes to debates surrounding the issue of identity by drawing on the arts, humanities, social sciences, and natural sciences.

Part 1

I began trying to grasp the nature of the mind and the self through exploring the ways in which different periods and cultures create concepts and devices to understand and enhance them.[1] I also wanted to understand what connects us and makes us distinct. For instance, why can we read a text, hear a piece of music, or look at an image from a long-gone time or a far-away place and resonate with it, and conversely what makes it unfamiliar? And why are both the resonances and dissonances valuable? Across cultural, scientific and technological concepts and devices some aspects tend to be intuitive while others require learned knowledge or skills. Grasping such fissions and fusions in our experiences and their relation to wider contexts, helps us understand the past, reflect on contemporary concepts and structures, and on the connections and distances between each and every being.

Notions of the mind and self are implicitly or explicitly manifested across academic disciplines and, more generally, in the ways we organise our world: for example, in the ways scientific experiments are set up, or technologies are designed, as well as shaping governmental policies and legal processes. Recent debates have focused on questions about the nature of identity, for example, in relation to decolonisation. One mode of responding to this has been through raising the complex nature of our identities: age, ethnicity, gender, sexuality, nationality, class, and so on, and the ways these intersect with one another. Yet the postmodern framework from which responses have arisen tends to elide the roles of physical bodies, focusing rather on the play of sociocultural forces, resulting in a form of cultural determinism. For example, Judith Butler has discussed how discursive modes give rise to the ways in which bodies materialise.[2] Yet her argument remains focused on our shaping by linguistic and other sociocultural forces; she does not consider the ways in which our neurophysiologies also poise us to adapt dynamically to these. In the vein of thinkers, such as Heidegger, I have argued that it is in fact our psychophysiologies' adaptive natures, that make them capable of operating seemingly transparently, enabling us to fuse seamlessly with aspects of the world beyond.[3] (Though aspects of our bodies move in and out of being more or less evident, particularly when they do not function as expected or

intended.) Ironically, it is their capacity for transparent operation that has enabled the emergence of the very socioconstructivist theories which consequently neglect them.

Butler persuasively makes a case as to the iterability of discursive modes that shape identity. Their iterability affords the opportunity for norms to be critically mimed and differently performed: 'when we do act and speak, we not only disclose ourselves but act on the schemes of intelligibility that govern who will be a speaking being, subjecting them to rupture or revision, consolidating their norms or contesting their hegemony.'[4] She defends the incoherence and multiplicity of human beings as producing the basis for ethical responsibility: that is, it comprises our connectedness to each other. Yet, important aspects of our incoherency, multiplicity and capacity to think are bodily: both the connectedness and the specificity of ourselves and the histories from which we emerge matter, and important aspects of these relate to physical bodies and bodily environments.

How can we explain the nature of identity in a way that is true to the complexity of people's lived experiences and that acknowledges biological and cultural factors in making us human? I set out to find a way of negotiating a path between extreme relativism and universalism; one which respects human histories and our adaptive natures. This path seeks to recognise continuities across people and the potential for distinctive characteristics to be of significance, leading to the possibility of more empirically grounded debates around matters of identity.

In some of my past works, particularly those ranging from 2015 to 2022, I have worked towards adapting a concept from the natural sciences to try to describe more accurately the nature of the mind and self. I use the term 'fission-fusion' for a more holistic conceptualisation of being human in the world. I created the term 'fission-fusion cognition' to describe the ways that clusters of elements (existing across the brain, body and world) merge (and divide) in their composing of cognitive processes.[5] Fission-fusion describes the flexible and shifting nature of the clusters that constitute the mind or self across a range of temporal and spatial scales. An instantiation of any mental capacity can be composed of processes in my brain, body or the world and may at times be composed by different clusters of these, with the particular nature of the composition only of import in certain cases. So, for example, pain can be caused by a complex amalgam of features that span internal and external phenomena; it could be caused by physical or psychological issues or by aspects of my social or physical environment, with different notions of ethical responsibility attendant on the nature of the combinatory factors.

Fusions sometimes seem to catch us up in our entirety and at others seem only to involve certain aspects of our minds and selves, while other aspects remain focused on other processes; so I can be drawn along by the patterns and moods of a piece of music that I am listening to, at the same time as I am aware of the rumble of traffic outside my window, the breeze from a fan on my skin, the lingering taste of coffee in my mouth, and the feel of the laptop keys beneath my fingers, as yet other aspects of my mind are caught up in attempting to form my thoughts into coherent sentences to convey my experiences to you. Aspects of these occur simultaneously, others consecutively or overlapping in waves, as my experiences are persistently shifting in and out of my awareness and varying in degrees of intensity.

