Wearing Two Hats: Reflecting Alongside Authentic Designing

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Abstract

To be useful in *research enquiry*, design practice should be *authentic* and include reflection *on* and *in* practice, creating a tension for those with the dual role of 'designer-researcher'. Designerly thinking and human-centred and participatory design characterise authentic practice and reinforce its applicability as *research through design* or *Action Research*. To move from contributions of *specifically what/how* to design to more *transferable principles*, designer-researchers should: provide accessible accounts of practice; evaluate the relevance or workability of what is designed; in AR, ensure stakeholder collaboration throughout; and, ensure systematic reflection on practice. Schön (1983) and Gedenryd (1998) explain reflection *in* design practice as an enquiry into problem-settings and solutions, and this involves *tacit* knowing (Polanyi, 1966). *Explicit* attendance and reflection on design moves during practice can then break down the process of designing. We propose reflection *alongside* practice to minimise this, which creates accounts of practice as a resource for practitioners to re-access their reflection *in* practice and further reflect *on* practice. In a short case study, an external researcher interviewed designer-researchers throughout a health service co-design project, enabling the research team to develop transferable principles from the design methods used. We discuss the advantages of this approach over self-directed accounting.

Keywords

Research through design, Action Research, reflection in/on practice, methodology

Discussions of designing within research (e.g. Archer, 1995; Zimmerman et al., 2010) typically focus on what designers should do to ensure their practice as a robust means or resource for academic enquiry. But the authenticity of the designing itself is also important. Swann's (2002) discussion of design as research centres on the similarity between professional (i.e. authentic) practice and Action Research. Binder and Redström (2006) discuss design practice as experiments that test and develop a research programme and, as such, "engage with a reality of designing outside the confines of the research setting" (p5).

Skilful designers' practices demonstrate designing as a form of enquiry (Schön, 1983; Gedenryd, 1998), but such *design enquiry* focuses on what is designed whereas design within *research enquiry* aims for broader understanding of designing itself and the social and technological contexts in which it is applied. Further, commercial measures of design

success relate to outputs' quality whereas measures in the academy relate to how well designing serves research enquiry. Although it may be applied for different ends, designing within research still should be suitably disciplined (Stolterman, 2008), else risk researchers 'playing at being designers'.

Design practice can produce exemplars of *what* can be designed and *how* (Binder & Redström, 2006), which may also suggest generalisable or transferable (Hayes, 2011) principles for other design situations. However design enquiry produces *specific* understanding (embodied in an artefact or design method) whereas research utilising design practice aims for *general* understanding (artefact classes, design methodologies) as intermediate-level knowledge rather than abstract theory (Löwgren, 2013).

Professional and graduate designers may become researchers by documenting their practice for subsequent academic analysis and peer review (e.g. Pedgley & Wormald, 2007). Similarly researchers may adopt designing as an alternative method of enquiry. Such individuals then have the role of both designer and researcher within the same project, but could these roles conflict? Our paper explores the implications for such 'designer-researchers' in ensuring the authenticity of both design and research activities.

In the paper's first section, we define *authentic design* practice using current thinking on design as a methodology and, in the second section, review two conceptualisations of design practice as *authentic research* (research through design and Action Research). In the third section, we revisit the features of authentic design practice that make it amenable for research and identify where additional attention is required (notably a need for systematic reflection upon and accessible accounts of practice).

Schön's (1983) and Gedenryd's (1998) descriptions of designing highlight a tension between the reflection inherent *in* practice and the reflection *on* practice necessary for research. Pedgley (2007) experienced similar difficulties in accounting his practice for research, and used structured diary entries to capture designing for subsequent analysis. Such an approach is appropriate where a single designer is motivated to document their practice for a personal research endeavour (although Pedgley had occasional lapses), but is less suited to collaborative design activity where many stakeholders are likely to be more concerned with design outputs than the practice as a research tool.

We propose reflection *alongside* practice to ensure collaborative designing remains authentic (as design enquiry) whilst supporting research enquiry, and illustrate with a short case study where semi-structured interviews provided a setting and resource for reflection, enabling the development of transferable knowledge on design methods.

Authentic Design Practice

Debate is ongoing on the nature of designing within our research community, but there is sufficient commonality to suggest principles or strategies that skilful (and successful) designers would recognise in their own practice and therefore provide an outline of designing as a *methodology*.

