

# Online Research @ Cardiff

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository: <http://orca.cf.ac.uk/96067/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Collins, Harold Maurice and Evans, Robert John 2017. The bearing of studies of expertise and experience on ethnography. *Qualitative Inquiry* 23 (6) , pp. 445-451. file

Publishers page: <http://dx.doi.org/10.1177/1077800416673663>  
<<http://dx.doi.org/10.1177/1077800416673663>>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See <http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



# The Bearing of Studies of Expertise and Experience (SEE) on Ethnography.

Harry Collins and Robert Evans

## VERSION HISTORY

This is the authors' version of a work that was submitted to *Qualitative Inquiry* on 29 July 2016 and accepted for publication on 8 August 2016. It is being made available in accordance with the publisher's policies on open access.

Please note that changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version.

For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper. For this, and other information, please go to: <http://dx.doi.org/10.1177/1077800416673663>

## Contact details (both authors)

Centre for the Study of Knowledge Expertise and Science (KES)  
Cardiff School of Social Sciences  
Glamorgan Building  
King Edward VII Avenue  
Cardiff CF10 3WT  
UK

Emails:

Collins: CollinsHM@Cardiff.ac.uk  
Evans: EvansRJ1@Cardiff.ac.uk (Corresponding author)

## **The Bearing of Studies of Expertise and Experience (SEE) on Ethnography.**

### **Abstract**

Atkinson and Morriss (2016) explore the kinds of expertise and competence needed by ethnographic researchers. In doing so, they refer to the work of Collins and Evans, and in particular the idea of interactional expertise, which they dismiss as largely unhelpful to their project. In this response, we show that the Atkinson and Morriss miss-represent this work in important ways and that, if these mistakes are corrected, interactional expertise provides a useful way of addressing the methodological concerns they identify.

### **Key Words**

Ethnography; New Methods & Methodologies; Qualitative Research; Qualitative Criteria

### **Introduction**

Atkinson and Morriss (2016; hereafter A+M) have produced a classification of styles of ethnographic work which turns on the extent to which the ethnographer understands or participates in the life and practices of those studied. Their project is descriptive rather than evaluative and they take the existence of a body of ethnographic work in a certain style as a warrant for claiming something like ‘ethnographic work can be done this way among other ways’. Nevertheless, they intend that their classification will relate methods of ethnographic work to various possible intended purposes.

Among their theoretical inputs is a discussion of our, Collins and Evans’s (C+E), approach to the analysis of expertise which we describe under the heading of ‘Studies of Expertise and Experience’, with the acronym SEE. A+M concentrate, though not

exclusively, on SEE's notions of 'interactional expertise' and 'contributory expertise' (Collins & Evans, 2002, 2007). This is useful as we have not been assiduous about drawing the link between what we have done and ethnography. Much of our work is based on our own quasi-participatory studies of, respectively, gravitational wave physics (45 years in duration and 5 books) and economic modelling (about 5 years duration and one book), and we have not done much in the way of comparing this with the ethnography methods literature. In this respect, we have fallen into the silo mentality that characterises some academic fields of research.

On the one hand, then, we are delighted that A+M have revealed the mutual relevance of the two approaches and started to explore more systematically a topic that we have overlooked in our theoretical and methodological work (e.g. Collins et al., 2015; Collins, Evans, Ribeiro, & Hall, 2006; Collins & Evans, 2014). On the other hand, we are disappointed that A+M have not fully escaped their own silo. Thus A+M describe our work as 'unhelpful' on no less than three occasions while mischaracterising the concepts they address and neglecting published work that would have saved them from a number of misunderstandings. Here we aim to help to round out A+M's initiative by filling in the gaps and showing that what they call unhelpful approaches are actually helpful to the project of ethnography. In the discussion we'll include some recent publications to which A+M would not have had easy access given the absence of personal contact;<sup>1</sup> all the ideas

