Routledge
Taylor & Francis Group

The Design Journal
An International Journal for All Aspects of Design

ISSN: 1460-6925 (Print) 1756-3062 (Online) Journal homepage: http://www.tandfonline.com/loi/rfdj20

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To cite this article: Michael Pierre Johnson, Jen Ballie, Tine Thorup & Elizabeth Brooks (2017) Living on the Edge: design artefacts as boundary objects, The Design Journal, 20:sup1, S219-S235, DOI: 10.1080/14606925.2017.1352771

To link to this article: https://doi.org/10.1080/14606925.2017.1352771

Published online: 06 Sep 2017.

DESIGN FOR NEXT
EAD12-ROME

doi: 10.1080/14606925.2017.1352771

Design for Next

12th EAD Conference
Sapienza University of Rome
12-14 April 2017

Living on the Edge: design artefacts as boundary objects

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Abstract: Design is being performed on an ever-increasing spectrum of complex practices. As a result there is demand on the articulation of design's application across disciplinary boundaries. This paper explores this context through acknowledging the retained role of design artefacts in engaging complex, collaborative contexts and a developing understanding of boundary objects. This paper expands on notions of design artefacts as boundary objects by offering reflections on existing examples from ongoing design research in the context of health and care innovation. Through the process of framing a design problem, live models are developed as dialogical tools with collaborators to validate and inform design solutions. Such models are argued to act as boundary objects that are not static, but living artefacts open to ongoing scrutiny within the design context, offering an understanding of the value and practice of design artefacts in complex, collaborative contexts.

Keywords: design artefacts, boundary objects, actor-network mapping, situational analysis, design-led innovation

1. Introduction

When considering what is next for design, on any level, then it makes sense to look at its boundaries. It is at the boundaries of design practice that we see emerging practices engaging with new technologies, new collaborations, and new contexts of social meaning. The boundaries of design itself are under constant disruption. As a result there is increasing demand on the articulation of design's application across disciplinary boundaries, in contexts where design cannot claim contextual expertise, which has led to many layers of abstraction in the communication and practice of design.

Within this context, this paper firstly scopes the growing influence of two concepts acknowledging the retained importance of artefacts. Firstly, through *design artefacts,* referring to the various representations produced to engage with the design problem, or 'constituents of the object of design' (Binder, De Michelis, Ehn, Jaccuci, Linde and Wagner, 2011:59). Secondly, through the concept of *boundary objects*; objects as a means of representing, learning about, and transforming knowledge to resolve the consequences that exist at a given boundary (Carlile, 2002).

Two cases are presented from a project of Experience Labs (French, Teal & Raman, 2016), developed in the context of digital innovation for health and wellbeing, which has brought together researchers from various disciplines, such as design researchers, creative technologists, social scientists and psychology. A method of *actor-network mapping* (Johnson, 2016) will be used to evaluate design artefacts developed between disciplines and offer insights on just how they function as boundary objects towards innovation.

2. Design Artefacts and Boundary Objects

Design artefacts come from the disciplinary tradition of Participatory Design, and are presented by Binder et al. (2011) as the various sketches, maps, diagrams, representations, storyboards, models and prototypes, *constitutive* of the 'object of design', or *design Thing*. For design artefacts to have value and significance, they have to become part of the living experience of human beings in the way these afford, invite, and oblige interactions (Binder et al., 2011:59). These constituents 'are not the object the [designers] are designing, but each of them allows them […] to interact with the object and to discuss its different features' (Binder et al., 2011:59). This is argued to possess a *performative* dimension, seeking to tap into the existing tacit knowledge of 'user participation as 'design-by-doing'' (Ehn, 2008).

Through design artefacts, designers are thus proposed to be engaging on two fronts: envisioning what the design thing should be, and playing with the socio-material things constituting it (Binder et al., 2012). Design is thus presented as a social act of 'drawing things together'; a framing of design competence, influenced by Latour's 'challenge to make public the design thing', as that which 'permits the heterogeneity of perspectives and actors to engage in alignments of their conflicting objects of design' (Binder et al., 2012:25). In contexts of user participation, this framing of design competence emerges through the ability to objectify, articulate and challenge assumptions in the design process. Articulating the *design knowledge* co-created in multi-disciplinary contexts, however, is rather more elusive, and an ongoing concern of design-led innovation (Manzini, 2009).

Carlile (2002) presents a *Pragmatic View of Knowledge in New Product Development*, framing such knowledge as 'localized around problems faced in a given practice', knowledge as 'embedded in practice', particularly as tacit knowledge residing in the doing of an activity, and knowledge as 'invested in practice […] in the methods, ways of doing things, and successes that demonstrate the value of the knowledge developed' (Carlile, 2002:446). Carlile draws on *boundaries* and *communities of practice* to build an empirical framework focused on the 'objects and ends used in a given practice' in order to analyse the benefits and hindrances of different objects at given boundaries (Carlile, 2002:450). This offered an initial insight on design artefacts as boundary objects, but this only acknowledges a fairly explicit design process. What about those contexts of design-led innovation where new communities of practice are brought into the design situation?

Wenger (2000) presents boundary objects as a constitutive element in organisations as social learning systems. This denotes objects that are not the exclusive concern of design, but between disciplines, and indicates something that would constitute design artefacts as a dialogical phenomenon (Akkerman and Bakker, 2011). Behind Wenger's conception of social learning systems are different forms of participation, distinguished as three *modes of belonging*: *engagement*, the ways in which we do things together; *imagination*, the ways in which we build identities in order to orient ourselves, reflect on our situation and explore possibilities; and *alignment*, the ways in which our activities align with other processes so that they can be effective (Wenger, 2000:227-228). However, pertinent to this paper are Wenger's articulations of progress within communities of

practice: *enterprise*, denoting the level of learning energy; *mutuality*, denoting the depth of social capital or value; and *repertoire*, denoting the degree of self-awareness (Wenger, 2000:230). These dimensions are expressed, alongside the modes of belonging, as a way to evaluate the design and management of organisations. It is in these terms that this paper recognises boundary objects as crucial sites of progression and where design innovation can be argued to take place.

3. Methodology

The methodology for this paper is adapted from the lead author's PhD thesis developing an *object-oriented approach* to trace and analyse multidisciplinary design work. Two cases of design artefacts from Experience Labs in the context of digital health are explored using *actor-network mapping* (Johnson, 2016), to capture each design artefact's context of development, and situational analysis (Clarke, 2005) to interpret the effects across the actor-network captured in each case.

3.1 Actor-Network Mapping

Actor-network mapping is a visual design method developed from actor-network theory (ANT) used to represent design artefacts within the complex network of people and things in the design situation. The main tenet in ANT is 'that actors themselves make everything, including their own frames, their own theories, their own contexts, their own metaphysics, even their own ontologies' (Latour, 2005: 150). In this paper, data capture is based on interviews with the Experience Lab designers and researchers that developed the selected design artefacts.