The strategies we highlight derive from the work of Cross (2011; 2007), Lawson (1997), Schön (1983), and Buchanan (1995), which Johansson-Sköldberg et al. (2013) observe present complementary accounts of "designerly thinking in practice":

> *Co-evolution of problem and solution* – designers do not approach problems as being 'fixed' and instead open-up problematic situations to seek alternate ways of conceptualising them that then suggest directions for solutions. The process then becomes a refinement of both problem and solution;

> *Making as enquiry* – designers sketch (and create models, mock-ups and prototypes etc.) to explore both problem and solution spaces. In sketching (etc.), a designer works out a potential solution to a potential problem and is then able to reflect upon the relevance and implications of both;
>
> *Developing and adopting frames* – designers impose *frames* or ordering principles to guide or inspire what they design. The selection or development of appropriate frames (proposals for working principles to create desired value) is a productive strategy for dealing with the open, complex situations designers typically encounter (Dorst, 2011);
>
> *Contextual immersion* – designers use past experience to inform but not dictate the moves they make. Schön (1983) discusses designers *seeing/doing* unfamiliar situations *as* familiar ones from their repertoire, and Stolterman (2008) discusses designers being prepared-for rather than guided-in action. In both descriptions, the designer selects and refines their approach through immersion in the design context.

These strategies are also recognised as being particularly (if not uniquely) suited to the challenge of wicked problems (Rittel & Webber, 1973; Rith & Dubberly, 2007), although Cross (2007) notes that designers tend to employ them irrespective of the 'wickedness' of the situation.

Design Practice as and in Research

Research Through Design

Research through design (RtD) has generated much interest as an approach for using design practice as the *means* of research enquiry. Although Frayling (1994) is commonly cited as the source of this idea, we prefer his colleague Archer's (1995) related discussion as it more explicitly considers research methodology.

Archer likens "research through the medium of practitioner activity" (ibid.) to Action Research because it involves value-laden change in the situation under study, and consequently researchers should clarify the exact nature of their intervention and their theoretical, ideological and ethical position in doing so. Such work should also adhere to "normal rules governing research practice" (ibid.) including clearly documented research questions and methods of enquiry and analysis, recording of data used and observations made, and the whole published and critically examined. In discussing RtD in Human-Computer Interaction (HCI), Zimmerman, Forlizzi and Evenson (2007) further propose that practitioners should also detail their process (including methods choices) such that it can be reproduced, demonstrate the real world relevance of designed artefacts (and justify the preferred state aimed for), and enable others to leverage the knowledge produced.

Archer (1995) notes that:

> "There are circumstances where the best or only way to shed light on a proposition, a principle, a material, a process or a function is to attempt to construct something, or to enact something, calculated to explore, embody or test it." (p11).

Such RtD emphasises knowledge on the *specific what and how* of design, but recent discussions recognise its potential for more *general* contributions. From interviews with twelve leading design researchers, Forlizzi, Stolterman and Zimmerman (2009) observed that RtD can produce conceptual frameworks and guiding philosophies for design practice, "new problem framings that suggest preferred states for the world", and "new product forms that broaden the space of design". Zimmerman, Stolterman and Forlizzi (2010) refer to this as *theory for design* (which aims to improve design practice) that may then lead to

theory on design (how and why people design to create a unified understanding of designing as a human activity). To support this, practitioners should "describe how their problem framing and their perception of a preferred state changed over time and document the findings that triggered these changes" (ibid.), and discuss how "the resulting artifact helps to refine or challenge the general theory through reflection on its application" (ibid.).

Gaver (2012) also discusses RtD as a means for exploring design spaces, observing that theory cannot completely specify design activities because of their generative nature and the complex or wicked situations in which they are applied, nor can all aspects of a successful design be translated into a single coherent theory. This would be problematic if the aim was falsifiablilty in the Popperian sense, but Gaver suggests that the value of RtD is demonstrated by its ability to inspire new design work.

Gaver recognises that knowledge can be embodied in what is designed with such artefacts plotting a point in design space. However, to usefully inspire others, they require annotations that highlight important features according to their designers. Collections of artefacts in an "annotated portfolio" then map out a programme of related research. Such work communicates knowledge of *what* may be designed but little of *how* to go about designing.

Löwgren (2013) discusses how design research produces knowledge at different levels of abstraction, from the completely specific (a particular artefact) to fully abstracted (general theory). Annotated portfolios lie in the middle as a form of "intermediate-level knowledge" having some specificity to the context in which it was produced but also providing more general insights, if not at the most abstract level of general theory. Theory for design produced by RtD (Zimmerman et al., 2010) is also intermediate-level knowledge.