---

<sup>1</sup> Ethnographers of academic life might be intrigued to note that Atkinson, Collins and Evans have had offices in the same corridor of the same university department for over 15 years but C+E knew nothing of the A+M paper and its criticisms of the C+E approach

have been there in the literature in a dispersed way for a while but these recent publications gather a lot together in one place. They are Collins and Evans (2015), which explains the origins and significance of the idea of ‘interactional expertise’, and Collins (2016) which draws together the whole SEE program and is easy to access and is a brief read (the Introduction, which is about the relationship between sociology and philosophy, can be skipped). A third paper, which we mention because A+M do spend some time on the notion of ‘contributory expertise’, is Collins, Evans, & Weinel (2016), though *we* won’t talk about that concept here.

In their discussion of our work, A+M say our approach is ‘unhelpful’ in the following three ways:

1. Our notion of ubiquitous expertise ‘blunts any distinction between expert or esoteric knowledge and everyday or common-sense knowledge’ (p. 4).
2. We should not have categorised certain ‘further forms of knowledge [that] can be highly pertinent for ethnographic understanding’ as ‘meta-expertise’ (p. 5)
3. That we take the need for the analyst to acquire what we call the ‘practice language’ of any group being studied to be the central feature of ethnographic method means that our ‘model of knowledge-ethnography [is] limited simply to

---

until Google Scholar, in an automated report of citations, revealed that it had been published; a short conversation prior to the completion of the paper could have resolved many of the problems. For an example of how to do things differently, see the paper by Collins and Reber entitled ‘Ships that Pass in the Night’ (Collins & Reber, 2013). Collins and Reber created this attempt at a silo-breaching dialogue at a distance of 6,000 miles from each other without ever having met.

interaction [with the idea of interactional expertise] based specifically on the interests of the sociologist, and on sociology practiced through interviews.’ (p. 5)

We will show that each of these claims is wrong or misplaced before returning to the central question that concerns both ourselves and A+M: what kinds of knowledge and expertise does an ethnographer need to acquire?

### **Ubiquitous and Esoteric Expertises**

A+M argue that the category of ‘ubiquitous expertise’, which they correctly characterise as the ‘mundane knowledge that is the stock-in-trade of any or all competent, skillful social actors’ (p4), makes it harder to distinguish between expert/esoteric knowledge and everyday/common-sense knowledge. Here they confusing two separate ways of thinking about expertise – expertise as a status that is granted to social actors and expertise as the possession of socially relevant knowledge that may or may not be valued by participants. Thus they fail to see that the idea of ubiquitous expertise makes possible a new distinction *because* it draws attention to ‘esotericity’ as a dimension of expertise.

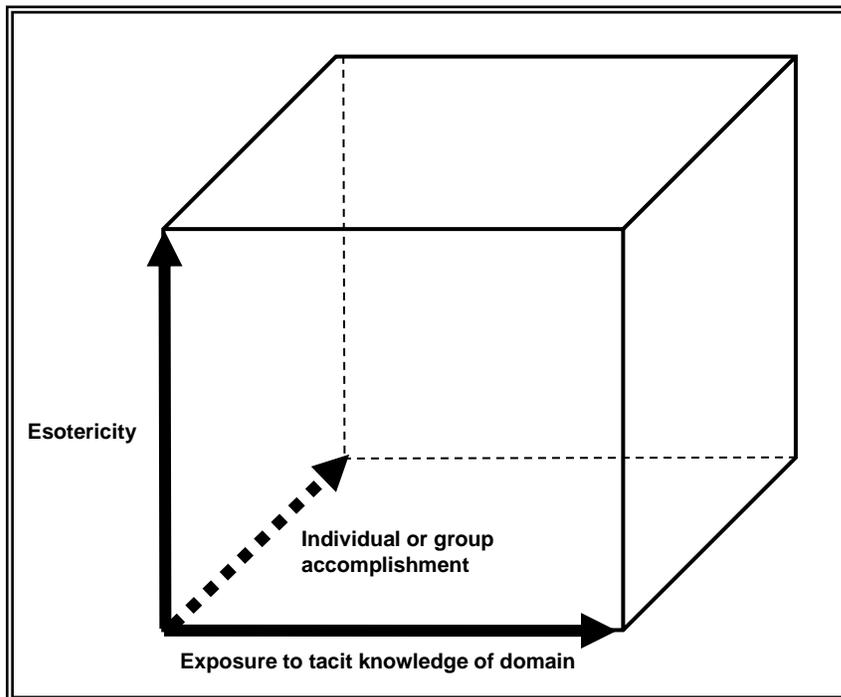
Consider the following examples, all of which turn on a recognising how the ubiquity or esotericity of expertise is a sociological phenomenon, not an epistemological one:

