Art as a Future-Generating Machine: Rheinberger’s Experimentalism in Practice-Based Arts Methodologies

Ash Tower

Dr. Ash Tower (artist, researcher), University of South Australia, UniSA: Creative, Level 3, Kaurna Building, City West Campus, GPO Box 2471, Adelaide SA 5001. Email <Ash.Tower@unisa.edu.au>. Website <https://www.ash-tower.com>. ORCID: 0000-0003-1527-826X

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Abstract
This article explores the potential syntheses between practice-based arts research methodologies and the historian of science Hans-Jörg Rheinberger’s framing of the scientific ‘experiment.’ Rheinberger offers the experiment as a ‘future-generating machine’ resulting from materials discursive processes enacted as ‘repetition with difference’. This framing of epistemological development has applications in practice-based methodologies through their simultaneous execution of action and reflection, as well as the importance of ‘surprise’ in experimental practice.

Scholarship of practice-based arts research has grown to identify itself as an outsider in the broader academic research community. [1] Arts research often defines itself against the parameters of more ‘traditional’ academic research, which uses a generalised model of scientific activity that champions rigorous experimental parameters, reproducibility of results, and robust standards of accuracy. While these features are often cited as the foundation for quality scientific practice, this lacks consideration for the epistemological pathways toward these ideals. The generalised model of scientific practice as espoused by non-scientific research scholarship misses important details that lie within science’s more reflexive shadow—the philosophy of science and the sociology of scientific knowledge. The scholarship that is aware of these fields—such as that of Barbara Bolt and Estelle Barrett—rarely examines the components of scientific practice in greater detail. Such an examination would dispel the reification of scientific work, rendering it more familiar to practice-based research methodologies. One such example is historian of science Hans-Jörg Rheinberger’s work on the scientific experiment (specifically within molecular biology). Rheinberger frames the experiment as a ‘tracing-game’ that implicates the intuitive, material configurations of experimental work as a “future-generating machine.” [2]

Since the rise of art/science programs in the 1960s like Billy Kluver and Robert Rauschenberg’s ‘Experiments in Art and Technology’, and Maurice Tuchman’s ‘Art and Technology’ program for the Los Angeles County Museum of Art, there has existed a rich discourse of knowledge production in artistic and scientific research cultures. This article takes Rheinberger’s experimental system and grounds it within contemporary theory surrounding the practice-based research methodologies of Barbara Bolt and Brad Haseman. It is not a comprehensive theorisation of art production, but constrains its scope to address practice-based research between art and science, from the university art school’s adoption of the practice-based PhD, to eminent art/science research programs such as the SymbioticA Centre for Excellence in the Biological Arts in Australia, and the Arts at CERN program in Switzerland. Extending Rheinberger’s
experimental thinking to art establishes what systems theorist Ludwig von Bertalanffy terms an ‘isomorphism’, which he describes as “structural uniformities, manifesting themselves by isomorphic traces of order in the different levels or realms.” [3] It is the intent of this paper to offer Rheinberger’s experiment as an isomorphic research methodology that is capable of encompassing artistic and scientific systems.

Rheinberger himself part-realises the interdisciplinary potential of his model. In a note to the first of a two-part paper entitled ‘Experiment, Difference, and Writing’, Rheinberger himself states “[t]here is a striking parallel here between the work of the experimentalist and the way George Kubler describes the work of the artist…” [4] Kubler—an art historian who features prominently in Rheinberger’s work—describes how “[e]ach artist works on in the dark, guided only by the tunnels and shafts of earlier work, following the vein and hoping for a bonanza, and fearing that the lode may play out tomorrow.” [5] A somewhat Romantic notion of art production beyond research, but nevertheless picks up upon some of the questions of knowledge in creative practice offered by Barbara Bolt, Estelle Barrett, and Brad Haseman.

It is important to establish that the scientific experiment has not always borne a relationship with art practice and objects; to do so would misrepresent the mutable and changing role of art (and of scientific practice) over history. The scientific experiment is a broadly defined topic, but this investigation uses Rheinberger’s own position, as detailed in the accompanying table (Table 1). This can be summarised as a ‘scientific object within the frame of technical conditions.” [6] Arts research, in this instance, uses Linda Candy and Ernest Edmonds’s framing of a practice-based approach where “practice [is] embedded in the research process but research questions arise from the process of practice, the answers to which are directed toward enlightening and enhancing practice.” [7] This definitions sit best at the conjunction of art schools and universities; the far more recent push towards creative research beyond universities, or the use of creative practices to generate knowledge. Thus, the topic of this article is research; or the acquisition of knowledge, and the different (or surprisingly similar) terms upon which knowledge arises in artistic and scientific practices.