Action Research

Swann (2002) demonstrates parity between professional design practice's principles and process and that of Action Research (AR). He discusses contemporary design as an inherently interpretive practice embracing a post-modern pluralistic view of end-user benefit, and attending to the social affect of what is designed. As such, like AR, it can be "described as a program for change in a social situation" (ibid., p56). Swann also recognises that increasingly user-centred design implies a commitment to the collaborative working essential in AR, although noting that user participation within this needs to be a genuine and emancipatory partnership. Swann notes the fluidity of the design process, with constant movement between problem specification, analysis, synthesis and evaluation, and shows the resemblance between iterations of these stages and AR's cycles of plan, act, observe and reflect.

Contemporary design practice is then analogous to (action) research but to function as such activity, Swann argues, its processes must be publicly accounted and demonstrate visible self-critique. He proposes a structured process that enables such "systematic and documented study" (ibid.) drawn from mature AR methodology (as described by Zuber-Skerritt (1992)) that includes self-reflection and self-evaluation by a critical community of collaborating practitioners, and reflection and communication to the broader community (Swann, 2002).

For Swann, design practice as AR, produces both action outcomes (the effects of what is designed) and research outcomes (new knowledge about designing). In the latter respect, Swann notes that self-critical systematic case studies build a body of knowledge of practice (*specific whats/hows*) from which insights may be interpreted in time. Such reflective accounts may contribute directly new knowledge of designing, such as when

designers "invent new answers to conventional situations that transcend the ordinary, with the result of creating a higher order of thinking about that situation" (2002, p60).

Hayes (2011) explores AR's application in Human Computer Interaction (HCI), which need not have an explicit design practice element (HCI includes the study as well as the design of interaction). Further, whereas Swann relates the action component to synthesis (designing), Hayes takes a broader view with the action component relating to sociotechnical interventions (i.e. deploying interactive systems) and the collaborative design of these interventions (which, then, may not include designing the systems themselves). Hayes' discussion provides a macro perspective to Swann's micro perspective: design practice as one (potential) element *in* an AR programme rather than (Swann's) systematic and documented design practice *as* an AR programme.

In discussing the relevance of AR to HCI research that aims for societal benefit, Hayes emphasises genuine emancipatory collaboration but here the participation is of communities in research rather than of end-users in designing. In Swann's discussion, participants are co-designers (where systematic, documented designing equates to research). For Hayes, participants are co-researchers (where designing is part of research). The practical implications Hayes discusses are then more appropriate to broader programmes of research that involve design practice, whereas Swann's proposals show how individual design projects can have value as AR.

Hayes' approach to AR in HCI emphasises researchers' deep and prolonged engagement with a research site to ensure sensitivity to the "deep-seated emotional responses or hidden tacit knowledge" present, and to the values and commitments the researchers themselves bring (ibid.). Further, participants should collaborate in planning, evaluating and disseminating research (for multiple audiences). This may not be practical or desirable in all research programmes, but Hayes' discussion of AR's knowledge outcomes sheds further light on how design case studies (as Swann's 'micro-AR') can make research contributions. As Hayes describes, AR develops localized solutions to specific situations emphasising 'trustworthiness' over generalisability (ibid., p15:7). Instead, the objective is transferability via the transparent collection, analysis and description of data (dependability) and presentation of supporting evidence (confirmability). The sensitive prolonged engagement and collaborative reflection inherent in AR deal well with issues of credibility and integrity, but dependability is also demonstrated by the "workability" of solutions, where "theoretical knowledge generated in the field is returned to the field in the form of some sort of action that can be evaluated" (ibid., p15:8).

When design practice is part of such AR programmes, this data and evidence then relates to the understanding and decisions within the design process, paralleling Swann's proposals for making the creative design process visible.

Authentic Design Practice as/in Research

Our summaries of authentic design and how it can function as or in research highlight implications for designer-researchers, and where attention is required to enable practice to support research enquiry.

First is the need for designer-researchers to provide accessible accounts of their practice. Designerly thinking strategies provide a framework for describing the creative process to make designers' aims, activities and rationales accessible to other practitioners (and consequently of value as a research resource). For example: What frames are chosen and why? What is made and deployed to explore and develop these frames? How does understanding of relevant problems and solutions change throughout the process? But, as

we shall discuss, this is about supporting reflection on practice rather than exhaustive documentation.