Other entities in my environment –a flatmate, a fly, a plant, the building, the air – share in aspects of these experiences, according to their physical constitution, its state and activities, and on the degrees of sharing across sociocultural, developmental and evolutionary realms. Fission-fusion, a physics term for the division of a nucleus or merging of nuclei, is also used by ethology to describe dynamic social networks, such as those found in elephant and monkey groups, that periodically merge and divide in order to optimise the performance of activities and in response to resource availability.[6] Fission-fusion occurs more complexly in the human domain due to the extensive nature of our cultural development.

Fission-fusion can express the nature of an experience of joy, for example, which might be constituted through the recalling of a particular memory, a chance meeting with a friend, or by my coalescence with the harmonies and melodies of a certain piece of music. Such experiences can, to varying degrees, involve sensory, interoceptive, verbal, affective, and other processes. Fission-fusion can also be used to describe the complex nature of the creation or performance of a piece of music, a literary or other artwork, which can occur across media, other people, environments, and time.

Fission-fusion also resonates with the notion of 'agential realism' proposed by another feminist theorist, Karen Barad, which I have recently come across, though in her case it merges from a quantum physics based approach. Like me, Barad argues for the entanglement of notions of ontology, epistemology and ethics. Like Butler, she puts an emphasis on there not being pre-existing entities, a notion Barad views as deriving from atomism. Barad rejects the notion of 'the prior existence of independent entities', instead arguing that 'relata do not preexist relations; rather, relata-within-phenomena emerge through specific intra-actions'.[7] Instead, I would argue both that boundaries are constantly renegotiated, and that there are significant temporal and spatial lineages expressed as aspects of the constitutive elements of any cognitive or ontological coalescence, though these are inflected distinctly in each iteration. While I may be composed of an ad hoc array of factors, these bring with them evolutionary and developmental dispositions, and many of these factors form patterns that persist across prolonged durations. Therefore, I can still refer to myself being a self.

Part 2

The particular 'I' that I am, came to the idea of fission-fusion from cognitive scientific research rather than from quantum physics. I base my approach on cognitive scientific and philosophical theories that claim that rather than being merely information processors or brain-bound, minds are distributed across the brain, body and world. The term distributed cognition is sometimes used interchangeably with 4E cognition, with the 4Es standing for embodied, enactive, embedded, and extended cognition. Embodied cognition argues that cognition is shaped by the body; enactive cognition views it as unfolding through engagements between organisms and environments; embedded cognition includes external resources as enabling factors, while extended cognition argues that the external resources are themselves part of the cognitive system. Drawing on scientific evidence from across areas such as cognitive science, neuroscience, philosophy of mind, psychology and linguistics, I have shown how this framework counters the elision of the body and the

physical world by postmodern social constructivism. For the last two decades I have been exploring how these theories illuminate the nature and value of the arts and humanities, working with colleagues to uncover evidence of notions and practises of distributed cognition between classical antiquity and the twentieth century, as well as focusing myself on how it operates in culture and the history of ideas.[8] I aim now also to collaborate with other thinkers to consider its wider remits for contemporary culture and society, as well as for other non-western cultures throughout history.

Paradigms about distributed or 4E cognition are abiding because they capture abiding aspects of human nature. 4E accounts of mind lead to more awareness of the fundamental cognitive roles of embodiment and environment. Yet the emergence of their current conceptualisations from discourses of evolutionary adaptivity and the computing revolution in the mid-twentieth century led to a different form of elision: a tendency to view cognition's distribution as necessarily beneficial, rather than realising negative aspects and ethical issues, or the significance of the capacity for separability and distinctness.

Questioning of the cognitive sciences' focus on distribution as enhancing cognition arose across the periods examined in The Edinburgh History of Distributed Cognition series (2018-20). Historically new technologies and forms of sociocultural norms generated most critiques and resistance. For instance, during industrialisation anxiety arose around ways in which human cognitive capacities were impinged upon, degraded, or replaced by forms of mechanisation, systematisation and routinisation; then as we moved into the twentieth century, these expanded into concerns about the flourishing of nationalism, propaganda and the manipulation of the masses.