- For the anthropologist studying a culture which is unfamiliar in his or her native society, the everyday understanding of how to go on within that society is ubiquitous to its native members but the very same understanding when brought back home by the anthropologist is esoteric – known only to the anthropologist or a small group of anthropologists.

- When driving a car was a pursuit available only to the very few, the expertise involved would have seemed quite esoteric. Now many more people can drive so the same skills seem quite ubiquitous – indeed, it is even possible that driving a car is now even more demanding, precisely because it is ubiquitous, than it was when the expertise was esoteric
- Psychological approaches, which define expertise in terms of individual accomplishment and practice – e.g. ‘an expertise takes 10,000 hours to learn’ (Ericsson, Krampe, & Tesch-Römer, 1993) – will sometimes be referring to the same body of knowledge as an expertise and sometimes as not an expertise because everyone in a society possesses it. The paradigm example is native language-speaking; thus, English speaking in England, where it is not seen as an expertise, whereas in France it is a skill for the exercise of which one can be paid. What has gone un-noticed is the 10,000 hours plus that children spend learning ubiquitous expertises like their native language. A similar oversight characterises much of the early AI research which often started from the assumption that language was not an expertise and that early computers would find it easy to learn.

In fact, the ubiquitous-esoteric dimension, is just one of three dimensions that SEE uses to characterise expertise. The other two are the proficiency of the individual practitioner and the extent to which the learner has access to the tacit knowledge of the domain. The model, which is helpful if you want to understand what kinds of expertise can be (or have been) acquired and how this relates to an expertise being ubiquitous or esoteric, is

summarised in Figure 1 (below, first published in Collins, 2013, but see also Collins, 2016).



*Figure 1: Expertise space diagram or ‘three-dimensional model of expertise.*

As can be seen, the regular psychological or stage-theory approach is shown on the axis going into the page (the Z-axis) with esotericity vertical (Y-axis) and the extent to which the putative acquirer of expertise is exposed to the tacit knowledge of the domain through full socialisation or immersion in the discourse shown left-to-right (X-axis). As Collins (2013b) and, much more briefly Collins (2016) show, one can represent all kinds of trajectories of expertise using this framework and one can use it in various different ways.

## Meta-Expertise

The next way in which SEE is said to be unhelpful is in describing certain expertises as ‘meta-expertise’, or expertises used to judge other expertises. Meta-expertises are the fourth line on the Periodic Table of Expertises which is shown in Figure 2 and is first found in Collins and Evans, 2007.

<b>1 UBIQUITOUS EXPERTISES</b>					
<b>2 DISPOSITIONS</b>		Interactive Ability			
					Reflective Ability
<b>3 SPECIALIST EXPERTISES</b>	<b>UBIQUITOUS TACIT KNOWLEDGE</b>			<b>SPECIALIST TACIT KNOWLEDGE</b>	
	Beer-mat Knowledge	Popular Understanding	Primary Source Knowledge	Interactional Expertise	Contributory Expertise
		<i>Polimorphic</i>			<i>Mimeomorphic</i>
<b>4 META-EXPERTISES</b>	<b>EXTERNAL (Transmuted expertises)</b>			<b>INTERNAL (Non-transmuted expertises)</b>	
	Ubiquitous Discrimination	Local Discrimination	Technical Connoisseurship	Downward Discrimination	Referred Expertise
<b>5 META-CRITERIA</b>	Credentials		Experience	Track-Record	