Callon (1986) provides a four step research frame for assembling actor-networks: *interessement*, *enrollment*, *point of passage* and *trial of strength*. For the purposes of this paper, actor-network mapping focuses on points of passage as the 'one or more actants […] who assigns roles […] or acts as a site of translation for the other actors in the network' (Akrich, 1992); identified here as providing the insights to tracing boundary objects. The mapping structure (see fig. 1) is based upon a timeline represented by a bold black angled line along the base of each map, and concentric, evenly distributed, semi-circular blue lines broken down into three sections: historical, live and potential. These sections frame the activity and design situation, while the concentric lines provide notional degrees of participation by which to order the identified actors and actants to be mapped.

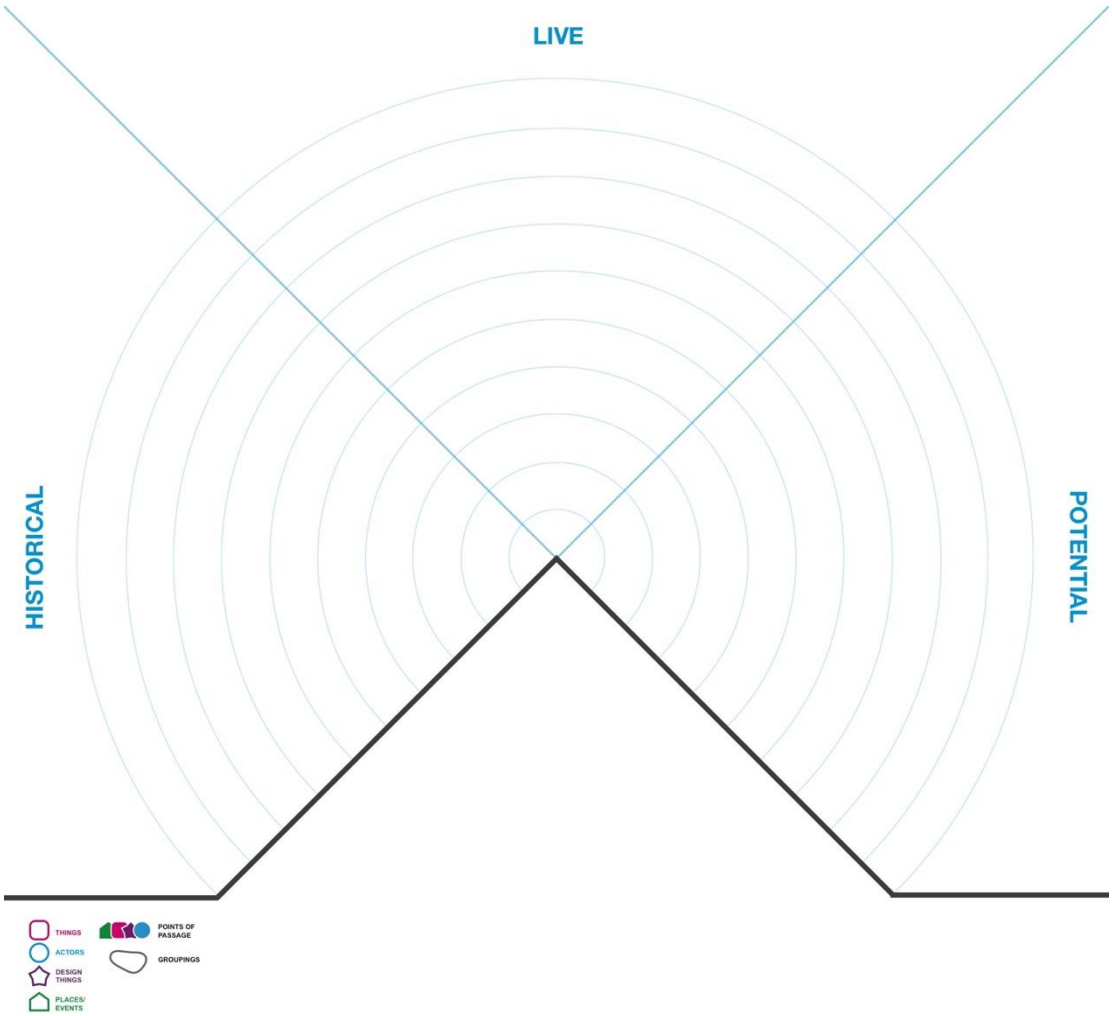

Figure 1. Actor-network Mapping Structure, source: Johnson, 2016

The actors and actants within each actor-network were designated into four categories represented as varying shaped nodes. *Actors*, a blue circle representing any human individuals, discernable groups or organisations. *Things*, a rounded pink square representing any non-human artefact, document, tool, entity or recognised group thereof. *Design Things*, a five-pointed purple star representing any non-human artefact, tool, visual representation or recognised output from design work. *Places/Events*, a house-shaped, green pentagon representing any recognised space, building, event, meeting or site where work had taken place. *Points of passage* are distinguished by filling actants with the associated colour. The physical mapping tool was composed on A2 printed paper, onto which card disks of the actants could be labelled, placed and attached (see fig. 2).

