

Constructivist computing for a pluralistic universe?

In a world of competing cultures and ideologies, tolerance is a key virtue. As "a disposition to allow freedom of choice and behaviour", tolerance entails appreciation of alternative points of view. But assuming such a disposition involves more than intellectual acquiescence to the idea that many different perspectives are plausible. For tolerance to have practical force, it must be alive in our experience whether or not it appeals to our reason. This is a theme that resonates with both science and engineering and the arts and humanities. In prosaic functional terms, we may subscribe to the engineer's grounded pragmatic notion of tolerance: "allowing reasonable leeway for imperfections and inherent variability without compromising performance". In a more radical, less utilitarian sense, we must recognise that the way in which a work of art affects us viscerally cannot be dictated merely by the products of an intellectual analysis. And as Giles Hooper (*The Discourse of Musicology*, 2006) remarks of post-modern musicology: "... one can assert the individuality, subjectivity or contingency of some meaning or value only for so long before such assertions eventually undermine the legitimacy of the very discursive field in which they are ordinarily articulated". To be tolerant is to wrestle in mind and body both with appreciating diversity and with maintaining integrity.

This fundamental issue of reconciling "plurality" with "monism" is the key theme of William James's *A Pluralistic Universe*. In part, James was motivated by his desire to counter the polarisation between scientific and religious viewpoints that was then and is still topical. James attributed such polarisation to too dogmatic and metaphysical a notion of agency ("monistic idealism") such as informs a narrow view of truth. In its place, James proposed a philosophic stance of *radical empiricism*, in which meaning has that 'individuality, subjectivity and contingency' that admits plurality, yet derives integrity from a single unifying principle - that of all knowing being ultimately rooted in direct personal experience. The most distinctive characteristic of radical empiricism is its refusal to make an absolute claim even for its own "truth". As James states in his preface to the *Will to Believe*: "I say 'empiricism', because it is contented to regard its most assured conclusions concerning matters of fact as hypotheses liable to modification in the course of future experience; and I say 'radical', because it treats the doctrine of monism itself as a hypothesis [and unlike other philosophies, does not] dogmatically affirm monism as something with which all experience has to square."

William James's *Essays in Radical Empiricism* (ERE) appeared over a century ago. They have not been regarded as favourably as his fundamental *Principles of Psychology*. Marianne Janack attributes this in part to James's refusal to respect "the epistemological borders" between philosophy and psychology. For James, since knowing of its essence concerns relationships given in personal experience, there can be no decisive separation of rational belief from personal feeling. Many other aspects of James's philosophical stance have proved equally controversial. These include his distrust of analytical approaches based on language, his invention of new and idiosyncratic terminology (such as "pure experience", "conjunctive relations", "understanding forwards") and his readiness to entertain unfashionable construals ("I am perfectly willing to admit any number of noumenal beings or events into philosophy if only their pragmatic value can be shown." James, *ERE* p242).

Our proposal for the *Science of Virtues* initiative is predicated on the idea that the socio-technological developments associated with the rise of computing lend new force and topicality to James's thinking. By way of *specific* focus, a broader conception of computing ("Empirical Modelling") developed by **Meurig Beynon** (the PI), **Steve Russ** and their collaborators over the last twenty years coheres with radical empiricism in key respects. This coherence can best be understood as deriving directly from re-contextualising James's radical empiricist hypothesis regarding the nature of knowing to take account of modern computing. In broad terms, the traditional conception of computing presumes notions of agency that inherently reflect the "monistic idealist" outlook. Behaviours are specified by programs whose mode of execution and interpretation is based on abstract mathematical and computational models. And though computing technology now provides the platform for varieties of experience far beyond the imagination of James's contemporaries, there is currently no accepted framework for thinking of computing as *fundamentally rooted in experience*.