*Figure 2: The Periodic Table of Expertises*

We don't understand why the notion of meta-expertises is considered unhelpful as it seems vital to us and this is the first time it has been subject to criticism. A+M do not explain the problem and we can only assume it is another case of what they see as the ‘blunting’ of categories that follows from referring to ‘everything as expertise’. Of course, if this really is their concern, we would reply that, as with the distinction between ubiquitous and esoteric, the adjective is important in distinguishing what kind of

expertise is being referred to.<sup>2</sup> In the case of meta-expertise, the adjective signals that these are not judgements made by the practitioner's peer group but by others, relying on the forms of expertise and experience that the wider society makes available for judging expertise and expert performance.

That said, we recognise that the Periodic Table of Expertises is a work in progress and must be subject to the usual scientific process of critique and revision. For example, over the years we have realised that there is some bleeding of meta-expertise into the higher levels of specialist expertise (interactional expertise and contributory expertise) in the form of what we call 'Domain Specific Discrimination' (Collins et al., 2016; Collins & Weinel, 2011). Domain specific discrimination is the non-technical judgment made by experts within an esoteric domain of the expertise of other experts within that domain, this being one of the ways that, for example, consensus in an esoteric science is developed (Collins, 1992) Whether this is a separate form of expertise, simply a component of interactional expertise or a capacity that comes with the acquisition of interactional expertise is something that could be debated further.

Likewise, we are not entirely happy with our understanding of connoisseurship. For example, to what extent does it depend on possessing interactional expertise in the domain being judged and/or to what extent is skilled consumption a practice, and hence

---

<sup>2</sup> We would also add, though this is not a point made by A+M, expertise needs to be tied to a domain. Rather than talk about expertise, we would much prefer to talk about interactional expertise in flower arranging or technical connoisseurship in experimental design.

specialist, contributory expertise, in its own right? Thus, though we think the details of the meta-expertise row need working on, we think the concept itself is sound and essential to any analysis of expertise – and it is, indeed, one of the central concepts in philosophers’ analysis of the assessment of expertise by the public (e.g. Goldman, 2001).

### **Interactional Expertise**

In their treatment of interactional expertise as ‘unhelpful’ that A+M go even more damagingly wrong than in the other cases. They say:

The model of knowledge-ethnography proposed by Collins is consequently *unhelpfully limited simply to interaction*. Indeed, the original formulation of interactional expertise seems to be based specifically on the interests of the sociologist, and on sociology practised through interviews. (our stress)

There are at least two different mistakes here. The first, and less serious one, is the reduction of interactional expertise to sociological fieldwork interviews. A+M are correct to say that the first publication to use the *term* ‘interactional expertise’ (Collins & Evans, 2002) did use fieldwork practices as a way of illustrating the concept but, even then it was part of a much bigger argument about the role of the social analyst in evaluating claims to expert status. But the *idea* of interactional expertise has much deeper origins, going back to 1996 (Collins, 1996), as set out in Collins (2004), and more fully and accessibly explained in Collins and Evans (2016).

The second, more serious mistake, is the way in which language appears is misunderstood by A+M. They draw a sharp contrast between language and practice

whereas fluent language-speaking *is* a practice. They somehow treat the acquisition of fluency in a language, or practice language, by immersion in the spoken discourse of the domain, as something that does not count as social interaction. They say that in stressing the centrality of learning the language we are advocating *non-participatory* (!) research methods as though acquiring fluency in a language did not, by definition, imply participation within a society. There is a philosophical argument about the extent to which this participation can rely on linguistic socialisation alone, with us claiming that, in principle, interactional expertise can be acquired solely through linguistic socialisation but this is still participation. More physical and embodied participation speeds the whole thing up and makes for a much more efficient process but even where interaction is as purely linguistic as such a thing can be (as when one of the parties is physically incapable of more extended physical engagement) becoming fluent is still interacting. Further arguments follow below.

