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A View of Design within Transdisciplinary Research: Diagnostic Development for AMR in Human and Animal Settings in India

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Transdisciplinary research is increasingly recognised for transgressing disciplinary boundaries in order to deal with intractable and complex challenges such as sustainability, climate change and global inequalities. Reflecting on an UKRI research project in India, DOSA (Diagnostics for a One-health User Driven Solution for AMR[1] – Antimicrobial resistance) and drawing on literature from design research, transdisciplinarity and anthropology, this short paper examines design's contribution to transdisciplinary modes of research as an opportunity to articulate and expand its contribution as a facilitator for knowledge co-creation in diverse academic teams and social settings.

Background

As a major global public health hazard, the rise of microbial-resistant bacteria is an example of how human biology and society are co-produced with "humans transforming the biological world in which they live and, in so doing, changing their own biological make-up" (Lock and Nguyen, 2010, p.99). Often presented as a biological problem with technology offering solutions (Lambert, 2016), AMR is entangled with healthcare infrastructures: "the availability of antibiotics; the accessibility to physicians; local prescribing habits of medical practitioners; the ability to pay for antibiotics and the presence of antibiotics in the food chain" (Lock and Nguyen, 2010, p.102). This interplay between natural and human systems (Orzech and Nichter, 2008) is recognised to include industrial biologicals whereby "antibiotics quickly became infrastructural to the production of many other things at scale from more health, meat, fruit and aquaculture produce" (Landecker, 2016, p.20). Indeed, recent research, singles out the humble "broiler chicken as a symbol of the Anthropocene - the age of man-made impacts on the planet" with its "transformation of the biosphere to fit evolving human consumption patterns" (Bennett et al., 2018, p.9). Thus, AMR may be placed within what Fortun (2012) identifies as this "historical period of late industrialisation, which is characterized by degraded infrastructures, exhausted paradigms and noisy news media", and compounded by "complex conditions, involving many nested systems – technical, biophysical, cultural, economic and thus a multiplicity of interactions, which keep the parameters of the problem from ever settling down" (Fortun, 2012, p.452).

As one of a number of recommendations to combat AMR, diagnostics has been highlighted as a solution to reduce the unnecessary prescribing of antibiotics (O'Neil, 2014) and also ensuring that the right antibiotic is used against the correct pathogen (Elvidge, 2017). Similarly, the WHO (2016) looks to antibiotic stewardship through the use of diagnostics to enable the "appropriate use of microbiological diagnostics to guide therapeutic decisions – promoting, appropriate, timely diagnostic testing, including specimen collection, and pathogen identification and accurate and timely reporting of results to guide patient treatment." Street (2017) notes that for these technical solutions there are multiple candidate diseases for which diagnostics may be developed, and as many different ways to diagnose for any single disease. The author also highlights that in countries with limited resources, where a lack of running water, electricity or limited laboratory equipment is commonplace, simple affordable and easy to use tests offer opportunities for diagnostics with different performance characteristics. Greenhalgh (2018) also raises caution over the all too often held belief that the introduction of technology in healthcare contexts can be determined to deliver a particular outcome with a degree of predictability, and emphasises the need for sociotechnical detail to identify the social meaning and the wider network in which the technology exists and the spaces and places that make up our lives.

About the Project

Against this complex background of AMR and diagnostics, DOSA aims to deliver diagnostic solutions for three settings in India, to address Urinary Tract Infections (UTI) in human health, mastitis in dairy cows and shrimp farming in aquaculture. The project is delivered by a team of academics from microbiology, chemistry, diagnostics, design, economics, and anthropology from the UK and India.

Because of the need for baseline data to identify the presence of bacteria, the type of pathogens, and their resistance within the settings – large microbiological data sets were gathered in parallel at the sites of the design ethnography. Throughout the project many forms of data gathering are used: from development testing in the lab, to sampling for microbiological presence of pathogens and antibiotic residues from the settings, with the design ethnographic fieldwork and co-design tools being applied for dynamic knowledge co-creation.