<1> Art and/as Research <1>

A tension lies at the heart of creative practice research regarding whether the art object is the method or the result; the process or the product; the action or reflection. While this issue can be easily resolved by designating the making of the art object can be considered the ‘method’, and the point at which the making stops becomes the ‘result’, this conclusion is troubled the performative turn and relational aesthetics in art, casting doubt as to whether the art object is ever actually ‘finished.’ [8]

Many scholars of arts research designate scientific practice as having a clear, delineated progression between method and result; indeed, the structure of scientific papers supports this claim. This assumption, however, has been long critiqued within the sociology of scientific knowledge and the philosophy of science. Bruno Latour, Steve Woolgar, Karin Knorr Cetina and other scholars of ‘laboratory studies’ dissect knowledge itself within the laboratory; revealing the translations, inscriptions, and notations that scientific ‘facts’ must survive before they are recognised as such. [9] Karin Knorr Cetina describes the selective erasure of laboratory action in
scientific papers – “the scientific paper hides more than it tells... it deliberately forgets much of what has happened in the laboratory, although it purports to present a “report” of that research.” [10] The need to position scientific experiments as devices that reproduce results and thus strengthen scientific consensus is a tempting conclusion, though it never seems to question how science is capable of producing new knowledge if it is devoted to the replication of the same. Nevertheless, this ‘stereotype’ of scientific practice is perpetuated in humanities scholarship, and often plays the villain to research disciplines whose methodologies are not so neatly defined. Barbara Bolt’s diagnosis of creative arts research’s challenges in academia foreground this:

“Creative arts research often seems nebulous, unquantifiable and untestable. […] In the academic world at least, the creative arts are seen to lack credibility because the methods cannot be replicated exactly and correspondence in findings between studies is not a goal that is valued.” [11]

In response to this idea of scientific research being exclusively problem/solution oriented, focused on the replication of the same, and pre-occupied with narrow definitions of ‘novelty’, creative researchers assembled approaches that would later be known as practice-based research methodologies in the mid-1990s. These methodologies have grown in popularity with the incorporation of art schools into universities that occurred during the same period, and the interest in undertaking creative practice as an epistemological pursuit. One such methodology was developed by Brad Haseman and termed ‘performative research’. In A Manifesto for Performative Research, Haseman describes how performative research (and practice-based research more generally) provides alternative framings of ‘original contributions to knowledge’ and resists the designation that research must begin with a ‘problem’ that needs solving. Haseman’s performative research is ‘intrinsically experiential’ [12] and involves “non-numeric data, […] include[ing] material forms of practice, of still and moving images, of music and sound, of live action and digital code.” [13]

Bolt interprets Haseman’s performative research within a creative arts context as depending on an approach of “repetition with difference.” [14] As Candy and Edmonds remind us: despite a 35-year legacy within research, practice-based methodologies have yet to constitute a robust discourse, and still find themselves lacking acceptance in more “mainstream academic research.” [15]

<1> ‘Experimental’ Science <1>

Rheinberger’s work has involved a sustained focus on the epistemological nature of experimental practice over the last 30 years, and typically places emphasis on materiality, surprise and difference as necessary components of scientific work. Rheinberger states of the experiment:

“It is a machine for ‘making the future’. It is not only a device that generates answers; at the same time, and as a prerequisite, it shapes the questions that are going to be answered. An experimental system is a device to materialize questions. It co-generates […] the phenomena or material entities and the concepts they embody.” [16]
Rheinberger argues his proposal of an ‘experimental situation’ along four key lines, summarised in the Table 1. For Rheinberger, experimental systems are empirical, material configurations. Experimentation is a process of negotiation with the material context of the task at hand; which, inevitably, leads to instances where materials do not ‘cooperate,’ or possibly offer up surprises or alternatives that were unexpected. This material reflexivity is also essential to creative-practice research. Interestingly, Rheinberger accounts for this surprise in experimental science in a similar way to practice-based research methodologies. He cites Thomas Kuhn’s remark that research is ‘a process driven from behind,’ [17] stating

“[Research] is not a teleological enterprise, […] you can have a goal in mind, and as a rule one must if one carries out research, but the end result defies again and again our capacity to anticipate.” [18]

So, for Rheinberger (via Kuhn), experimentalism defies our capacity to anticipate results. There is a necessary element of ‘things not going to plan’ in order to provide further questions for investigation, or to provide greater detail on questions yet unanswered. It declares there is still useful data in a ‘failed’ experiment. In discussing this, Rheinberger draws on Mahlon Hoagland’s description of the experiment as a “generator of surprises.” [19]

Having introduced the necessity for surprise (and thus another set of agencies beyond the human), we return to Rheinberger’s experiment, which is articulated as a ‘tracing-game’. The tracing-game is a reference to Ludwig Wittgenstein’s ‘language-game’, where the meaning of language is dependent upon the ‘game’ or meta-structure in which it occurs. [20]

“Given a research system, and given its formal dynamics as a future generating machine, how does it display what I have called, preliminarily, the ‘tracing-game’? This is a question of representation, or of translation. A scientific object investigated by an experimental system is deployed and articulated within a space of material representation.” [21]

For Rheinberger, the scientific object is represented in a material, which is then materialized, after which it can be translated and inscribed through a range of second-order references, joining into a network of scientific knowledge systems that draw from those same references. The experiment, through its potential for differential reproduction, then consolidates patterns through confirmation (or elimination) of phenomena and continues through a scientific method until it is reified into a ‘fact’.