Second is a need to evidence the relevance (Zimmerman et al., 2007) or workability (Hayes, 2011) of designed artefacts to demonstrate the practical value and trustworthiness of the knowledge produced. The shift in focus from user-centred to human-centred design (Bannon, 2011; Buchanan 2001) demonstrates that relevance or workability are the objectives of such practice (i.e. ensuring better fit to broader stakeholders' needs, a holistic consideration of human needs and values rather than solely those relating to technical function, and attention to the wider roles of what is designed rather than uncritical optimisation for an assumed narrow 'use'). Additional attention is then required to explicitly evaluate relevance/workability according to appropriate stakeholders.

Third, to claim the work as Action Research, participants should be partners throughout a research programme. Design is increasingly considered as a medium for broader societal change (Sangiorgi, 2011). Such practice embodies propositions for involving stakeholders as active partners in design – satisfying their *moral* right to be included as those most affected by what is designed, and *pragmatically* accessing their expertise and preferences for more successful design outcomes (Carroll and Rosson, 2007) (c.f. Ehn's (1993) *political* and *technical* features of Participatory Design). However, although human-centred and participatory design approaches' transformational aims are close to the goal of emancipation through collaborative participation in AR, research *through* such co-design is not necessarily the same as AR. Human-centred design activities need not be participatory (although they often are), and the moral and pragmatic commitments of Participatory or Co- Design make it inherently human-centred albeit with a stronger political character. This suggests that non-participatory design practice cannot easily be claimed as AR. So, if claiming their work as AR, designer-researchers must ensure *genuine collaboration* throughout the research process (i.e. in addition to the design work), and explicitly attend to knowledge outcomes through *collective* critical reflection, evaluation and dissemination.

Fourth, AR's systematic use of reflection on practice is also essential for *all* design practice as/in research. Swann (2002) and Zimmerman et al. (2010) both highlight the importance of reflecting on practice and sharing insights in order to create theory for and on design, i.e. to move from *specific what/how* to more *general principles*. But could such reflection make design practice less authentic?

Schön (1983) and Gedenryd (1998) provide descriptions of designing that explain its operation and the nature of reflection within it. Schön (1983) demonstrates "reflection-in-action" as the essential means by which designers (and other practitioners) deal with situations where "there is a problem in finding the problem" (p129). Schön shows how skilful designers progress towards relevant solutions through a reflective conversation with such ill-defined situations as series of moves (e.g. sketching), attending to impacts, and further moves. Gedenryd (1998) extends this work by explaining designing as an enquiring process of developing problem-settings that produce desirable solutions.

Gedenryd (ibid.) shows how designers' flexible approach to problems and solutions relates to a pragmatic view (after Dewey) of problem statements as forms of instrumental knowing – they have purpose in directing solution attempts rather than fixed, independent meaning. Designing is then an enquiry into problem-settings and solutions, and designers explore this instrumental knowing through making – determining whether a particular problem-setting suggests satisfactory solutions or whether a different framing is required. Adopting frames, or developing new ones, is then not simply a matter of imposing order

on an otherwise complex or chaotic problematic situation, it is an enquiry into the function of these frames (in specifying the role of design solutions).

Schön's and Gedenryd's discussions explain how three of the designerly strategies outlined earlier (co-evolution of problem and solution, making as enquiry, and developing and adopting frames) function within designing as a reflective and enquiring activity. Such reflection *in* practice then serves the design enquiry (i.e. relating to *specifically what* to design and *specifically how*), but reflection *on* practice (its nature and principles, the *general what and ho*w) is also required for research enquiry. In Gedenryd's (1998) terms, designing develops instrumental knowing whose purpose is to determine productive problem-settings or framings (i.e. the *specific what/how*) but research enquiry requires developing instrumental knowing for a more *general* purpose (e.g. identifying transferable principles).

Schön (1983) notes that reflection-in-action is usually bounded by the practice itself as a "system of knowing-in-practice" (p283). He also recognises that reflection on practice is essential to demystify and deepen practice, but could paralyse the practice through undermining the system of knowing-in-practice on which it relies. Designers' immersion in the context for their work (our fourth designerly strategy) is an important aspect that supports this knowing-in-practice.

Schön (ibid.) discusses skilful designers' "artistry" as drawing upon a repertoire of previous situations that they have successfully tackled in a certain manner. Here, designers reflect-in-action by framing the current, ill-defined situation in terms of their productive response to a prior situation. Schön discusses this in terms of both "*seeing-as* and *doing-as* [which] may proceed without conscious articulation" (p139). Such artistry involves immersive *seeing/doing as* to enable practitioners to develop "a feel for problems that do not fit existing rules" (p140).