I foreground this work as transdisciplinary in order to provide a frame to articulate design's role within the complex collaborative context of AMR in human and animal health in India. For the purpose of the present paper, the focus will be on design in DOSA as a facilitator for enabling a transdisciplinary mode of research.

What is Transdisciplinary Research?

Transdisciplinary research emerged in the 1970s, and has its origins in "sustainability challenges that are characterized by complex social-ecological systems under conditions of uncertainty, plurality of values and perspectives" (Popa, Guillermin, & Dedeurwaerdere, 2015, p.46). Jahn et al. (2012) create a framework for transdisciplinary research that they see as "a particular mode of working that always starts with a complex societal problem that is not set within a disciplinary boundary; that involves both inner-scientific co-operation between various disciplines and fields, as well as co-operation between science and society". They emphasise it is not a research methodology nor theory, but an action-orientated and demand-driven mode of research. Furthermore, they present transdisciplinary research as enabling processes of mutual learning between science and society that is dependent on "reflexive processes to maintain the close ties between scientific and societal problem descriptions"(p.3). This multi-dimensional nature of a problem space, involving an interface of human and natural systems is also recognised by Wickson et al. (2006), who see the research at its start as situated in "the world and actual" as opposed to "in my head and conceptual" (p.1048). To further characterise transdisciplinary research, Wickson et al. (2006) deem the delivery of practical outcomes that can be applied to a social or environmental context – which will bring about a degree of change in those contexts – as another important feature. Thus, to achieve this change there is a requirement to extend beyond the interdisciplinary integration in the team and to involve non-academic stakeholders in the research process (Lyall & Meagher, 2015), so that any gaps in local knowledge and practical expertise are identified and met (Lawrence & Després, 2004).

In understanding the particular nature of transdisciplinary research, we are also presented with specific challenges in effectively delivering this disciplinary rich and pluralistic form of working. One of many obstacles identified by Jahn et al. is "the cognitive challenge of integration", which the authors define as "the cognitive operation that establishes a novel, hitherto non-existent connection between distinct entities of a given context" (2012, p.7). The authors also see the need to establish different forms of communicative practice and some form of common language to progress mutual understanding and agreement. Popa et al. (2015) recommend transdisciplinary processes as benefiting from "a pragmatist approach to reflexivity which argues for extending the actors reflexivity through their participation in concreate problem solving and social experimentation and learning processes" (p.46). Thus, describing the characteristics of transdisciplinary research enables a conceptualisation of design's contribution to complex sustainable and environmental problems, that transgress disciplinary boundaries.

