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Exploring the spatialities of technological and user re-scripting: The case of decision support tools in UK agriculture

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ABSTRACT

The use of decision support tools on-farm may help to deliver evidence-based guidance to farmers, helping to improve productivity and prevent environmental degradation. While much research has sought to increase the uptake of decision support tools in practice, largely by identifying desirable characteristics of system design, rather little work has used a spatial lens to investigate *how* they are actually used. Using Latour's notion of 'the script', this paper looks at the spatialities of technological and user re-scripting associated with the introduction of decision support tools on-farm. Although there is some literature on how technologies may be re-scripted by users, studies concerning decision support tools are more limited. Furthermore, while there are studies about how technology (not decision support tools) re-scripts agricultural societies, these are generally concerned with macro-level impacts (e.g. labour changes), rather than exploring life on individual farms. This paper, therefore, focuses on exploring the spatialities of re-scripting, investigating how tools themselves are co-constituted in various ways by different users in different spaces, but more particularly on how life on the farm may be changed by the introduction of decision tools. A case study of decision support tool use on farms in England and Wales demonstrates the need to explore spaces on individual farms if we wish to understand processes occurring at the interface between tools and farmers. Firstly, situated knowledge held by farmers and advisers leads to resistance, negotiation, and re-scripting of decision support tools, which are perceived to provide the 'view from nowhere'. Secondly, the introduction of decision support tools changes the workflows of farmers, affecting how and when they interact with different spaces of their farm. In signalling the need for more research to theorise the spatialities of re-scripting, we briefly explore how our work can inform policy and the development of decision support tools.

1. Introduction

The use of decision support tools by farmers has been the subject of research over the last two decades, particularly in developed countries, such as Australia, Belgium, Italy, the USA, and the UK (see Rose et al., 2016; Rose and Bruce, 2017). These tools provide evidence in a useable form and tend to be delivered in the form of computer software, mobile applications, or web-based interfaces (Dicks et al., 2014), but they can also be paper-based. They have the potential to improve decision-making by guiding a farmer through clear evidence-based decision steps towards a final decision. For example, farmers often need to make a decision about how much manure to spread on a particular crop. There are various decision support tools, including mobile applications, that can specify the quantity of nutrients found within manures spread at varying rates. Using a specially designed calculator, the farmer can enter various data into the tool – such as field size, crop type, spread rate, and manure type – and it will generate an evidence-based output that suggests how much manure to spread in order to meet crop nutrient requirements. The logical impacts of evidence-based decision-making are then increased production, reduced costs, and a lower environmental impact if yields can be increased without excess nutrients being lost to water courses.

Studies into the uptake and continued use of computer-based decision support tools, however, have noted low farmer engagement

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(Alvarez and Nuthall, 2006; Gent et al., 2013; Kerselaers et al., 2015; Lindblom et al., 2017; McCown, 2002; Rose et al., in press). In response to this problem, research has assessed how tools can be better designed and delivered to increase uptake (Hochman and Carberry, 2011; Kerselaers et al., 2015; McCown, 2002, 2012; Rose et al., 2016, in press). While it has proven popular to investigate *whether* decision support tools are used in agriculture (and how to encourage uptake), or their likely impact *if* used (Zhang et al., 2012), little attention has been paid to the question of *how* they are used. Rather, there is often a conscious, or tacit, assumption that a linear relationship exists between the production of scientific knowledge in the form of decision support tools and its uptake by the end user.

This assumption is apparent even in recent explorations of the relationship between designers of tools and users, despite the spatial shift in scholarship across the social sciences. This shift has seen the emphasis move away from technology transfer and innovation adoption, instead exploring the role of space, place, and situated knowledge, in the interpretation of technologies (Holloway et al., 2014). A further analysis of this work on the geography of knowledge and technology demonstrates that the presence of a linear relationship has been conclusively rejected; yet there appears to be little evidence that research into decision support tool use has shifted accordingly. Since farmers are increasingly being asked to use various forms of technology (Morris and Holloway, 2014), including decision support tools, it is important that research into tool use develops a spatial and social lens.

In this paper we address this underdeveloped spatiality and social sensitivity. By using Latour's notion of 'the script', we argue that use of decision support tools should be seen as a co-productive relationship between designers, knowledge brokers, and end users; one in which tools are interpreted, resisted, and modified by users, whilst simultaneously re-scripting life on the farm. Although some work has examined how technologies are shaped by users, including how situated knowledge contributes to this, rather less has explored the way in which they might shape how and when farmers interact with different spaces of their farm. We are thus particularly interested in how technologies change the material nature of farming on an individual farm basis, for example by altering where farmers choose to spend their time or make decisions. The implications of the changing spatialities of farm decision-making with increased technology use are also discussed, including how they might affect the imagined space of farming. Based on our empirical example, we suggest that more research is needed to theorise how changes might take place on farms.