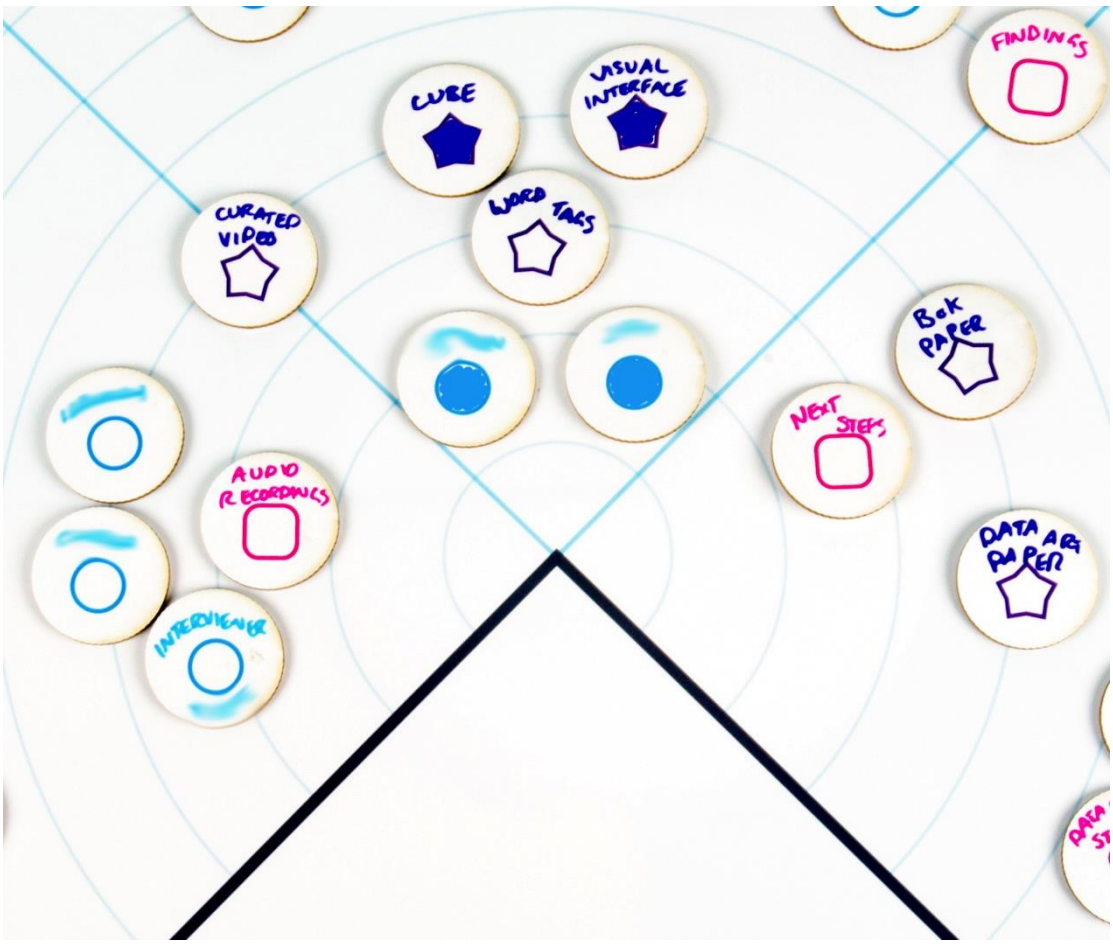

Figure 2. Physical Actor-Network Mapping, source: Johnson, 2016

3.2 Situational Analysis

Clarke (2005) presents situational analysis as methods of mapping to support grounded theory analysis, the initial form being situational maps, which 'lay out the major human, non-human, discursive, and other elements in the research situation of inquiry and provoke analysis of relations among them' (Clarke, 2005:xxii). In Clarke's method of situational mapping, the question is 'who and what matters in this situation?' calling on the researcher's (or informant's) experience observing (or participating) in the situation under inquiry. Clarke then suggests the analyst performs a *relational analysis*, 'literally centre on one element and draw lines between it and others and specify the nature of the relationship by describing the nature of that line' (Clarke, 2005:102). This is performed systematically, one selected element at a time. For each case, selected actants would undergo relational analysis drawn on a sheet of tracing paper placed over their actor-network map, with the map visible underneath (see fig. 3). This would all be supported by asking questions on each relation, annotating the informant's interpretations, with the discussion audio-recorded for further analysis.

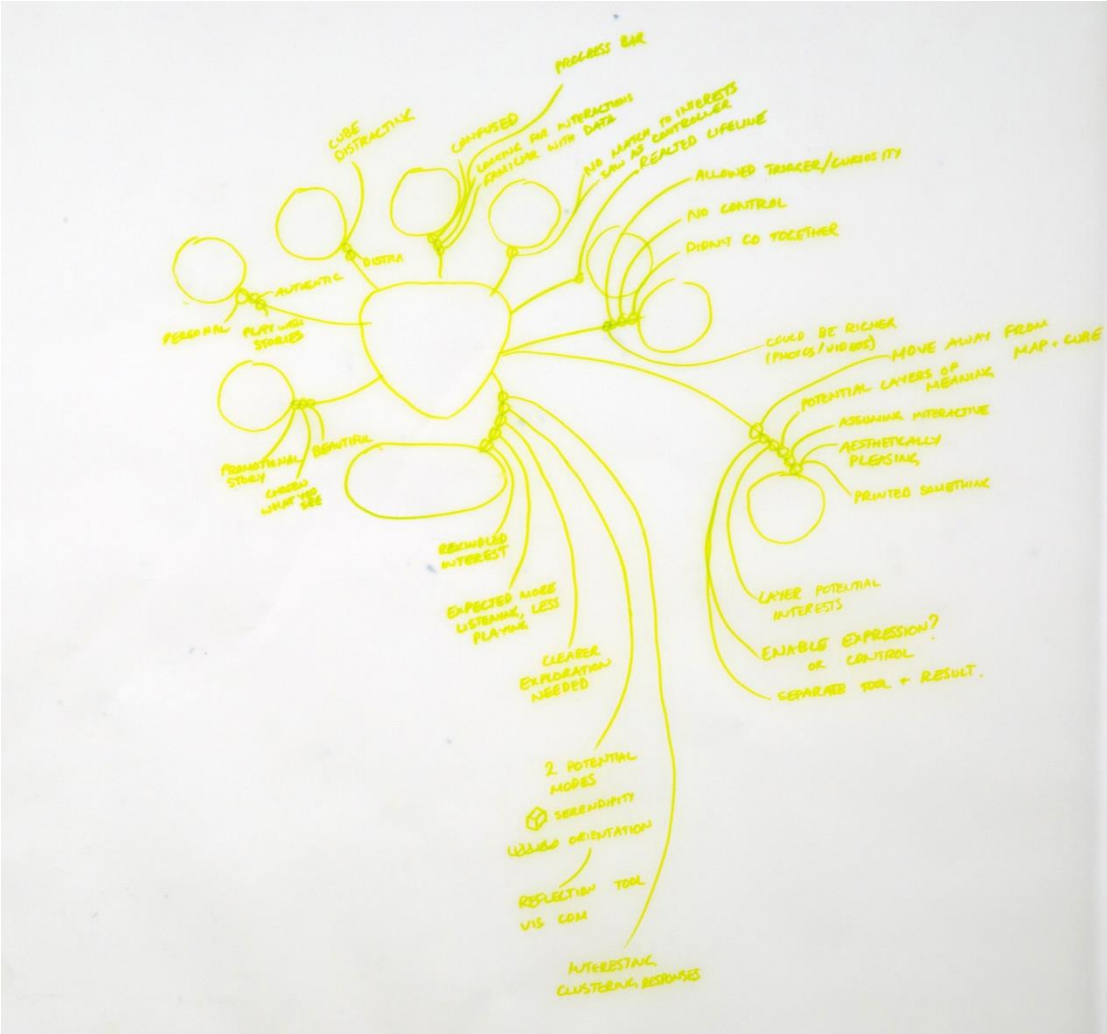

Figure 3. Relational Analysis on Paper Overlay (with Map Removed), source: Johnson, 2016

4. Case Studies

The two cases of design artefacts were selected according to their shared connection to an Experience Lab programme of seven innovation projects developing digital concepts for people living with diabetes and their support professionals, supported by the Digital Health and Care Institute, with the aim of fostering collaboration and integration where possible across the projects. Each case is presented through the actor-network maps and situational analysis performed with the lead researchers, who are hereon in referred to as informants, and are digitally redrawn to allow for anonymity and clearer presentation.