In challenging the narrow view of computers as of their essence algorithmic processors, Empirical Modelling (EM) identifies computing activity with making interactive environments through the disposition and integration of human and automatic agents. Within such an environment, the maker

can explore interactive experience that in general admits interpretation as open and negotiable as that embraced by the arts and humanities, but is also subject to be constrained so as to be viewed as *as reliable* and *as formal* as is demanded of engineering and science. Plurality and integrity are explored through the classification of experiences of the same interactive environment when subject to different patterns of interaction or interpretation, or when taken in different contexts. Such exploration and classification is in keeping with James's pragmatic stance on knowledge, but can be far more explicitly realised, recorded and revisited with the benefit of modern technologies. The degree of control we can have over experiences generated in this way also serves to expose the links, typically obscured in our everyday experience, between *knowing* in the primitive personal sense that James identifies as fundamental and *knowledge* as it is understood in other philosophical frameworks.

In practical terms, James's vision endorses the idea that if each person could better appreciate the experiential basis on which another makes a claim to knowledge they would be more tolerant. In her study 'How computers change the way we think' (2004), Sherry Turkle identifies "embedding [information technology] in a culture that supports democracy, freedom of expression, tolerance, diversity and complexity of opinion" as "one of the next decade's greatest challenges". She contrasts the "binary assumptions" and "reassuring microworlds where the rules are clear" associated with the shift from meaning to mechanism with the vital need to be able "to consider life in shades of gray" and "to have many contradictory thoughts and feelings at the same time".

Empirical Modelling represents a decisive rejection of the idea that computing technology has to be conceived mechanistically in stark binary terms. Its benefits in supporting the kinds of open-ended exploratory sense-making activities that were envisaged by James have been shown by several generations of highly trained computer science students who Turkle classifies as "computer people". Our proposal aims to build upon existing principles, tools and models, promoting a new conception of computing by making EM more accessible to computing non-specialists and applicable to a wider range of disciplines. This is in line with Turkle's observation that "if we take the computer as a carrier of a way of knowing, a way of seeing the world and our place in it, we are all computer people now". In the process, we intend to bring greater clarity to the fundamental hypothesis that informs James's radical empiricism and advance more compelling evidence in support of its claim to generality.

We adopt the term *constructivist computing* (CC) to describe the new computing culture to which our project aspires. This term is suggested by the fact that EM establishes a live connection - manifest in the aspiration to know the meanings of a model state-by-state throughout its construction - between *making a model* and *learning about a domain*. In adopting this view, we side with **Bruno Latour** in his bid to rehabilitate the notion of constructivism. Crucial to this bid is respect for those dispositions (Latour's '[The] Promises of Constructivism' (2002)) that must guide authentic construction, which relate to what Janack has characterised as "epistemic virtues": capacity for objectivity, openness to new experiences, openness to evidence, openness to revising one's beliefs, etc. The philosophical framework afforded by radical empiricism gives authority to this conception of construction.

In CC, experience and social interaction rather than technological affordances define and distinguish the many varieties of human agency. We see it as a medium to promote tolerance, through which ever-evolving artefacts to support communication and understanding can be developed collaboratively by participants with quite different motivations, levels of technical expertise and domain knowledge.

Realising this vision for CC in its full maturity is beyond the scope of this proposal. It relies upon recruiting scholars from the humanities and scientists alike. Our present objective is to refine and organise the ideas, principles and tools we have so far developed so that their affinities with radical empiricism can be appreciated, and they can be disseminated to interested scholars from other disciplines. To this end, we shall compile a suite of artefacts, publications and auxiliary resources for open access on the web that is specifically framed to introduce CC and to expose the connections with James's thinking. Though this consolidation and amplification of existing materials will be the core activity, it will be carried out in close cooperation with an interdisciplinary body of scholars who will act in the role of an advisory board. The names of key members who have already agreed to act are here highlighted in **bold**. Several have already collaborated with the EM research group, and all have interest and expertise relevant to constructivism, computing, or the work of William James. We aim to create new, and deepen existing, interdisciplinary collaborations, compile a portfolio of collaborative papers, and engage other researchers, both known to us and as yet unidentified, as allies and critics.