Succulently, much of what has just been argued is necessary to make sense of A+M's own description of aspects of their ethnographic world. Thus, Atkinson describes his engagement in the world of opera and points out that he could not be said to be a full practitioner in that world despite his substantial knowledge of opera, excellent access and long immersion. He says:

there was no single body of expertise [that could be acquired] ... It would imply – possibly as a prerequisite to conducting the fieldwork – vulgar competence as a solo singer, a member of the chorus, an orchestral musician, a conductor, a repetiteur, a set designer, a director, a stage manager, a crew member, a carpenter,

a lighting technician, a dramaturg, an artistic administrator, and so on. In many settings, after all, there is a complex division of labour. In order to study how social actors work together, it is neither desirable nor feasible to become expert at all they know individually. However, the ethnographer does need to be able to *make sense of the talk* between various actors and this does require a certain level of competence. (p. 3, our stress)

Making sense of the talk between actors is acquiring *interactional expertise*. That's not just a word for something that everyone understands already because the idea has many ramifications. One of these is that each of the actors who engage in an enterprise characterised by a complex division of labour must also be an interactional expert in all the other specialist practices with which they must coordinate their actions yet without practising those practices and, usually, without being capable of practicing those practices; an opera company is a perfect illustration. Being an interactional expert means having a fluency in the practice language that enables one to make sound practical judgments in respect of practices that one cannot practice.<sup>3</sup> Language, at a level of fluency that embodies tacit knowledge in its form, substance and silences, makes division

---

<sup>3</sup> See Collins and Sanders (2007) for a discussion of the concept between Collins and the one-time Project Manager of the Laser Interferometer Gravitational-Wave Observatory (LIGO) and now Manager of the 30-Meter Telescope project. Sanders explains that interactional expertise is what he uses to deal with all the different practices he must direct.

of labour possible and, in exactly the same way, makes ethnography possible.<sup>4</sup> The ethnographer, however deeply immersed in a native society, cannot possibly be practising every practice just as we do not practice every practice within our own societies. Most of what we understand about our own societies we understand through the language we speak. Aspiring to know the relevant language fluently does not in any way limit the research ‘*simply to interaction*’ – the notion is utterly incoherent.

The thrust of the argument from language does, of course, fly in the face of a long tradition of phenomenological analysis associated with Heidegger, Merleau-Ponty, Todes, Dreyfus and others.<sup>5</sup> Yet it just has to be the case or we cannot make sense of our world – for instance we would not be able to understand the division of labour nor the fluency of the congenitally physically challenged without the idea of interactional

---

<sup>4</sup> One wonders if there is any society with a language that does not have a division of labour.

<sup>5</sup> One of the strangest of A+M’s criticisms of our work is that ‘Collins and Evans rely almost exclusively on the five-stage model summarised by Dreyfus and Dreyfus (1986)’. They go on to say we share Dreyfus’s faults, in particular not understanding that some ethnographers do not just sit back and think about skills like driving but actually engage in the practices of those they study. In response, first we do not rely on the Dreyfus and Dreyfus model and many criticisms of it will be found in our writings. For a recent critique of the Dreyfus position in general see Collins (2016 forthcoming). Furthermore, in our work there are many instances of our participating in the work we analyse. For example, in gravitational wave physics Collins tried to participate in the discussion of ‘little dogs’ (Collins, 2013a, Appendix 4). Collins has also helped to put lasers together and published research in parapsychology and in the area of computerised expert systems and built an expert system to guide the creation of semi-conductors. But, more important, the notion of ubiquitous expertise shows that we are participating all the time and a more careful analysis of what ethnographers do shows that, except under remarkable circumstances, they cannot be physically participating in anything but a small part of the activities they analyse.

expertise. The way interactional expertise operates in domains characterised by division of labour, and the position of the ethnographer within such fields, is explained by Collins in his paper 'Language and Practice' (Collins, 2011). This paper shows how Atkinson's immersion in the world of opera could work by explaining how Collins's immersion in the world of gravitational wave physics did work. So, once more, the idea of interactional expertise seems more helpful than unhelpful.