4.1 Case 1: The Balloon Model

The first design artefact investigated is known as the Balloon Model, which came directly from the Experience Labs diabetes programme. The Balloon Model was the output of a *preliminary* and *general* phase of Experience Lab work to allow the researchers to immerse themselves in the context, and bring together people living with diabetes, carers, clinicians and representatives from the third sector to understand how people would like to be supported to engage in self management. The Balloon Model has a visual representation comprising of a central section

representing 'life in the basket', a ring outside the basket comprising the 'tools of support', and an outer ring comprising the 'communities of support', such as peers and professionals. This visual model is not shared here as it is ongoing work yet to be published.

Figure 4. 'General Lab Workshop Activity with Health Professionals Using Hot Air Balloon Analogy', source: Digital Health and Care Institute

4.2 Actor-Network Mapping

The mapping of actors and actants (*see figure* 5) focused on how the Balloon Model emerged and how it was being used in an ongoing programme of *Niche Labs* for the seven concepts under development. The informant described how the Balloon Model was synthesised from General Lab workshop materials (*see figure 4)*, transcriptions and research notes, using thematic analysis building on a hot air balloon analogy developed from the Pre-Lab activities. This led into mapping the *live* suite of design and conversation tools, as well as *potential* translations for upcoming Niche Labs, tools and papers. The research team were identified as at the heart of developing the model, as "although we involved partners in a Lab, we weren't working as closely with them at this stage. They were participants rather than partners at that stage." The Balloon Model was expressed more as a reference for the research team, "not a core thing […] The Niche Lab Plan has been more talked about than the Balloon Model." As a result, both are highlighted in the map as points of passage: one supporting the perspective of the researchers and the research questions, and the other translating a strategy in delivering the Niche Labs for the project partners and concepts under development.

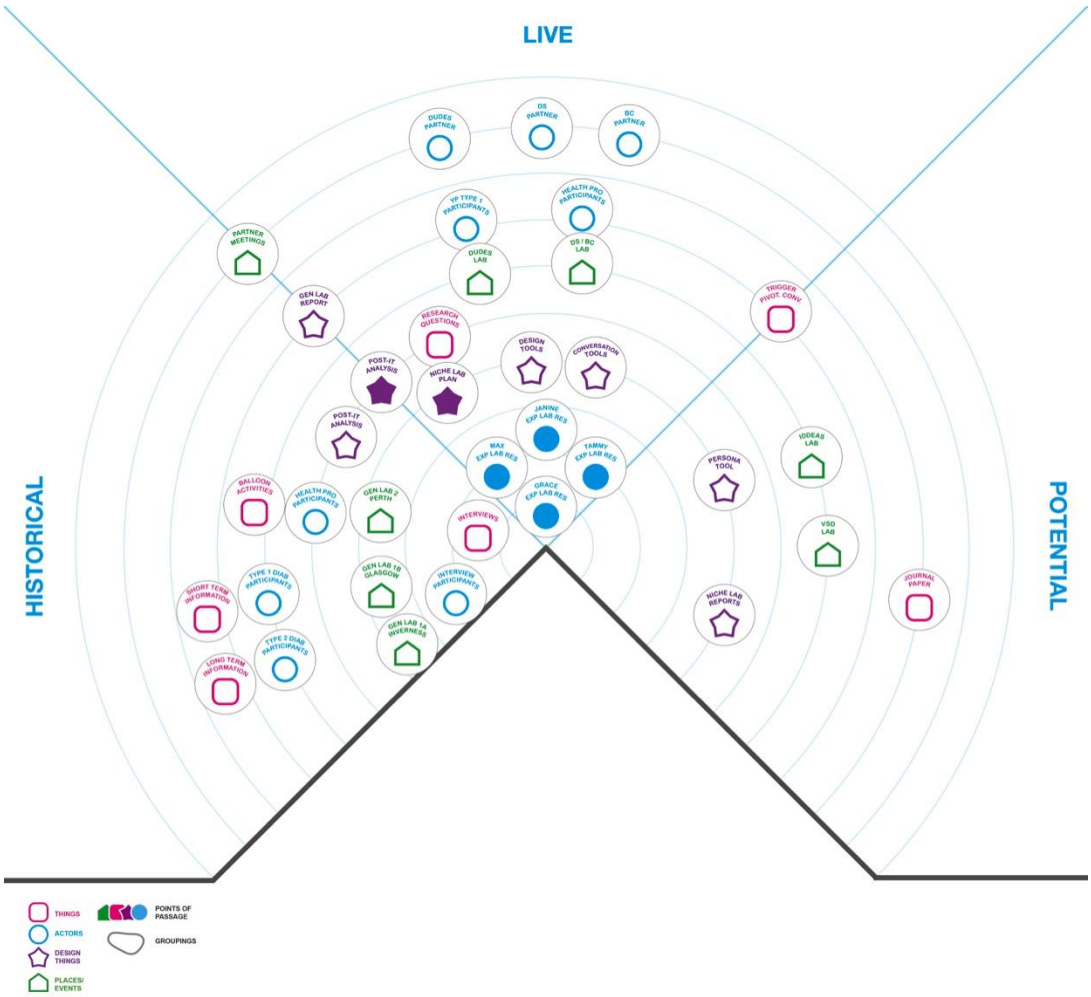

Figure 5. Actor-Network Map of the Balloon Model, source: Johnson, 2016

4.3 Situational Analysis

The overlay of relational analysis brought out five key relations for reflection around the Balloon Model (*see figure 6*), four of which are presented here using key quotes and points of discussion articulating the Balloon Model as a design artefact and the 'boundaries' it engages. The journal paper relation is omitted.