2. Technology and society

Latour's (1992, 1994) notion of 'the script' refers to the ways in which actions are mediated by artifacts. If we think of some common uses of 'scripts', for example in artistic production, sports management, or traffic control, instructions given in the form of a 'script' tell people how to behave – an actor is expected to learn and repeat lines, sports players may be expected to stick to a rigid formation and play in a certain way, whilst road users are required to pay attention to signs. Artifacts (e.g. text, diagrams, signs) are devised to prescribe the action of these users and designers usually hope that the script is followed without alteration. Yet, it is well-known that talented actors are able to improvise, change, or repeat their lines in a way not originally intended by the director, but beneficial to the performance. It is evident that some of the best sports players ignore the instructions of their manager and roam outside the set formation to great advantage. Furthermore, it is not uncommon for drivers to ignore road signs if they consider that the potential advantages of doing so outweigh the risks. Thus, while artifacts certainly do shape the lives of their users, they are, at the same time, mediated through user interpretation (Verbeek, 2006). Knowledge therefore rarely flows between two points without changing, necessitating a spatial lens to analyses of knowledge-practice interfaces (Finnegan, 2008).

Artifacts can also take the form of technology. Using the example of the smartphone, manufacturers have designed a number of functions, including allowing people to make phone calls, send text messages, take photos, and browse the internet. However, Oudshoorn and Pinch (2005) suggest that there is rarely a single 'correct' use of a technology since individual users decide upon their preferred mode of use. A smartphone, therefore, might only be a device used to make phone calls for one person, but represent a hand-held computer for someone else. Latour also noted that artifacts could shape user experience. Technology thus becomes a social construct, shaped by societal structures and by the ingenuity of individual users (Bijker, 1995). The meaning of a technical artifact can, therefore, never reside in the technical design of that technology alone; it is shaped by social interaction (Pirnejad and Bal, 2011).

Employing the same example of smartphone, their introduction has undoubtedly changed social interactions and the social conditions into which it has been launched. For example, research has suggested that personal relationships are affected as couples prefer to check their smartphones rather interact with each other (Levy, 2014), and that increasingly sophisticated problem-solving apps are restricting our ability to think for ourselves (Hadlington, 2015). The ability of technological artifacts to change social interaction is also discussed by Verbeek (2006) through the example of the microwave oven. After the introduction of the microwave into the home, he argues that social structures were changed, enabling users to prepare meals more quickly, but also encouraging people to cook individual meals. This had the effect of discouraging the preparation of food for a joint family mealtime. The microwave oven, therefore, offered time-saving benefits to busy people, but also changed the dynamics of the family home.

Impacts of technology, therefore, can be bi-directional; influencing the behaviour of users, but also shaping the nature of the technology itself. The theory of re-scripting has, to a certain extent, influenced some scholarship on technology use in agriculture.

3. Re-scripting decision support tools in agriculture

In many cases, research into the use of technologies, and specifically decision support tools, in agriculture continues to adopt a linear model of research translation. Such work is concerned with improving uptake, and removing barriers to use (see Rose et al., 2016). Yet, there has also been a proliferation of social science studies in agriculture that have moved beyond conducting innovation-adoption studies. A brief outline of this work is useful here, but more detail can be found in reviews such as the one by Bear and Holloway (2015).

From the 1980s onwards, innovation-adoption research, which had dominated scholarship to this point, began to be convincingly critiqued for being deterministic and linear (Hinchcliffe, 1996; Kirsch, 1995; Roling, 1985; Ruttan, 1996), in other words for assuming that technology improved on-farm decision-making and flowed unproblematically from designer to user without changing. These assumptions meant that research had a pro-innovation bias, and there was a tendency to blame the farmer for non-adoption rather than to criticise the technology for being poorly designed or surplus to requirements (Morris and Holloway, 2014).

Since the decline of innovation-adoption studies in the 1980s and 1990s, expertise also started to be considered as something more practical, rather than being associated purely with scientists in research institutions (Collins and Evans, 2009). Livingstone (2003) demonstrates the spectrum of sites from which scientific knowledge emerges, such as laboratories, museums, botanic gardens, hospitals, and the human body. He shows the significance of these locations in shaping their scientific enquiry, and thus illustrates how science is always embedded in specific contexts (see also de Laet and Mol, 2000). Once we problematize expert knowledge in this way, and accept that it embodies a particular place and culture, the divide between expert and lay knowledges is no longer tenable (Wynne, 1996). Thus, science is always