The nature of experiments for sustainability transformations: A search for common ground

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1. Introduction

Sustainable development is an endeavour that comprises all areas of contemporary societies (e.g., UNCED, 1992; Lafferty and Meadowcroft, 2000; Newig et al., 2007). It is widely acknowledged that transforming society towards a sustainable development path will require technological innovations, but also new practices and organisational structures to deal adequately with the functioning and limitations of socio-ecological systems (Grin et al., 2010). Sustainability transformations have been defined as long-term and fundamental processes of change through which established socio-technical systems shift to more sustainable modes of production and consumption (Rotmans et al., 2001). Sustainability transformations also require fundamental changes in values, as well as modifications of the social order (e.g., Shove and Walker, 2010).

One central issue in research and management of sustainability transformations is the drivers that bring about fundamental changes in socio-technical systems. Social experimentation can be seen as such a driver to plant the seeds of change that may induce a broader transformation. A variety of experiments have been conducted with the aim to develop alternative socio-technical visions in real-world contexts (Sengers et al., 2016). They strive to provide learning opportunities and to find new solutions to current problems of unsustainability. We have seen an increased interest in such experiments in recent years, with contributions from researchers and policy-makers alike, for example on socio-technical experimentation (e.g., Schot and Geels, 2008), experimental governance (e.g., Sabel and Zeitlin, 2010), and urban experimentation (e.g., Castán Broto and Bulkeley, 2013). The literature on experimentation in the context of sustainability transformations is rapidly growing, (see, for example, in this journal Jalas et al., 2017; Williams, 2017; Luederitz et al., 2016), leading to a diversity of perspectives and classifications of experiments (for useful overview articles, see Sengers et al., 2016; Kivimaa et al., 2017; Laakso et al., 2017).

This article contributes to this dynamic debate. By highlighting central characteristics that underlie different types of experiments, we want to clarify some of the more implicit assumptions about
experimentation aimed at fostering societal transformations towards sustainability.¹ We thereby wish to provide common ground for different approaches in an increasingly complex research area. Being aware of the nature of experiments, as well as the shared assumptions of different types of experimentation enables a better understanding of the roles, responsibilities and possible outcomes of experimentation. From an analytical point of view, such consideration allows to specify experimental processes and to distinguish them from other types of learning, and from incremental policy change. From a policy-making point of view, it helps to develop strategies to apply experimentation in meaningful ways, ensure its effectiveness and avoid pitfalls.

In methodological terms, we conducted a narrative literature review (Rumrill and Fitzgerald, 2001; Baumeister and Leary, 1997) on the notion of ‘experiment’ as it is used in two fields: the sociology of knowledge research on the history of (natural and social) sciences, and sustainability transformation research, particularly in the theories of transition management and reflexive governance. In contrast to a systematic review, we used this qualitative method to describe and discuss the state of science regarding experiments by relying on the writings of key scholars in the respective fields. Contrasting the different notions of experiments allows us to bring to light some of the taken-for-granted assumptions that underlie the currently discussed concepts of sustainability-oriented experimentation.

The article proceeds as follows: In Section 2, we briefly recall from a historical perspective how the term ‘experiment’ has been used in science, and then spell out a number of central dimensions that characterise different types of experimentation. On that basis, we derive a systematic understanding of sustainability transformation experiments as practice-based endeavours of social actors with the aim to achieve societal transformations towards sustainability. This understanding is underlying all of the current notions of experiments in sustainability transformation research (Sengers et al., 2016). Whereas most concepts take this basis for granted, our analysis strives to shed light on the implicit assumptions behind experimentation, to make them explicit, and to discuss their implications.

In Section 3, we contrast the characteristics of sustainability transformation experiments with the use of experimentation in two influential theories in current thinking about sustainability transformation, namely transition management and reflexive governance. Both theories deal with multi-dimensional and multi-level shifts that may evolve and spread across society. They both refer to experimentation (in different ways), yet the substance thereof is rarely elaborated in transition management, and paid no attention to in reflexive governance. We find that there is room for mutual enrichment of the concepts: both theories currently have a partial view of experimentation, but highlight the importance of experimentation within the field of (multi-level) governance as an element of transformation processes.

In Section 4, we use these insights to focus on governance experiments as a hitherto neglected aspect in the debate (for notable exceptions, see Kivimaa et al., 2017; Laakso et al., 2017; Bos et al., 2013). Sustainability transformations require governance innovations that may eventually change policies and institutions. This raises the question of appropriate design of sustainability governance experiments. The article concludes with a summary of the main findings in Section 5.

2. Notions and characteristics of experiments

In this section, we scrutinise experiments from a historical perspective. We highlight their fundamental characteristics that shed light on the implicit assumptions in the literature on experiments for sustainability transformations. To this end, the historical development of ‘classical’ experiments in the natural and social sciences is briefly described and several central dimensions of experimentation are spelled out (2.1). On that basis, we then characterise the notion of ‘sustainability transformation experiments’ and its key features (2.2).

2.1. Experiments in historical perspective

Experimentation is an essential method and tool of modern science for producing knowledge. Galileo Galilei and Francis Bacon can be regarded as inventors of the idea of transferring (natural) phenomena into experimental arrangements in order to single out variables and study them under controlled conditions (Krohn and Weyer, 1994; Gross et al., 2005). Bacon’s idea of a laboratory introduced the modern relation between science and society. This laboratory assigns experimentation a specific institutionalised space in which science can be carried out without burdening society with its potentially undesirable results and without being burdened by society (Guggenheim, 2012).

The laboratory can be understood as a ‘world on trial’ (Krohn and Weyer, 1994) where things are tried out, developments can be withdrawn, and failures and mishaps are interpreted as valuable contributions to knowledge generation. A central assumption in experimental arrangements that rely on this early understanding is that manipulation and observation of objects and parameters can be fully controlled. Within the manipulated setting, experimentation seeks to produce knowledge on interdependencies of the experimental variables and thereby on the complex natural system. Results of experimentation might be unforeseen, surprising, and may disprove initial hypotheses (Krohn and Weyer, 1994; Guggenheim, 2012). However, it is presumed that (unexpected) outcomes remain within the controllable conditions of the laboratory. In the classical conceptualisation of experiments the experimenter is a trained scientist. He or she develops the experimental setting based on hypotheses, designs and initiates the process of experimentation, controls and evaluates its outcomes, and publicises the newly generated knowledge. Societal actors in the classical conceptualisation take the role of either spectators or experimental subjects.

In the course of the 19th and 20th centuries, the scope of experimentation was significantly expanded to include different social science fields. In the late 19th century, psychologists started to use experiments to investigate human behaviour and underlying processes, including perception, memory, cognition, learning, and motivation (Mandler, 2007). In the early 20th century, the Chicago School of sociology invented the idea of social experimentation. Sociologists understood the city as a laboratory that just needed to be studied in order to gain knowledge on societal processes and the human beings therein. In the mid-20th century, psychologists, too, started to transfer experimentation from the laboratory to the real world. The field of experimental economics emerged to test the validity of economic theory and to study the functioning of markets and other institutions (Smith, 2008). Later, larger-scale social experiments funded by government agencies were conducted to evaluate proposals for new programmes or policies on issues such as welfare, education, employment, or electricity pricing (Hausman and Wise, 1985). More recently, economics and neighbouring disciplines started using smaller-scale field experimentation on diverse issues, such as market and auction design, industrial

¹ In a recent literature review on experiments in climate governance, Kivimaa et al. (2017) found that 17 out of the 25 studies reviewed did not employ a specific definition of ‘experiments’ in their research.

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