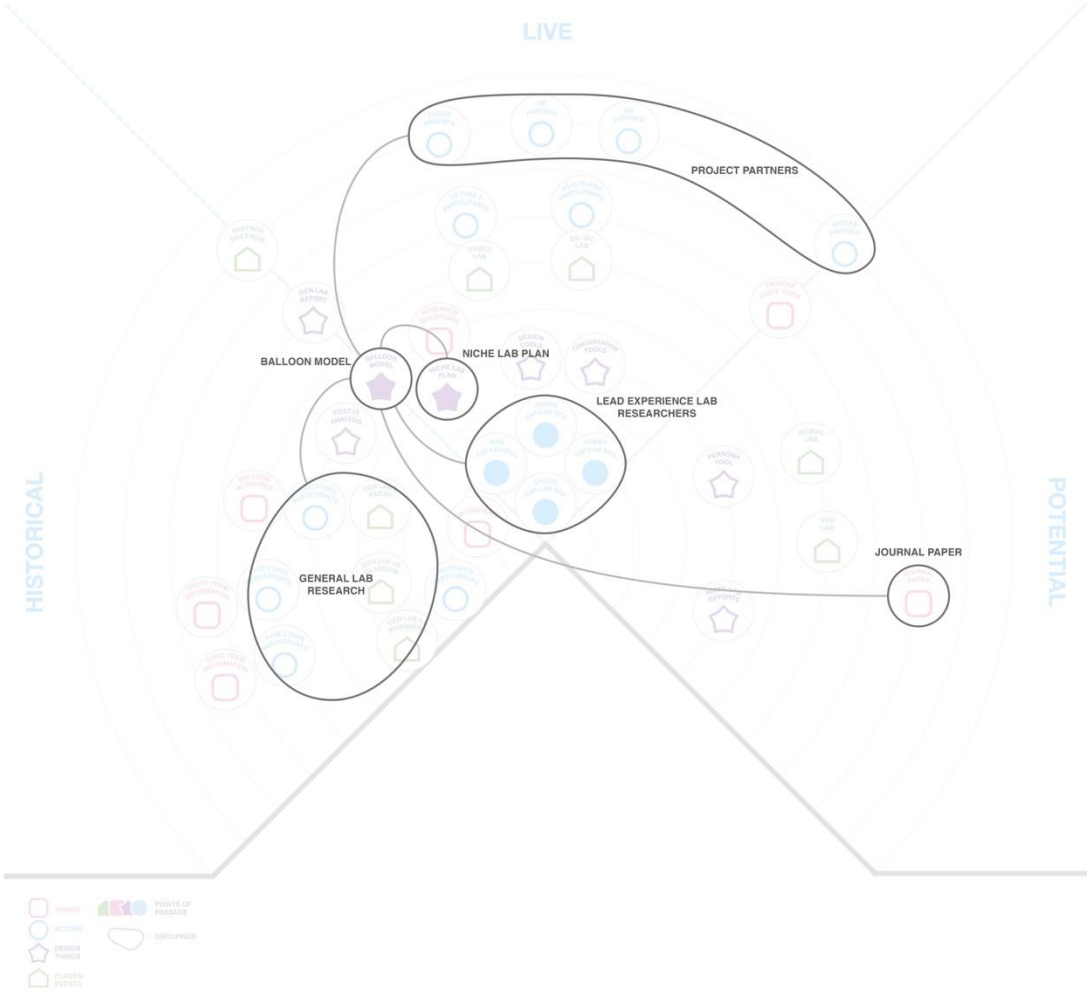

Figure 6: 'Digitised Relational Overlay – Balloon Model', source: Johnson, 2016

Pre- and General Lab Research

The informant described the Balloon Model as forming to "encapsulate how we spoke to so many people and perspectives and […] carry that through." In this sense, it brought a design perspective to the experience of living with diabetes and "becomes a way of relating it back to the users all the time." This describes the first boundary crossed by the Balloon Model, in representing the experiences of people living with diabetes, the research team could continually connect them with the tools and people positioned to support them.

Project Partners

The informant described how the Model was presented to each of the partners, with many stating how "it corresponds with existing research." This process provided initial validation and has been used by the informant "as a device to sell or rationalise what we're proposing with the [Niche] Labs." This is expressed as allowing the research team to follow a design-led process, "rather than what [the partners] would have set out to do." This represented the initial stages of forging a boundary object, one that would build new knowledge and understanding going forward as it "communicated a different perspective that was a useful way of thinking about it."

Niche Lab Plan

At the time of the mapping session, the informant felt “the model hasn’t necessarily influenced the tools [within the Niche Labs], but the way the Niche Labs fitted together”. This meant the Niche Labs would focus, not only on individual concepts for partners, but themes of interest connected across projects - “i.e. we were interested in conversations.” Not only is this argued to have simplified the aim, but to create a “vision of what we can do to influence their experience […] a rationale for the way we separated and combined projects.” From the Balloon Model, the Niche Lab Plan acted as a translation of the findings embodied in the Model into a strategy of design-led innovation, “giving credibility to an already heavily researched area, where we could add value beyond digital.”

Research Team

For the Research Team delivering the programme, the informant reflected it provided a “common language” and “facilitated our conversations for constructive discussions”. While the Research Team could be considered a close-knit community of practice, the insights collected through Pre- and General Lab work were distributed across the team. “What shaped the model was various sectors emerging in the interviews,” which came together in a joint analysis session to bridge those gaps of knowledge between the team. Going forward, the informant is keen to use the Model as a tool in a Niche Lab “to focus the persona conversation […] less about experiences but challenges […] to validate the Model, or not,” retracing aspects of the Model’s boundary with participants.

4.4 Case 2: Body of Knowledge

The second design artefact investigated came through an exploratory investigation called *Body of Knowledge*, which looked at how to creatively make sense of the data and metadata produced across the portfolio of projects delivered by Experience Labs. The two lead researchers recognised how the richness of the conversations Experience Labs captured through audio recordings and transcripts were not extensively used in produced outcomes, such as final reports. Their initial approach was to produce a package of audio files from a single interview in the diabetes programme to be explored through an interactive cube (*see fig. 7*), with a visualisation produced to show participants navigating through the audio files via a word tagging system (*see fig. 8*).