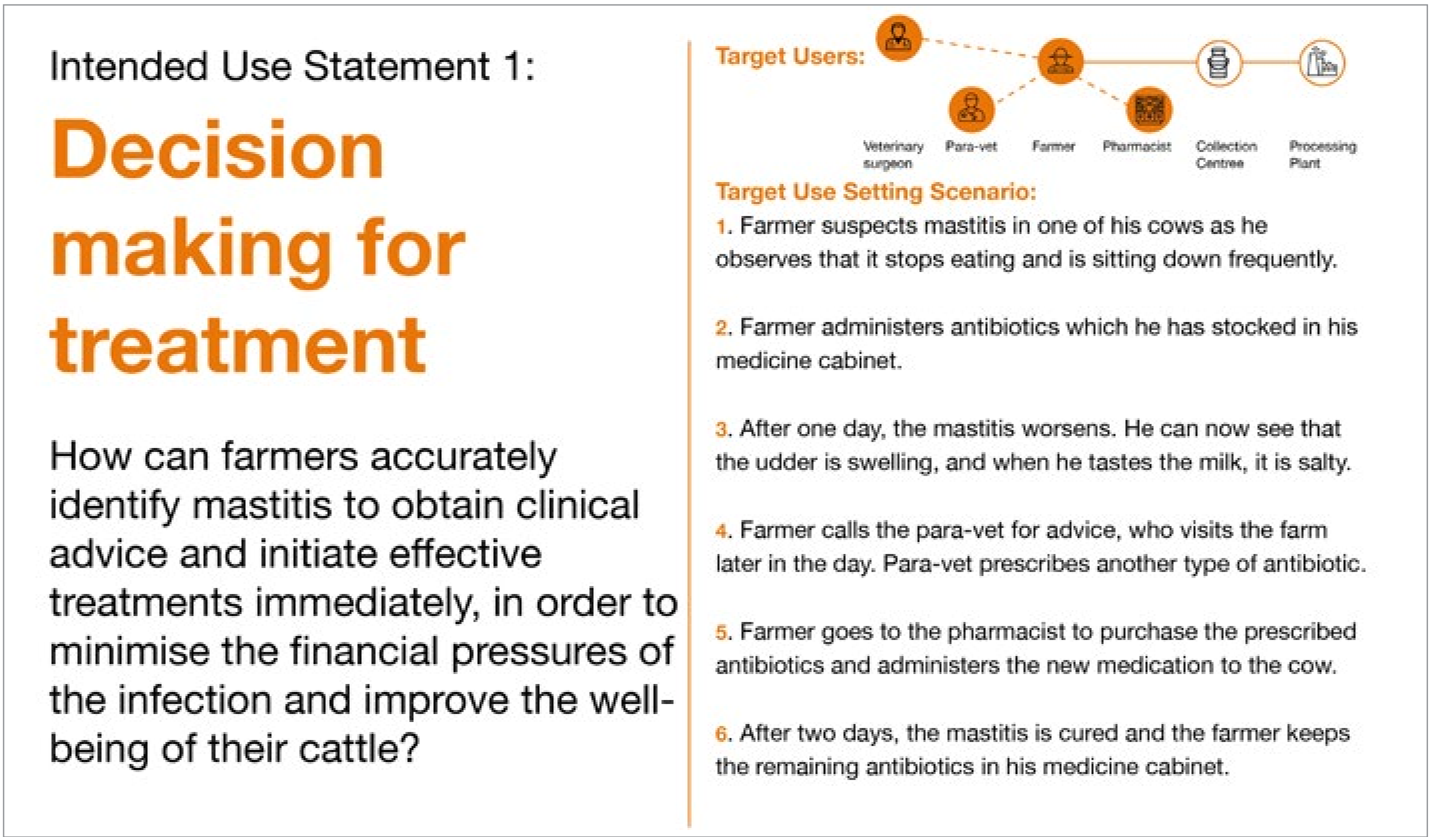
DOSA as Transdisciplinary Research

From the start DOSA's purpose was to deliver a user-led and human-centred approach to diagnostic developments in human-and animal-health contexts, with the ultimate aim of addressing AMR. The geographic spread of the three settings – with aquaculture in Kerala, human health in Assam, and the dairy setting located in Haryana – has also meant that there are three diagnostics projects brought together to deliver a One-Health approach to AMR. In addition to the two UK researchers overseeing the fieldwork, DOSA involved five post-graduate science researchers from IIT Delhi to also support the field study. The purpose of the diagnostic was to conceptualise the development not from a technological angle, but as a service that would be situated within local practices and drawing on local indigenous knowledge and values. This bottom-up endeavour, engaging multiple actors from the three settings, has required the building of trust with community members, the sharing of knowledge, and an understanding of livelihoods and its pressures. Here design is reframed as a form of fieldwork by engaging informants in the processes of creating knowledge (Kjærsgaard & Otto, 2012).

As used in the project, the design ethnography creates a holistic picture of local lives as they are lived within the human and dairy setting, and in aquaculture because of its very different nature, with a focus on the supply chain issues of the shrimp farmers. The work follows an exploratory process (Manzini, 2015) and a sense-making activity (Manzini, 2014) that frames place through revealing tacit knowledge, daily activities, journeys, and movement (Prendiville, 2017). Co-design enables, through open-ended practices of prototyping and scenario building (Escobar 2018, p.113), multiple relationships to be formed and the visualisation of local knowledge. Used with focus group discussions, mappings, and interviews, co-design reveals the underpinning cultural issues and situated practices within the communities. Thus, this interactive fieldwork reflects Manzini's view of co-design as facilitating social conversations (Manzini, 2016), with each of the settings shaping the nature of the diagnostic intervention. This, to echo McCullough, reflects the need for "situated technologies that, rather being decontextualized and value neutral, are embodied, place based, convivial and conducive to care" (Escobar 2018, p.35).