Seeing/doing as then involves tacit knowing (Polanyi, 1966) where the practitioner appreciates their (proximal) design artistry only in terms of its effect on the (distal) design context. Polanyi describes how attending to the particulars of such proximal/distal relationships, rather than "dwelling in them", causes breakdowns in the complex knowing process that they constitute. Here, *explicit* attendance and reflection on design moves whilst immersed in the design problem, breaks down the process of designing. Or, to use Schön's terminology, the designer's repertoire embodies her system of knowing-in-practice (as ways of *seeing*, *doing*) so attempting to step outside and question this system during practice, undermines its use and consequently disrupts skilled practice.

In summary, research enquiry requires both reflection on and in practice. But practitioners' explicit attention to the tacitly-known particulars of their practice causes it to break down and thus it becomes less authentic. Polanyi (1966) recognises that such breakdowns enable practitioners to develop new understandings of their practice, but require the interiorization of this developed knowledge. Explicit attention to particulars is then a problem if it is *during* practice, either as reflection upon it or consideration of what is worthy of accounting (in the moment or subsequently). We therefore propose reflection *alongside* practice to generate accounts of practice from which practitioners can recognise their reflection *in* their practice and further reflect *on* it. We describe how we have enabled this in the following case study.

Case Study: Co-Designing with Young People

The authors developed methods for engaging young people in health service co-design through co-designing novel services to support teenagers with type 1 diabetes with teenagers and their parents. Our principle aim was to develop general principles for *how*

to do such designing, which we achieved through producing an example of *what* may be designed (as RtD). The design project is detailed in (Sustar et al., 2013), our aim here is to describe how reflections prompted during the project, and used for further reflection afterwards, enabled the designer-researchers to develop insights into the design methods they had developed and applied. Our process followed AR cycles of action and reflection, but with an intention to minimise the interference on the co-design activities to enable us to concentrate on designing 'the best thing' with the young people.

During the design work, another researcher (not involved in the design, with a background in qualitative approaches for studying human communication) conducted semi-structured interviews with each designer-researcher (once, two designer-researchers together) before and after each of the project's eight participatory workshops. These interviews explored, before workshops: aims, planned activities and the thinking behind them (including relationship to theory and previous activities); and after workshops: what went well (or not) and how this related to the individual's expectations and the thinking behind the activity, what might have been done differently and why, the main outcomes, and what was planned next as a consequence and if/how the individual's thinking had changed.

Transcripts of these interviews subsequently provided a resource for the designer-researchers, working with the communications researcher, to collectively reflect on the design project and develop their understanding of the value of the design methods they had used. Transcripts were read to re-immerse ourselves in our design practice, so that critical incidents and turning points could be identified. A more formal collaborative coding and thematic analysis is ongoing, but this paper is based only on the initial findings. Below, we illustrate how our thinking developed and how the technique made the design choices available for analysis.

Excerpts are given from two participants' interviews, both designers with industrial experience now conducting research (Designer-Researcher 1 post-doctoral, Designer-Researcher 2 postgraduate).

Productive Engagement via Popular Culture

The design team outlined their overall aims in devising activities before each workshop:

"What we've always tried to do with each workshop is to bring in a fun element to make it engaging, to make it interesting, to give a flavour of what's happening."
(Designer-Researcher 1, before #5)

"We're starting to see that we need to make the activities that we have with the parents and the children both engaging, so interesting for them, but also productive."
(Designer-Researcher 1, before #6)

A common tactic for achieving this (which we principally recognised after the project) was to use references from popular culture to structure activities. E.g. an activity to select ideas for further development was based on the popular TV talent show X-Factor:

"[…] it's something that both the parents and the children have talked about and obviously are quite keyed into. So the idea is that with X-Factor we have that kind of framing of criticism, of audition, of development as well because this kind of idea within X-Factor called 'boot camp'. So somebody comes along, they get auditioned, if they think they've got potential they go to boot camp then they go to the finals."
(Designer-Researcher 1, before #5)

This tactic was generally successful…:

"It went better than we could have expected"
(Designer-Researcher 1, after #6)

"It went really, really well […] there seemed to be a really good energy about the whole thing"
(Designer-Researcher 2, after # 6)

…but not always:

"I was a bit disappointed that people didn't engage with the service visualisations a bit more"
(Designer-Researcher 1, after #8)

"[participants] weren't being particularly creative this time"
(Designer-Researcher 2, after #8)

Reflecting during the project, designer-researchers had some initial ideas of why certain activities were less useful:

