Author’s response to reviews

Title: Healthcare Information Systems: The Cognitive Challenge

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Author’s response to reviews:

The general tenor of the reviewers’ comments suggested to us that we had not been sufficiently explicit in explaining what we are trying to do in this paper.

To correct that, we have expanded the first section, background. After that section, we have added a section, purpose, in which we explain what we are trying to achieve with the paper and our strategy for selection of the case studies and what we want to abstract out of this case studies.

Within the first section, we have also cited several studies (including some by Trisha Greenhalgh) that reference issues with current electronic healthcare systems. We have added a subsection on user centered design and explain why we think that approach has proved to be unsatisfactory. We have also added a subsection on macrocognition and decision-centered design, which we now make the focus of the paper as an alternative to talking more generally about cognitive systems engineering.

Reviewer one

Summarise research (from particularly sociology and user-centred design) that has addressed the inadequacy of a narrow technological focus to the design of EHRs (e.g. research by Trisha Greenhalgh).

We have addressed this comment in our expanded background and significance section.

justify the particular case studies

we have addressed this comment in the subsection, purpose, and added some clarifying comments to discussions of each of our case studies.

explain what you mean by the 'healthcare community' - it is not simply healthcare practitioners who need to be involved in terms of understanding their cognitive capabilities, but patients and carers (as some of your examples attest).
We have clarified this in our first paragraph of the expanded background section.

More specific requests are listed included below:

Abstract and elsewhere: 'Natural cognitive capabilities and skills' - what appears natural is very much indebted to the ecological and cultural contexts in which cognition operates and is honed; I suggest removing the term 'natural' and using simply the phrase 'cognitive capabilities and skills'.

Deleted natural, selectively replaced with informal where that is useful

Acknowledge other things beside the cognitive - eg the affective -- which have a bearing on how information systems are used, and the difficulties that they can face.

Research that we know of that implicates the affective is poorly conceptualized. Dealing with that would extend the paper and distract from the flow of the argument. There is, for example, a good deal of literature on trust. However, those who lean on this idea are missing the point that trust in systems evolves when the systems are reliable in helping us to do what we need to do – that requires good cognitive design

p.4 You need to justify your selection of the case studies / the papers you interrogate.

See new section, Purpose

p. 6 'Healthcare involves a dynamic mix …': what about the affective components? It's not just physical and cognitive.

We have retitled and rewritten this section. This dynamic mix statement is no longer in the paper.

p. 6 'Presumably, those involved …' - this sounds speculative; it would be preferable to turn specifically to the existing research that has been done on this existing case study rather than to speculate about the intentions of those involved in the development work.

We have adjusted the wording and added citations.

p.6 Facing the challenge - it's fine for the article to centre on cognitive systems engineers, but it would be good to acknowledge here (and perhaps cite an example of) other crucial contributions from those with other sets of expertise.

Our claim for this paper is that no one else is addressing the cognitive design issues effectively

p.7 'healthcare community' - this needs to be unpacked. Who makes up this community? It's surely a range of heterogeneous clinicians, plus, crucially, clinical managers, patients and carers. I would argue that all should have a stake in the design - not least because they have differing priorities and different ways of mobilizing their own cognitive capabilities. For example, in
relation to the colorectal screening example, it would be crucial to ensure that patients are consulted and involved alongside practitioners to explore why there might be resistance to having the checks - it's not necessarily simply a case of 'educating' the patients about the 'right' medical thing to do.

We have defined this in first paragraph and in the new Purpose section. In addition, we now refer to those involved in patient care at various points and have made it clear that patients themselves and patients’ families are included in that and have substituted references to healthcare professionals with terms that are inclusive of patients and families unless we are referencing work that refers specifically to healthcare professionals.

p.8 What motivates your selection of the particular case studies?

As noted above, this is clarified in the Purpose section

p.10 Discussion - you mention 'experts'. Who are the experts? They surely include patients in certain respects, since arguably patients are expert in managing their own conditions. It would be worth extending this paragraph to explore what exactly you mean by expertise.

As explained above in reference to the p 7 comment.

p.11 In relation to the previous point - surely then you need to track the cognitive capabilities of healthcare practitioners and of patients (and of carers).

As explained above in reference to the p 7 comment.