This is such an important point that it is worth repeating. It is simply not true, as A+M say, that 'privileging spoken interaction in the absence of participation (participant observation) or the personal acquisition of practical competence is an apologia for non-ethnographic investigation.' Atkinson himself has to privilege spoken interaction if he is to claim that he is doing something other than 'non-ethnographic investigation' in respect of every aspect of opera other than that in which he is practically accomplished! A+M simply have not thought through the complicated relationship between what we know through language and what we know through practice – they are simply confused; spoken interaction, if it is fluent, *is* participation. The fundamental relationship between ethnographers and those they study is that the ethnographer hangs around the practitioners in order to learn to understand their practices through acquiring their language. Where there is no division of labour, more embodied practice might be possible but exactly what it delivers aside from access is not so clear given that the ethnographer *has to be able to understand* things that he or she does not practice. Where there is any significant division of labour, it is logistically impossible for qualitative research to be done in any other way.

## ***Imitation Games***

There is another aspect of SEE that is not mentioned at all by A+M but which we *have* suggested might be helpful to ethnographers and other participatory fieldworkers. This is the ‘Imitation Game’ (we capitalize to refer to our technically developed method). Alan Turing based his famous idea that has become known as the ‘Turing Test’ on a parlour game in which a hidden man pretended to be a woman when answering questions from a ‘judge’ while a hidden woman answered the same questions for comparison. Turing replaced the man with a computer. We have developed the Imitation Game as a full-scale method for testing the extent to which one person or group understands the culture of another – the extent to which one group or person *possesses the interactional expertise* of another (Collins, forthcoming; Collins et al., 2015; Collins & Evans, 2014). Hundreds of games can be run on a national scale to look at the competence of groups pretending to be other groups (such as secular people pretending to be religious and *vice versa*), through to a dozen or so games on a small group (such as the blind pretending to be sighted and vice versa), down to the testing of individuals (such as Collins pretending to be a gravitational wave physicist). In the last form it is a way for ethnographers, anthropologists, and so forth to test their native competence rather than just talk about it. Thus Collins did pass as a gravitational wave physicist (Giles, 2006) and in a more recent test did quite well again, this time comparing his abilities with those of astrophysicists and sociologists (Collins, 2017, Chapter 14; also available at <http://arxiv.org/abs/1607.07373>). The test is very easy to carry out in computer literate societies, either by getting someone to set questions and organize the answers over email or by using a specialized ‘app’ that we

have developed for Apple and Android devices<sup>6</sup>. In non-computer literate societies, more ingenuity might be required. Now, the idea of testing one's native competence is forbidding but there is no suggestion that a competent ethnographer has always to 'pass'. The test can be used as a way of thinking about one's expertise and where it is lacking and is even valuable as a thought experiment without actually carrying it through.

### **Varieties of ethnography**

A+M start with a clear and valuable project – 'What kind and what level of competence can and should the ethnographer seek to attain?' – but they choose to dodge their own question. Their paper offers a rough categorisation of ways in which ethnographers can engage with those they study but they ultimately avoid any evaluation, arguing instead that:

there is no single answer to the question. Indeed, one really needs to turn the question round. There is clearly no one level or type of knowledge that can be aspired to. The competence achieved by the ethnographer must clearly depend to a considerable extent on the project in hand. (p. 7)

Now, quite apart from whether A+M want to evaluate the expertise needed to conduct ethnographic research, they would not be able to use their categorisation to do so. The categorisation (pp 6-7) goes as follows:

---

<sup>6</sup> Information about the app can be found at: <http://blogs.cardiff.ac.uk/imgame>

*Practical competence.* Practical competence means that one can actually perform to a given level. The novice can undertake basic tasks to a moderate level.