"[Designer-Researcher 1] produced these engines which were representative of the clinic. So that metaphor was quite complicated and there was a lot going on and it was all new. I found it quite hard to understand and I think certainly the young people and the adults found them quite hard to understand."
(Designer-Researcher 2, after #8)

"I think the metaphor was useful in the X-Factor and it was useful in Dragons' Den because it told people what was happening. With [workshop 8] we really struggled to come up with something and maybe the metaphor was a metaphor too far, so I think maybe we should have done it differently and lets just look at, 'here's the kinds of things that come in and out, here's the [health service], here's you' "
(Designer-Researcher 1, after #8)

However it was only after further collective reflection, following the project, that the team identified the important ingredients of successful activities and found relevant thinking about design that explained why these activities worked better than others. (Here, Ehn's (1988) model of design participation using Wittgenstein's language-games.)

In exploring this model, the interview transcripts enabled designer-researchers to re-access their reflection *in* their practice to surface their reasoning for the activities developed and, in reflection *on* this thinking, suggest features of participatory activities that would enable other designers to use similar principles in their own practice.

Discussion

Our case study demonstrates one means of enabling designer-researchers to reflect in and on their practice to make the *why* of it visible. Our approach minimises impact on designing because it does not depend on practitioners' additional reflection within it, or disciplined intentional reflection outside it. Interviews elicited the designers' accounts of the design process and their reflection upon it but this was a reactive activity, driven by someone not familiar with the project. Where accounting is self-directed, the designer must consider which parts of their practice and reasoning are worthy of recording. They must switch their attention deliberately from conducting the design process as an enquiry into problem setting and solution, to analysing the design process for the purpose of communicating it to others.

In contrast, in these interviews the designer is responding to questions from an external researcher who prompts for additional clarifications and details that the designer might assume or omit from a self-directed account. The interviewer principally attends to what information is relevant to report for the research enquiry via their questioning, leaving the designer free to focus on the design project.

Interviews cannot be viewed as completely neutral observation and unavoidably affect the design process. However, the natural activity of conversation in the semi-structured interviews prompts the designers to articulate their thinking in a way that helps to reinforce and clarify that thinking for the purpose of the design challenge whilst remaining immersed in it. This is in contrast to a situation where the designer has to prompt his or her own reflection and make editorial decisions about what to report (or not). Pedgley's (2007) design diary dealt with this by defining prompts for daily entries, which became 'external' directions for accounting, but lacked inter-personal dialogue's potential for eliciting richer accounts (reflective conversations satisfy Pedgley's criteria for capturing designing for research, but he was unable to use them due to practical constraints).

Transcripts of such interviews then provide a resource for subsequent collective reflection that enables designers to re-access and re-evaluate their thinking once the pressures of the design project have passed. Such transcripts and further reflections can then provide an account of practice that represent designers' intentions and activities in their own terms, which are therefore more accessible to other designers and better able to inform their practice. Such accounts of designerly thinking (e.g. the frames used, the enquiring purposes of what is made) then both communicate the design rationale and evidence the authenticity of practice, and enable others to assess and assimilate it.

We propose that there is value in designers using transcripts in this way as an alternative to formal coding and analysis. Whilst external researchers can use such data to complete research *about* design (providing external understanding of the generic processes involved in designing), the designers involved can utilise the data, together with the deep understanding that they have developed about the particular design challenge or domain, to provide integrated accounts of their discoveries about the domain and their design responses.

Conclusions

The starting point for our paper was that design practice used as or in research should be authentic. We demonstrated relevant features of authentic design that enable such practice to be used as/in research and how such work aims to go beyond contributing *specific* knowledge of what can be designed and how to *general* principles transferable to other design situations.

Human-centred, participatory design practice embodies similar values to AR and has a similar focus on the relevance or workability of what is designed, but such design needs to involve explicit reflection and accounting to make the actions and rationales within creative practice visible for others' critique. Such reflection *on* practice extends beyond the reflection inherent *in* practice (Schön, 1983) and could cause designing as a process of tacit knowing to break down (Polanyi, 1966). We proposed reflection *alongside* practice to minimise disruption, and the use of reflective interviews as an example of doing so for collaborative design activity.

This approach is not ideal and we acknowledge that any intervention into the design process is likely to affect it, and in future design projects we are exploring the use of other means of reflection (including methods closer to Action Research). But beyond these specific points, we hope that this paper encourages the design research community to

discuss the authenticity of design practice as/in research and to attend to potential impacts of trying to 'wear both design and research hats'.

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