Figure 7. Body of Knowledge: Interactive Cube, source: Blom and Bradley, 2016

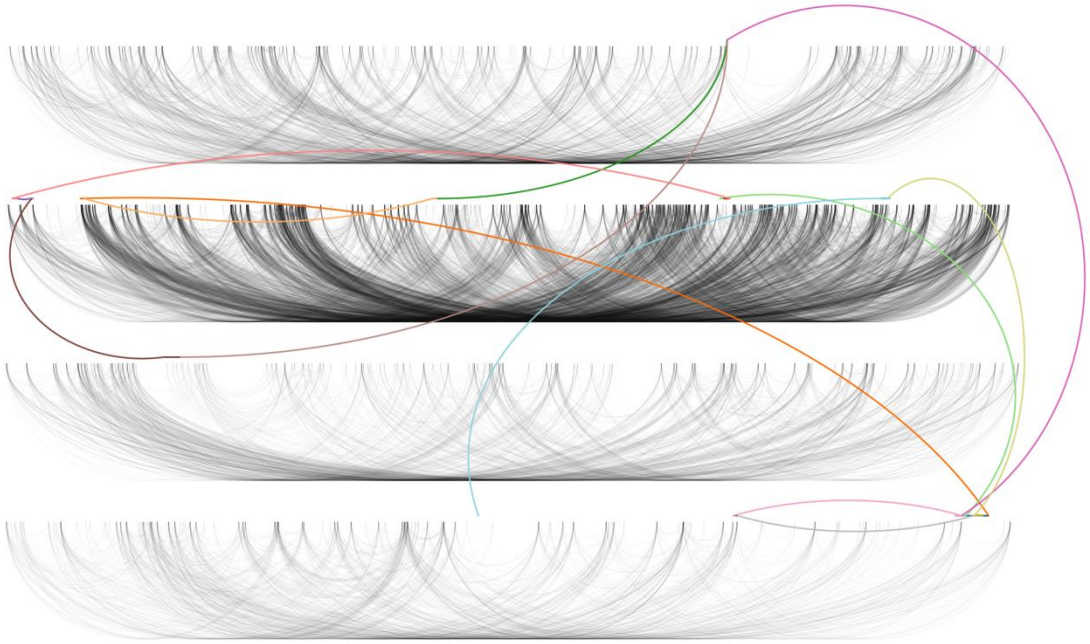

Figure 8. Body of Knowledge: Audio Navigation Visual, source: Blom and Bradley, 2016

4.5 Actor-Network Mapping

The *live* mapping of actors and actants focused on the tests performed with Experience Labs researchers as participants using the interactive cube, audio files and visualisation (*see fig. 9*). The informants emphasised the Word Tags selected as an important element constituting the design artefacts they produced. They traced the *history* of the project through what was called the 'Data Lab', which explored insights on the metadata gathered across Experience Labs through expressions of abstract art. This was then followed by the selection of a data source for this interactive inquiry, which included a Curated Video from selected interviews exploring the experiences of living with diabetes. They focused the *potential* for the project towards producing papers based on their findings towards a potential 'expressive' form of data art, as well as a data management strategy for Experience Labs. During the mapping activity they expressed their intentions for the abstract system they had devised as wanting "to provide a serendipity, a lack of control." The only recognised points of passage were the researchers themselves and the design artefacts through the interactions they afforded the participants.

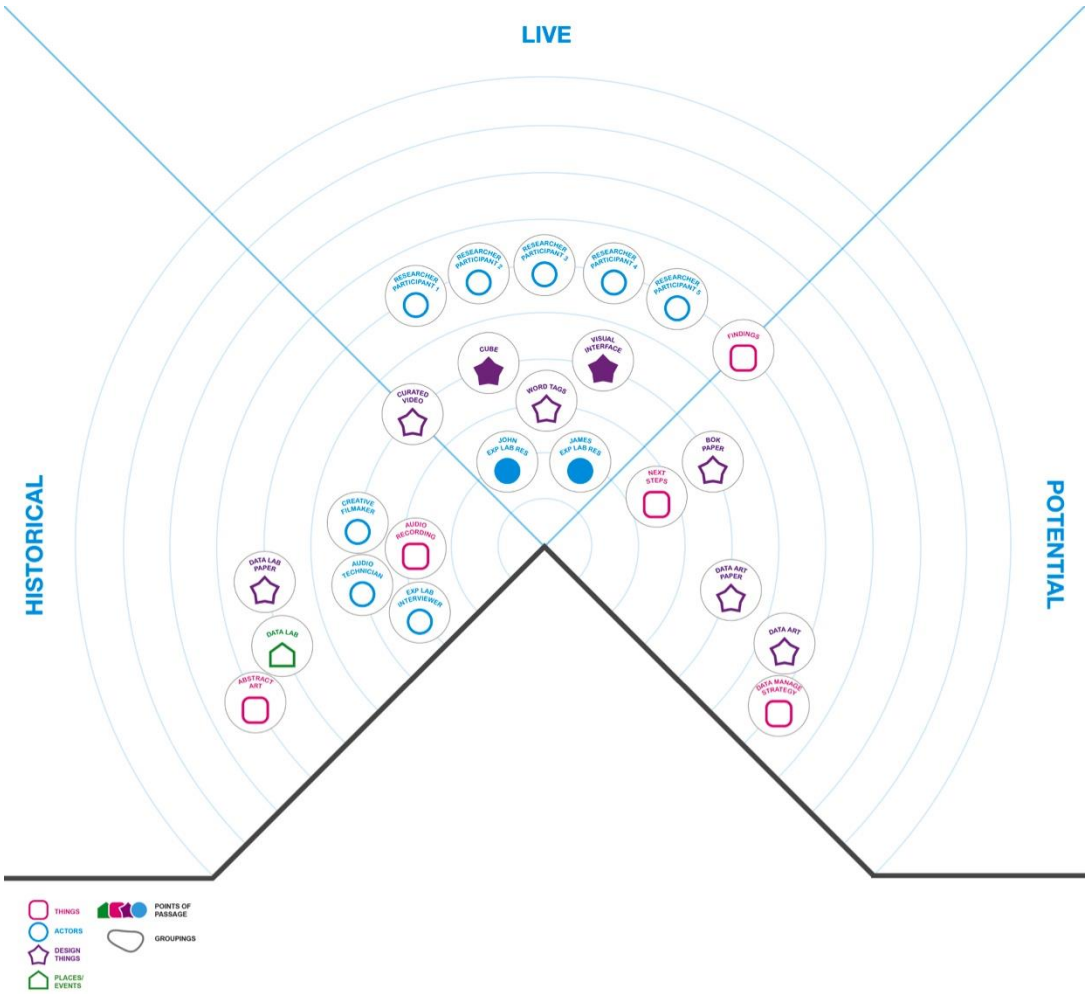

Figure 9. Actor-Network Map of Body of Knowledge, source: Johnson, 2016

4.6 Situational Analysis

The overlay of situational analysis brought out nine key relations for reflection around the balloon model, including the five individual researcher participant relations, which will be clustered as one. These are presented here using key quotes and points of discussion articulating the Cube and Visualisation as design artefacts and the boundaries they engaged.