*Critical competence or connoisseurship.* There is a range of competence that depends on the ability to offer an informed opinion *about* performance. The connoisseur or aficionado is capable of applying fine discriminations in evaluating and classifying styles and levels of performative skill. Obviously, the professional critic is a key exemplar.

*Situational competence.* Situational competence reflects a degree of enculturation, to the extent that the fully socialised member is tacitly versed in the ordinary and special forms of social encounter, has interactional competence in dealing with fellow members, and can sustain unselfconscious social interaction.

*Descriptive competence.* Descriptive or recognition competence allows the observer to identify and to describe cases, types and instance. The bird-watcher can exercise such competence in distinguishing between species, and can describe the characteristic shape and markings of each. *Commentary competence* is a variant, based on an analogy with the sports commentator on TV or radio.

*Pedagogical competence.* The competent pedagogue possesses enough practical, advanced competence to be able to instruct and coach others.

But these are not distinct categories of expertise, they are aspirations for different kinds of ethnographic output. As forms of expertise, they come all mixed up as one immerses

oneself in a new society, allowing processes of socialisation to run their course. If one can converse fluently one might well have acquired at least one practical competence because it is through practice that entry is most usually achieved (though bear in mind the case of technical managers and what we call ‘special interactional experts’ – Collins and Sanders, 2007, Collins, 2011), and one is going to be able to be comfortable in the typical social situations in which conversation takes place and one will be able to teach people about that society and its ways of going on. These categories cannot be distinguished in anything other than an analytic way. That’s why the Turing Test and the Imitation Game are so powerful: demonstrate fluency and you demonstrate social understanding. Even a macho enthusiast for artificial intelligence and believer in the coming ‘singularity’, when computers will take over the world, understands this; Ray Kurzweil, does not believe the Turing Test will be passed until 2029. He says: ‘There is no set of tricks or algorithms that would allow a machine to pass a properly designed Turing test without actually possessing intelligence at a fully human level.’<sup>7</sup> For Turing test read ‘Imitation Game’ and for ‘intelligence’ read ‘cultural understanding.

Note that the above paragraph does not cover one category -- *Critical competence or connoisseurship*. That’s because it is something quite different to the others – it is not an expertise but a meta-expertise. And there are certainly institutions and cultural domains, such as art or theatre criticism, where what counts as definitive critical acumen and

---

<sup>7</sup> This remark can be found in Kurzweil (2002, and 2005, p. 505).

connoisseurship does not require any ability to practice within, talk within, or, in the opinion of at least some of the practitioners, even understand the domain being judged.

That category aside, the ability to converse fluently within a domain, which can be tested, or at least thought about, via the Imitation Game, represents a general measure of cultural competence in that domain and a point from which one *can* begin to ask the question – what level should ethnographers and other participatory researchers aspired to achieve?

### References cited

Atkinson, P., & Morriss, L. (2016). On Ethnographic Knowledge. *Qualitative Inquiry*, 1077800416655825. <http://doi.org/10.1177/1077800416655825>

Collins, H. (2016 forthcoming). Interactional Expertise and Embodiment. In J. Sandberg, L. Rouleau, A. Langley, & H. Tsoukas (Eds.), *Skillful Performance: Enacting Expertise, Competence, and Capabilities in Organisations* (Vol. 7). Oxford: Oxford University Press. (<http://arxiv.org/abs/1607.08224>)

Collins, H. (1992). *Changing order: replication and induction in scientific practice*. Chicago: University of Chicago Press.

Collins, H. (1996). Embedded or embodied? a review of Hubert Dreyfus' What Computers Still Can't Do. *Artificial Intelligence*, 80(1), 99–117. [http://doi.org/10.1016/0004-3702\(96\)00083-6](http://doi.org/10.1016/0004-3702(96)00083-6)