↑ **Figure 1. A co-design session with dairy farmers exploring different routes to diagnosing mastitis in cows, 2013 © Alison Prendiville / Dosa Team**

As well as iteratively engaging the local communities of villagers and farmers in the design ethnography, attention was given to translating the fieldwork into codesign activities for the DOSA team, so that the diagnostic developments could be situated for each of the settings in ways that would be reflective of existing infrastructures and systems. Effective knowledge sharing within transdisciplinary projects is considered to be one of the problematic areas within this mode of working (Brandt et al., 2013). Throughout DOSA, knowledge exchange occurs at regular meetings using design tools and templates to translate and share the non-scientific fieldwork and to facilitate meaningful engagement with other DOSA team members, particularly the micro-biologists and diagnostic developers in the UK and India. To further consolidate the fieldwork and converge the diagnostic development to the contexts, at the end of the first year a four-day workshop was held, to problematise the different settings in relation to the diagnostic developments and the existing service ecologies (figure 1). For these sessions, knowledge co-creation activities were designed to reconceptualise the role of the diagnostics as services, provide provocations for new imaginaries, and to reflect on the contexts of each of the settings – with material generated from the fieldwork to support these inquiries.



↑ **Figure 2. One of the intended use statements generated for the Target Product Profile workshop which aimed to engage the DOSA team in rethinking the role of diagnostics for the dairy setting.**

Responding to personas, current treatment journeys, and antibiotic usage for mastitis in dairy farming, UTIs in human health, and the shrimp farming supply chain, the team members worked collaboratively to explore how the diagnostics would respond to “intended use statements” generated from the fieldwork (figure 2). They then mapped out how diagnostics would change the decision pathways and, more speculatively, commented on the co-creation of value through the process. The final element of this work was the integration of their diagnostic responses to the fieldwork into Target Product Profiles (TPP) to identify the minimum and optimum requirements[2]. These are being iteratively up-dated in response to on-going fieldwork. In this sense, the DOSA project established the co-design process as an agent of transformation, capable of altering pre-existing knowledge systems, challenging them and integrating them – in order to generate new insights and perspectives (Moser, 2016).

Conclusion

This paper has looked to transdisciplinary research as a means to explore and expand design’s role in diverse scientific teams that are addressing subjects such as AMR, in what can be considered as complex environmental and human and animal settings. As design is increasingly collaborating in these problem spaces, there is value in reflecting on design’s role in delivering change, particularly to overcome approaches that Lawrence & Després refer to as “ontological frameworks that do not address fundamental issues but only topics isolated from the societal context” (2004, p.392). Throughout DOSA, the project has applied design as a sense-making activity, one that is focused on building trust through co-design sessions and using visual prompts and prototyping to engage local communities in Haryana, Assam, and Kerala in discussions on livelihoods, relationships, human and animal health. From the fieldwork we have come to understand how health is considered, symptoms treated, and how people locally approach the use of medicines, supply-chain relationships and many more human and animal entanglements that explain the reliance on antibiotics in each of the settings. Furthermore, design has played a key role in experimenting to make effective the transfer of knowledge within the team and to break down siloed thinking. Design was also used to create connections between the diagnostic technologies under development as they were situated in each of the settings, and to actively engage team members in challenging their priorities and thinking about what each of the diagnostics’ need to deliver, in order to be meaningful and relevant for the communities.

■

Endnotes

[1] https://gtr.ukri.org/projects?ref=ES/S000208/1

[2] A Target Product Profile (TPP) outlines the desired 'profile' or characteristic that is aimed at a particular disease or diseases. A TPP states intended use, target population and other desired attributes of products including safety and efficacy-related characteristics. These profiles direct the product research and development. (WHO Target Product Profiles). https://www.who.int/research-observatory/analyses/tpp/en/

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