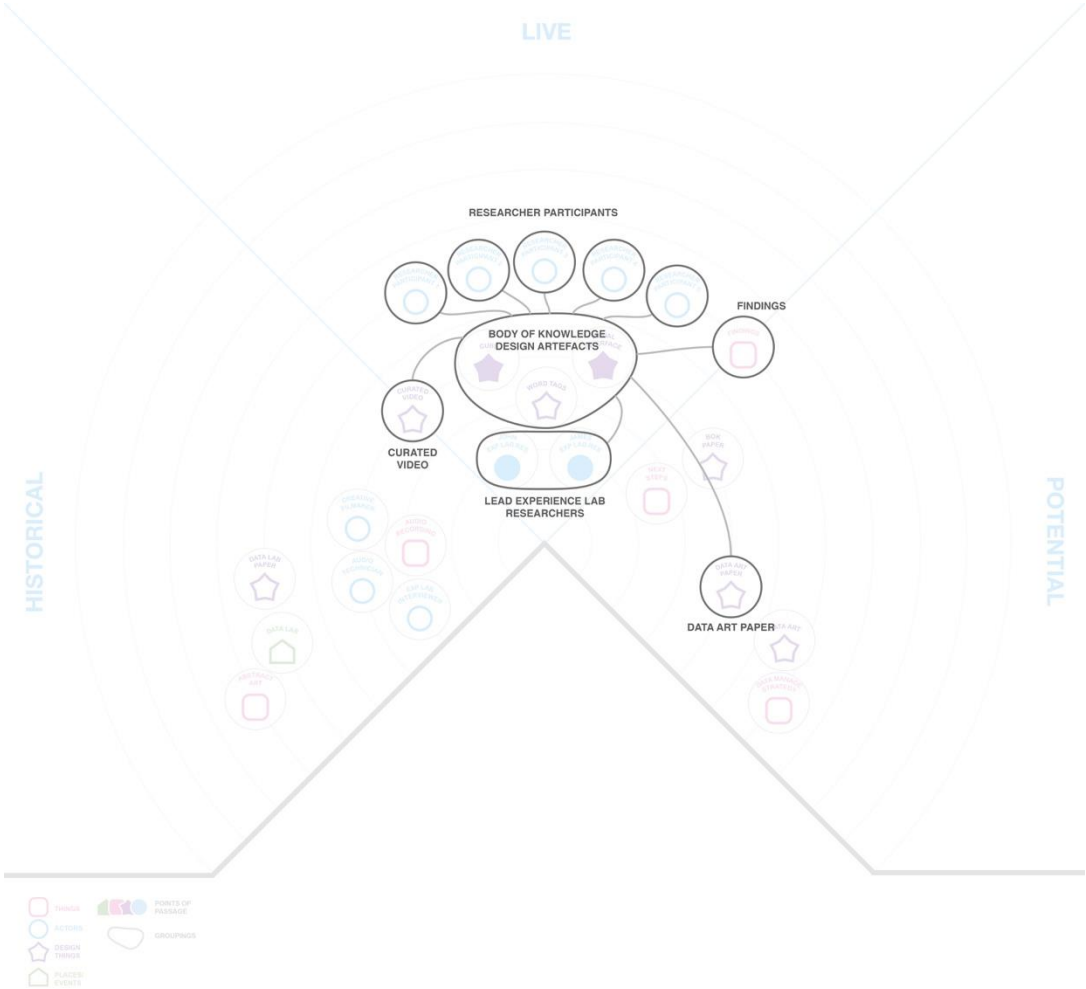

Figure 10. Relational Analysis of Body of Knowledge, source: Johnson, 2016

Researcher Participants

The informants' reflected on how their participants seemed unable to find a "relation between the object and thing they were listening to […] they mainly responded to the themes, and what themes were linked to." As a result, they expressed that participants weren't listening as much as they had intended them to. One participant responded to an audio that was tagged 'lifeline', and "it was literally the end of the interview." The participant was dejected, but her response indicated that it was meaningful to her. For another participant, "the themes that were provided didn't match her interests" and she interpreted "the cube as a traditional controller, like pause, fast forward etc." This was reflected as being overly influenced by presenting the visual alongside the cube, distracting the participant, rather than encouraging the exploration they wanted. Here the boundaries the informants wanted to cross by using tags of meta data were not yet manifest in these interactions. However, they did find indicators of interest through the interactions.

Lead Researchers

For the informants themselves, they focused on what they had learnt through the process to take forward. They mentioned their own key reflections "talked about two different modes, between explore and control." This was grounded in their chosen approach to the project for serendipity,

which meant insights would always be lead by participant responses. Where the Cube and Visual were developed "far more on a basis for searching", they would need to find "a curious mix of the two." This reveals engagement at a boundary in a fairly novel way. The design artefacts are evaluated according to how they afforded exploration for the participants; not how efficiently they could search the data, nor how effectively the data could be analysed, but how their distinctive, intuitive interpretation of journeying through the data could come to the fore.

Curated Video

The informants revealed all the participants viewed the Curated Video, each describing it as "more for a promotional story." One participant compared the Curated Video, where "the choice had been made" for the viewer, to the Cube and Visual, which "felt more authentic than the video as it wasn't controlled" and "able to trigger interests." Comparison to the Video emphasised how the data was presented in a novel way and subtle knowledge was being co-created through indicators to be further explored.

Findings

When reflecting on their findings, the informants felt it was interesting how "everyone came across an interesting thing […] You could use this and get rubbish [but] people did get whole sentences meaning something." In fact, they revealed how participants were "going back to the same thing two or three times by chance [to] make a clustering according to the interactions with the cube." Such a clustering was cautioned as potentially due to how they tagged the audio, but offered objective evidence for identifying those indicators of interest. It raises the question, therefore, whether such features point to a boundary with a body of knowledge, rather than a community of practice.

Data Art Paper

Finally, the informants reflected how this project would inform future research towards a paper on their interest in Data Art. From this exploratory process, they've "learnt that there are these variables," providing a clear brief to "integrate these variables into a data art thing, then enable people to use our data art thing […] that really shows the characteristics for how they're using data, and that's then what we're learning a lot about." The remarkable conclusion was that they intended to keep the exploration and the Data Art thing separate entities: "They shouldn't be interested in painting a picture […] the experience should drive it." This indicates an intended preservation of a boundary in order to evidence knowledge, embodied through a system of tagging, learnt from participants' exploratory sense making through the Cube and Visual, or future iterations thereof.

5. Design Artefacts *as* Boundary Objects

This discussion section will summarise the findings developed across the two cases using existing literature to discuss how framing design artefacts as boundary objects gains insights into the processes of design for innovation.