Reviewer 2

2. Article Structure- The overall article structure is unclear. The background and significance section is followed by a challenge section that is not clearly stated. Perhaps a subheading: technology focused design in electronic health records would improve the clarity. After the second case study there is a section called overview but it is not clear what it is an overview of. The next subheading "facing the challenge" is also unclear perhaps because the challenge is not clearly articulated. The second set of case studies would benefit from a clearer sub heading title as well. This is followed by a discussion but no conclusion.

We respond to this summary in detail below.

3. Background and Significance-This section gives a reasonable broad introduction. Citations are needed to strengthen and support. In particular, cites for P 1 S4

P2 S2-3

P3 S1-3
We could not identify which comments these requests for citations were referring to but have added citations for the issues discussed and hope that we’ve covered these concerns.

This section would also be strengthened by a clear purpose statement.

We have added a purpose subsection as a response to this comment.

4. Case study 1- This case study is not particularly strong or generalizable to many organizations. I believe there are stronger case studies that would better support their argument. If this case study remains, it would be improved by defining: unscheduled evacuations including a clearer explanation of the implications for nonmilitary readers, situation awareness and why it is important and what they mean by comprehensive cognitive analysis.

Underlying our argument in this paper is the belief that healthcare practitioners are engaging in macrocognition on a moment to moment basis. It is essentially invisible to everyone because these activities merge seamlessly with the work. Quite a lot of healthcare research refers tangentially to macrocognition but because macrocognition is so poorly understood, little design work refers to it explicitly. We took the reviewer’s comment seriously and searched for a more recent study undertaken in a more common healthcare environment that would reveal with sufficient clarity the problem of ignoring macrocognition in the design of a healthcare system. There is quite a large literature to show that healthcare technologies can be poorly designed, and it is clear from the discussion that there is a cognitive issue, but the nature of that issue is typically not discussed at a level of detail that would allow us to implicate specific macrocognitive activities. Unfortunately, we could find no substitute for this paper that would be more clarifying.

We have defined unscheduled evacuations

We have cited another paper on bed allocations in intensive care that suggests the relevance of this for nonmilitary readers

We have deleted the reference to situation awareness

We did find another study that implicates other cognitive processes and have added it. We think both are informative but believe the paper would not suffer appreciably if we are required to delete one.

5. Case Study 2-This case study is somewhat more illustrative but uses only one cite when much has been written about the NHS electronic record system that could be included.

We have added some citations here and have also added citations in the background section

6. Facing the Challenge-This section could be clarified. This includes a definition of usability and usability paradigm (p. 4 P2) and an explanation of the methods used by cognitive systems engineers. The text box on P4 illustrates the different between rule based and dynamic control but is not referenced in the text or titled. The top of p5 is a good explanation of macro and micro
cognitive processes, some explanations like this would aid in the first part of the paper. At the end of this discussion they appear to be discussing data visualization to enable rapid cognition for which there is a considerable amount of research to cite, but they do not mention it by name.

We have moved some of this to other places and we think we have responded to all of this except for data visualization. There is a design literature relevant to this but it is an extensive topic that we did not want to raise because to do so briefly leaves too many hanging threads.

7. Case Study 3-This case study is more detailed than the first two with convincing details.

Definitions are needed for mental effort.

We took this term from the cited paper, where it was undefined. We traced the literature back to find the definition but, problematically, that just leads to more terms that are undefined. We added some words in parentheses to the following sentence: Primary-care providers also reported reduced mental effort (assessed subjectively on a nine-point scale from extreme to none) ………. We are not sure it helps.

I also believe there are opportunities to make more concise and retain the clarity and depth.

We struggled with this. We have done some editing, and have removed some repetitious statements, but were not able to respond substantively to this comment.

8. Case Study 4-This case study is also more developed than the first 2. I suggest the authors define cognitive interviews.

We found it difficult to define cognitive interviews because the definition refers to other undefined concepts, but we have added a sentence that describes the information sought in the interviews.

9. Discussion-The discussion seems repetitive in places and does not tie to the literature as it should.

We have added citations but have not changed this much. We have taken out a couple of sentences that seemed repetitive but overall, we thought this is the type of ending needed for the argument we have made.

X. Surprising Omission-I am surprised there was no mention of user center design and the evidence that support this method.

We now have a subsection on this in Background