In our own society, the arts make visible why there should be anxieties about corporately motivated and under-regulated forms of technological domination. The internet, computers and mobiles enable the digitally connected to communicate instantly and remotely, fact-check, work, shop, socialise and protest or rebel against existing forms of power. Yet several artworks in The Extended Mind exhibition, which I curated with Talbot Rice Gallery, such as those by Agnieszka Kurant, cast light on the socio-economic and ethical dimensions of contemporary forms of distributing cognition across networks of minds. Kurant created A.A.I. by using unwitting termite colonies supplied with coloured sand and glitter, out of which they created mounds which she then sold as artworks to illustrate the silent exploitation of our collective intelligence, such that 'we no longer know when our labor or social capital is being stealthily harvested'.[9] Sociocultural, political, and economic systems and practices, and our conceptualisations of them, undergo myopic manipulations by multinational corporations wielding huge amounts of opaque power. While rendering us servile rather than superhuman, this is oft accompanied by an idealism around technology and virtualisation that speaks of our old hubris of human superiority – seeing ourselves as lords of the world rather than as entangled in it. The ways in which our current context constrains our theories of minds and selves are evident, and consequently the need for it to be informed by historically oriented studies and alternative cultural perspectives.

Agnieszka Kurant, 'A.A.I.' [photographic representation], 2019. Installation view, 'The Extended Mind', 2019. Image courtesy Talbot Rice Gallery, University of Edinburgh.

The development of the 4E cognition framework over the last thirty years heightened concern over what exactly could be used as a defining 'mark of the mental': a way of distinguishing the mental from the non-mental.[10] Using the 'fission-fusion' concept helps illuminate the fact that there is, in fact, no such defining 'mark'. I adopted fission-fusion to communicate my belief that rather than there being any single defining feature, the mind and the self are polythetic. Polythetic classifications are defined by Wittgenstein as follows: 'the strength of a thread does not reside in the fact that some one thread runs through its whole length, but in the *overlapping* of many fibres.'[11] Rather than any single mark of the mental that is required to run throughout, the fission-fusion approach argues that a variable cluster of combined strands can constitute the mind or a certain feature of the mind; and this can also be said about a self, or an artwork or technology or environment. The exact combination of constitutive strands can vary, with variation in their make-up, potentially, though not always, having an effect depending on their intended function and the wider context. This view is also complementary to predictive processing, widely posited for around the last decade as the means whereby the mind engages with the world.[12]

Fission-fusion complements Daniel Casasanto and Gary Lupyan's theory of language, which argues that while we have conventional word definitions, these are merely cues that guide our ad hoc use of them.[13] In order to parse the nature of our engagements with the world, we require both Newtonian and more relativistic physics concepts, as Casasanto points out, giving the comparison of someone on a diet using scales and so adhering to Newtonian notions of mass, versus someone pondering the nature of the universe.[14] Thus, we need an

array of concepts to grasp and navigate the multidimensional nature of reality. Indeed, fission-fusion can again be applied as a kind of meta-concept to consider the sharing and distinctions between these different concepts of mass. Diverse ways of being and knowing are embedded in and revealed by kaleidoscopes of cultural and historical ideas and practises.

A fission-fusion approach chimes with decolonisation debates, which have highlighted the need to 're-attune to decolonial ways of seeing-thinking-doing-listening' through 'the practice of other ways of thinking, knowing and learning' in order to counteract the elision of material nature and the body.[15] If we consider questions of self in relation to the concept of fission-fusion, then it helps to explain why positioning one aspect of someone as a defining feature and as having universal characteristics that are not variably expressed in relation to other aspects of their self is an artificial conceptual constraint. Such ideas are already implicit in the ways people try to negotiate questions of identity. Artist and film director Steve McQueen resists the narrowing of his work's potential in his description that *Twelve Years a Slave* is 'not a black movie. It's an American movie. It's a narrative about human respect, more than anything.'[16] This is echoed in his resistance to reductive essentialising notions of selves: 'We are complex people…we are not one dimensional…we are human fucking beings…we are not stereotypes.'[17] There is a similar resistance to essentialising notions in Bernardine Evaristo's *Girl, Woman, Other* (2019) through the creation of multiple interweaving narratives exploring how one characteristic, here being a woman, comes into play in a complex array of ways with other aspects of the characters' lifeworlds. In fact, intuitive grasping of these ideas has been around for a long time. For example, Shakespeare's *Sonnets* uses music as a way of illustrating the fission-fusion nature of the self, as like 'the concord of well-tuned sounds' each string is 'sweet husband to another' and 'strikes each by each in mutual ordering'.[18]