From the Balloon Model case, its origins were expressed as rooted in the insights gathered from the research team's immersion into preliminary and general research with people's experiences of living with diabetes. This was iteratively translated into an analogy of flying a hot air balloon and a visual model, or 'vision', for bringing a design perspective into the challenges of self-management. This vision functioned predominantly as a reference for the design research team, but would gain gradual validation in its dissemination through the General Lab Report, the Niche Lab Plan and Conversation

Tools. The boundaries here lay in these various translations of the model for various audiences. As expressed by the lead researcher, “it wouldn’t work without the analogy, without a story […] we tell the story to introduce it and for people to understand it.” This concurs with Ehn’s (2008) and Leigh Star’s (2010) conceptualisation of design artefacts as boundary objects in how they ‘might be weakly structured as to achieve flexibility and allowing transference and commonality, but strong enough to be used in individual use or use in a uniform environment.’ (Ehn, 2008:96)

There is evidence to suggest that the Balloon Model is mediating Wenger’s three articulations of progress in social learning systems (Wenger, 2000:230). *Enterprise*, denoting the level of learning energy, is identified in the swift, yet methodical, articulation of a design perspective to diabetes self-management. *Mutuality*, denoting the depth of social capital or value, is identified in the quality and persistence of the analogy across the programmes activities. *Repertoire*, denoting the degree of self-awareness, is identified, and currently limited to, the ongoing need to validate the model in the context.

From the Body of Knowledge case, we find that the Cube and Visualisation design artefacts were attempting to co-create knowledge on very intangible qualities within the data collected through Experience Labs. While the core relationship was found between these artefacts and the lead researchers, the boundary lay with the other researchers as participants and their interpretations of the interactions they used for exploring such data. In their interactions, peaks or moments of interest were observed and articulated, which were expressed by the lead researchers as indicators of the variables that would inform future development. This recognises such design artefacts as boundary objects *within*, rather than *between*, communities of practice. As such, it offers much more insight through Wenger’s *modes of belonging*, in particular, *engaging* the ways in which Experience Labs uses its data; *imagining* the ways in which such data is analysed in a designerly way; and *aligning* the ways in which such data exploration can be effective. (Wenger, 2000:227-228)

The value of design, observed through the above process, gains a complex and nuanced understanding, but offers ways to render it traceable. In both cases, the design artefacts gained meaning through very particular translations: articulating an analogy of living with diabetes for the Balloon Model, and providing an abstract platform for exploring audio data for Body of Knowledge. Design artefacts were at their most primal form of sense-making (Hekkert, 2006); new representations of newly articulated phenomena. This follows Bredies, Chow and Joost’s (2010) suggestion that the less familiar a new artefact is, and a design artefact deviates from the norm, the more its meaning has to be coordinated anew and understanding it (in terms of use) becomes increasingly similar to designing (Bredies, Chow and Joost, 2010:159). Identifying design artefacts as boundary objects in processes of collaborative, design-led innovation, is a process of sense-making, a process of design. This co-creation of knowledge is argued to be best evaluated through relational, *performative* effects in the context.

6. Conclusion

This paper has sought to contribute to an expanding notion of design artefacts and how they perform as boundary objects by exploring two related cases of Experience Labs. The authors have done so by highlighting the opportunity space labelled as methodologically establishing an *object-oriented approach* (Johnson, 2016). This reflexive process built around generating accounts of the work performed through design artefacts is argued to make the new knowledge generated at the boundaries of design activity more explicit. This follows Krippendorff’s (2006) observation that people, in perceiving artefacts, construct and coordinate meanings by assuming a mutual

understanding, so designers should employ this 'second-order understanding' if the artefacts are to be useful, usable and understandable. In design-led innovation, the success of a new design artefact cannot necessarily be deduced from existing meanings, as it requires a re-coordination of those meanings. It must be performed within a new context and an object-oriented approach, of actor-network mapping and situational analysis, offers a way to bring the knowledge created through design artefacts at complex boundaries to life.

References

Akkerman, S. F., & Bakker, A. (2011). 'Boundary crossing and boundary objects'. In *Review of educational research*, *81*(2), 132-169.

Akrich, M. (1992). 'The De-Scription of Technical Objects'. In Bijker and Law (eds.) *Shaping Technology/Building Society.* 205-227. MIT Press.

Binder, T., De Michelis, G., Ehn, P., Jacucci, G., Linde, P., & Wagner, I. (2011). *Design Things*. MIT Press.

Binder, T., De Michelis, G., Ehn, P., Jacucci, G., Linde, P., & Wagner, I. (2012). 'What is the object of design?'. In *CHI'12 Extended Abstracts on Human Factors in Computing Systems* (pp. 21-30). ACM.

Carlile, P. R. (2002). A pragmatic view of knowledge and boundaries: Boundary objects in new product development. *Organization science*, *13*(4), 442-455.

Clarke, A. (2005). *Situational analysis: Grounded theory after the postmodern turn*. Sage.

Ehn, P. (2008). 'Participation in design things'. In *Proceedings of the tenth anniversary conference on participatory design 2008* (pp. 92-101). Indiana University.

French, T., Teal, G., & Raman, S. (2016). Experience Labs: co-creating health and care innovations using design tools and artefacts. In proceedings of DRS2016: Design+ Research+ Society-Future-Focused Thinking, 7, 2965-2979.

Hekkert, P. (2006). 'Design aesthetics: principles of pleasure in design' in *Psychology Science, 48* (2), 157-172.

Johnson, M. P. (2016). *Mapping Design Things: making design explicit in the discourse of change*. (doctoral dissertation, The Glasgow School of Art).

Krippendorff, K. (2005). *The semantic turn: A new foundation for design*. CRC Press.

Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory*. Oxford university press.

Star, S. L. (2010). 'This is not a boundary object: Reflections on the origin of a concept'. In *Science, Technology & Human Values*, *35*(5), 601-617.

Manzini, E. (2009). 'New design knowledge' in *Design Studies*, *30*(1), 4-12.

Wenger, E. (2000). 'Communities of practice and social learning systems.' In *Organization*, *7*(2), 225-246.

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Tine Thorup is an Innovation Designer and Researcher at the Glasgow School of Art with a background in sculpture and anthropology of visual culture and innovation & entrepreneurship. She has worked with service innovation and research in museums and in health and social care.

Elizabeth Brooks is the Design Director for the DHI Innovation Centre. She leads a multi-disciplinary team based in the Highlands responsible for the planning and execution of the Experience Lab which use design practice to create a safe environment to carry out rapid cycles of experience trialling of new ideas including new technology, new services and roles and behaviours.

Dr Michael Pierre Johnson is Research Fellow at the Institute of Design Innovation at The Glasgow School of Art, with experience in ethnographic research and design-led approaches to inform product, digital, service and organisational innovation. His research centres on making the effects and viability of design innovation approaches, and the preferable changes they seek to serve, more explicit within increasingly complex social design contexts.

Michael's AHRC-funded PhD, Mapping Design Things: making design explicit in the discourse of change, was awarded in 2016, and was supported as part of the knowledge exchange hub, Design in Action.

By combining an actor-network theory approach with grounded theory analysis, Michael is exploring methodologies of visual mapping to support reflexive discourse between designers and multi-disciplinary collaborators, framing design as a performative act. This research aims to contribute to core areas of co-design theory and methodologies, while supporting the articulation and evaluation of co-design practice.