- Collins, H. (2004). Interactional expertise as a third kind of knowledge. *Phenomenology and the Cognitive Sciences*, 3(2), 125–143.  
<http://doi.org/10.1023/B:PHEN.0000040824.89221.1a>
- Collins, H. (2011). Language and practice. *Social Studies of Science*, 41(2), 271–300.  
<http://doi.org/10.1177/03063127111399665>
- Collins, H. (2013a). *Gravity's Ghost and Big Dog: scientific discovery and social analysis in the twenty-first century* (Enlarged edition). Chicago: The University of Chicago Press.
- Collins, H. (2013b). Three dimensions of expertise. *Phenomenology and the Cognitive Sciences*, 12(2), 253–273. <http://doi.org/10.1007/s11097-011-9203-5>
- Collins, H. (2016). Studies of Expertise and Experience. *Topoi*, 1–11.  
<http://doi.org/10.1007/s11245-016-9412-1>
- Collins, H. (2017). *Gravity's Kiss*. Cambridge, Mass: MIT Press.
- Collins, H., & Evans, R. (2002). The Third Wave of Science Studies: Studies of Expertise and Experience. *Social Studies of Science*, 32(2), 235–296.  
<http://doi.org/10.1177/0306312702032002003>
- Collins, H., & Evans, R. (2007). *Rethinking expertise*. Chicago: University of Chicago Press.

Collins, H., & Evans, R. (2014). Quantifying the Tacit: The Imitation Game and Social Fluency. *Sociology*, 48(1), 3–19. <http://doi.org/10.1177/0038038512455735>

Collins, H., & Evans, R. (2015). Expertise revisited, Part I—Interactional expertise. *Studies in History and Philosophy of Science Part A*, 54, 113–123. <http://doi.org/10.1016/j.shpsa.2015.07.004>

Collins, H., Evans, R., Ribeiro, R., & Hall, M. (2006). Experiments with interactional expertise. *Studies in History and Philosophy of Science Part A*, 37(4), 656–674. <http://doi.org/10.1016/j.shpsa.2006.09.005>

Collins, H., Evans, R., & Weinel, M. (2016). Expertise revisited, Part II: Contributory expertise. *Studies in History and Philosophy of Science Part A*, 56, 103–110. <http://doi.org/10.1016/j.shpsa.2015.07.003>

Collins, H., Evans, R., Weinel, M., Lyttleton-Smith, J., Bartlett, A., & Hall, M. (2015). The Imitation Game and the Nature of Mixed Methods. *Journal of Mixed Methods Research*. <http://doi.org/10.1177/1558689815619824>

Collins, H., & Reber, A. (2013). Ships that Pass in the Night: Tacit Knowledge in Psychology and Sociology. *Philosophia Scientiae*, (17-3), 135–154. <http://doi.org/10.4000/philosophiascientiae.893>

Collins, H., & Sanders, G. (2007). They give you the keys and say “drive it!” Managers, referred expertise, and other expertises. *Studies in History and Philosophy of Science Part A*, 38(4), 621–641. <http://doi.org/10.1016/j.shpsa.2007.09.002>

Collins, H., & Weinel, M. (2011). Transmuted Expertise: How Technical Non-Experts Can Assess Experts and Expertise. *Argumentation*, 25(3), 401–413.

<http://doi.org/10.1007/s10503-011-9217-8>

Dreyfus, H. L., & Dreyfus, S. E. (1986). *Mind over machine: the power of human intuition and expertise in the era of the computer*. New York: Free Press.

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review*, 100(3), 363–406. <http://doi.org/10.1037/0033-295X.100.3.363>

Giles, J. (2006). Sociologist fools physics judges. *Nature*, 442(7098), 8–8.

<http://doi.org/10.1038/442008a>

Goldman, A. I. (2001). Experts: Which Ones Should You Trust? *Philosophy and Phenomenological Research*, 63(1), 85–110. <http://doi.org/10.2307/3071090>

Kurzweil, R. (2002, April 9). A Wager on the Turing Test: Why I Think I Will Win.

Retrieved July 28, 2016, from <http://www.kurzweilai.net/a-wager-on-the-turing-test-why-i-think-i-will-win>

Kurzweil, R. (2005). *The singularity is near: when humans transcend biology*. New York: Viking.