Our project will be organised in three interlinked strands, each of which is itself an exercise in bringing integrity to a plurality in an aspect of constructivist computing. These relate to (a) the conception of CC, (b) the social and cognitive implications of CC and (c) the philosophy of CC.

With respect to (a), we take our inspiration from **Willard McCarty's** pluralistic vision of *Humanities Computing* (2005) and from humanities scholars such as his reviewer **Johanna Drucker** who believes that "the cultural authority of computing has rested too squarely on an assumption of the intellectual validity of reason and rational process". We shall build on a joint publication with McCarty [4] that connects EM with the many varieties of modelling he identifies as informing Humanities Computing, and a subsequent paper [22] entitled "Humanities' Computings" presented at Digital Humanities 2006. The case for adopting CC as a new conceptual framework for computing was the focal point of a workshop on *Thinking Through Computing* [28] organised by Russ and Beynon at Warwick in November 2007 (the numbered citations here can be found in Beynon's summary CV). In the spirit of James's own thinking, and in particular his distinctive notion of *understanding forwards*, CC recognises no sharp duality between theory and practice: the development of principles is of a piece with that of tools and models. At present the tools we have prototyped for CC are hybrid in nature, and in this respect betray the mismatch with conventional computing paradigms. Gerald Edelman's Jamesian theory of consciousness may inspire tools less indebted to the computational theory of mind.

With respect to (b), we are concerned with how CC can contribute to a computing culture that accommodates human diversity. Our previous research has shown the potential for CC – as an approach to computing that emphasises disposition rather than specification – to support open-ended interaction of a highly flexible nature that is well-suited to sense-making and the negotiation of meaning. Our advisors include researchers who have viewed the technological challenge that plurality presents from a complementary social science perspective. **Bonnie Nardi** notes: "we need better ways to use digital technologies to organise multiple activities, establish meaningful contexts for different activities, and collaborate with others. A different level of design and implementation is needed to make that happen." As an expert in Activity Theory, she believes "that application is an outcome of theory, not a separate activity", but recognises the need for broader conceptual and philosophical frameworks that transcend "the depiction of an ordered reality regulated through objects, mediators and goal-directed behaviour". Supporting collaboration and enhancing usability are two key challenges to be addressed in promoting CC. **Diane Sonnenwald** is an international expert on empirical studies and analysis of collaborative activities in science and business, and **Maria Kutar** is an authority on the analysis of many aspects of usability through the study of "cognitive dimensions".

With respect to (c), we have collaborated with **Joachim Petsche** in connection with his Philosophy module *William James' "Radical Empiricism" als Konzept des Empirical Modelling in der Computer Science*, and with **Marianne Janack** on her ongoing project on the philosophical concept of experience and its relationship to problems of knowledge in science and in moral philosophy, for which James's work provides the primary inspiration. In other work [24], we have identified connections with other philosophical traditions, notably – via the key notion of 'disposition' – with the Chinese concept of *shi* that the philosopher Jullien identifies with "efficacy" and "the harmonious union of all potential values". The artefacts of CC are well-characterised by **David Gooding's** notion of construals as "proto-interpretative representations which combine images and words as provisional or tentative interpretations of novel experience". Our goal in (c) is to understand to what extent the *principles* of radical empiricism – as expressed in the classification of experience of CC – can reconcile the plurality of competing philosophical outlooks with radical empiricism itself.

By giving greater coherence and focus to existing resources for teaching CC and disseminating these for broader use, we aim to attract interest in wider open-source development of tools and models. Existing case-studies, such as McCarty's Onomasticon for Ovid's *Metamorphoses*, the 'humanities games' devised by McGann and Drucker, and the visual representations for archaeology developed by **Hugh Denard et al** will provide inspiration. Denard's aim of *intellectual transparency* for model-building informed by history, archaeology and engineering illustrates our project theme in microcosm. The project cost of \$161,575 comprises \$83,645 (with \$26,930 indirect costs) to buy out 30 weeks teaching for Beynon and Russ, \$34K to fund meetings with advisors, and \$17K for a symposium to be held in the US in March 2011 at which we propose to convene all the members of our advisory board.