Enmeshed with factors that make us human are processes in the world beyond the human. Particular combinations of human minds and selves are composed by and resonate to varying degrees with processes ongoing in other entities, as our reformulatory capacity enables *interconnections* with and *disconnections* from aspects of others and the world. A dynamic multiplicity of factors come together to compose the mind or self at any one point in time, with experience an evolving array of intermingling threads across which consciousnesses play. That we are neither merely separated off from one another nor form a continuous amalgam avoids the extreme of our operating as an undifferentiated mass or in solipsistic isolation. Together these create the basis for ethical values and behaviour. Particular characteristics generate a 'relative functional irreplaceability', combining a distinctive grounding and responsibility in each self with an awareness of that self as being composed of multiple processes that extend beyond it across space and time.[19] Rousseau famously claimed that 'One believes himself the others' master, and yet is more a slave than they'; this is true because the capacity of our minds to be free does not merely operate in an individualistic way, since our minds are not discrete monolithic entities entirely separable from other people or environments.[20] Fission-fusion provides a basis for an epistemological realist approach, which is pluralist and recognises situatedness, yet is also committed to our access to reality despite the partial and situated nature of each perspective. Fission-fusion

cognition illuminates the potentially positive nature of limits, separations and distinctions, as well as of openings, merging and continuities. Through such fissions we can have a reflective understanding of our holistic embodied natures and emergence from wider sociocultural and natural ecologies, rather than being simply immersed in them.

Miranda Anderson

Contact author information: miranda.anderson@ed.ac.uk

[1] See, for example, Anderson, Miranda (2007) *The Book of the Mirror*.

[2] See, for example: Butler, Judith (1993) *Bodies that Matter: On the Discursive Limits of Sex*.

[3] Anderson, Miranda (2015a) *The Renaissance Extended Mind*.

[4] Butler, Judith (2005) *Giving an Account of Oneself*, 132.

[5] Anderson (2015a); (2015b) 'Fission-fusion cognition', *Narrative* 23.2, (2022); '4E Cognition and the Mind-Expanding Arts'.

[6] Aureli et al. (2008) 'Fission-Fusion Dynamics', *Current Anthropology* 49.4.

[7] Barad, Karen (2003) 'Posthumanist Performativity', *Signs* 28.3, 815.

[8] Anderson, M, D. Cairns and M. Sprevak (eds) (2018), *Distributed Cognition in Classical Antiquity*; Anderson, M. and M. Wheeler (eds) (2019), *Distributed Cognition in Medieval and Renaissance Culture*; Anderson, M., G. Rousseau and M. Wheeler (eds) (2019), *Distributed Cognition in Enlightenment and Romantic Culture*; Anderson, M., P. Garratt and M. Sprevak (eds) (2020), *Distributed Cognition in Victorian Culture and Modernism*.

[9] Kurant, Agnieszka, 'Uncomputables', *Cabinet* 61, 58; see also Anderson (2022).

[10] This concern over what would be a defining 'mark of the mental' is of much longer standing, e.g, Rorty, Richard (1970) 'Incorrigibility as a Mark of the Mental', *The Journal of Philosophy* 67.12.

[11] Wittgenstein, Ludwig (1999) 'Philosophical Investigations', *Concepts*, 172.

[12] For example, see: Hohwy, Jakob (2013) *The Predictive Mind*; Clark, Andy (2016), *Surfing Uncertainty*.

[13] Casasanto, D. & Lupyan, G. (2015), 'All Concepts are Ad Hoc Concepts', *The Conceptual Mind*

[14] See: Casasanto, Daniel, 'All Concepts are Ad Hoc Concepts', Conceptual Engineering Network.

[15] See susan pui san lok (34-8), Kamini Vellodi (60-62), and John Onians (44-5) interviewed in 'Decolonizing Art History' (2020), *Association for Art History*.

[16] Steve McQueen, interview by Dan P. Lee, 'Where It Hurts', December 16, 2013, *New York* Magazine.

[17] Steve McQueen (2018), "Steve McQueen Career Retrospective," interview by Jenelle Riley, SAG-AFTRA Foundation.

[18] Sonnet 8; I also explored these ideas in a joint paper on Shakespeare's Sonnets with Shaun Gallagher in Helsinki in 2016.

[19] Frankl, Viktor [1946 lectures] (2019) *Yes to Life*, 54.

[20] Rousseau, Jean Jacques, [1762] (2019) *The Social Contract and Other Later Political Writings*, ed. and trans. Victor Gourevitch, Book I: 1.