It is not only a process of repetition of whole experiments (which Rheinberger claims are the ‘smallest functional units of science’) that give rise to variation, but adjustments and vying agencies within experiments. By positioning the experiment as the smallest functional unit of science, Rheinberger enables an easy demarcation of ‘method’ and ‘result’ from the experiment, for surely the smallest unit of science precludes an internal negotiation between experimenter and experiment. This, in turn, would trouble Rheinberger’s relationship to practice-based research (which does not have such a clear distinction).

The work of philosopher of science and synchrotron operator Park Doing demonstrates that experiments themselves are not necessarily ‘black boxes’ in which an experiment must be totally
isolated from exterior influence. Discussing time spent working on the Cornell University Synchrotron, Doing details the role of the operator in maintaining the experimental parameters of the synchrotron and the operators’ ‘lab hands.’ [22] For Doing, “an operator with good lab hands had a feel for equipment that enabled [them] to sense problems and get equipment working.” [23] Doing’s describes the synchrotron operator’s shift at the laboratory as a sustained interaction with the experimental setup, where the operator is responsible for maintaining and adjusting the synchrotron while it is running, often for extended periods of time. To put this another way, it is impossible to disentangle the operator from the synchrotron and allot them each clearly defined actions which can be subsumed into iterative stages.

Artists, too, would be quick to dismiss the frequency of processes that occur without their reflection or supervision. This entanglement of laboratory, production, and mediation has also been explored by Martin Kemp, Peter Galison and Caroline Jones. [24] Even in dark room photography or kiln-firing ceramics (situations where the artist is dependent on specific functions of equipment) there are techniques of monitoring, adjusting, tweaking, and tinkering that ultimately introduce other agencies and shape the final product. There lacks a clear delineation between action and reflection, and all the other elements of artistic or scientific production, and refers to action, reflection adjustment, and sustainment occurring simultaneously.

**<1> Experimental Practice in the Arts and the Sciences <1>**

Rheinberger’s experiment offers a useful approach to artistic production. As Rheinberger himself claims, “[e]xperimental systems have to be constantly reproduced, but in a differential and iterative manner, if they are to remain arrangements in which new knowledge is generated…” [25] This refers to series of experiments that are iteratively changed, an analogy which conveniently lends itself to the production of artistic works in research environments. This resonates with Barbara Bolt’s description of a performative paradigm within creative practice research as requiring “repetition with difference.” [26]

It is here that the works of Bolt and Rheinberger finally collide: difference is thus offered forth as a means of knowing, specifically *repetition with difference* which then engages a temporality, a sense of rhythm, repetition, alternation (all of which is done with the eyes and hands at the bench or the studio). This process is designated as ‘tinkering’ but in fact intuitively engages a process of repetition with difference, conservation and alteration.

As mentioned previously; a key issue within practice-based or creative practice research methodologies is the difficulty in clearly defining ‘methods’ and ‘results’. Making, like experimentation, is a manifold practice of exploration and execution, where the artwork is steered in an approximate direction, but whose creation nevertheless offers alternatives beyond the artists’ intent. The artist’s creation of a work is the ‘space of material representation’ that Rheinberger describes:

> “An experimental system is the basic unit structure from which experimental tracing proceeds. It constitutes an epistemic thing within the frame of technical conditions. The system must be capable of differential reproduction in order to behave as a future-generating machine.” [27]
Following this, a work of art is the ‘epistemic thing’ within a set of technical conditions. Rheinberger’s experiment possesses the potential to generate the future exactly because it defies prediction. It offers up formations of reality that were not in the mind of the individual at the start of the task. It is this defiance of expectation that implicates time and temporality as intrinsic elements of the experiment as a ‘future-generating machine’. Time is rendered visible only where it deviates from foreseen futures (returning back to Marion Hoagland’s notion of a ‘generator of surprises’). As Elizabeth Grosz describes

“[Time] cannot be viewed directly, nor can it be eliminated from pragmatic consideration. It is a kind of evanescence that appears only at those moments when our expectations are (positively or negatively) surprised. We can think it only when we are jarred out of our immersion in its continuity, when something ultimately disrupts our expectations.” [28]

Following Rheinberger’s offer of a ‘future-generating machine’ we can conceive of artworks as a cascade of branching futures that rise from an artist’s negotiation with the material discursive constellation of a works’ becoming. The implication of time is not only in duration, but also of expectation and surprise; offering knowledges and futures that can only arise in the interaction between the artist, the artwork and the world in a mutually constituted intra-activity.

Both experimental science (within Rheinberger’s account) and art-making are both devices ‘to materialize questions’ in research environments. They are not the products of investigation but investigative acts that are then consolidated into their own objects (‘the experiment’, ‘the work of art’). Through their investigations (which are sustained as they are re-experienced and re-framed) offer unforeseen futures and unexpected potentialities. They are also objects that are interpreted within a ‘space of representation’, implicating their epistemological contexts as labelling them as ‘research’. For the creative research object, there are equivalent spaces that serve to embed the object within a frame that allows it to embody a form of knowledge. The object is not replicable, yet its differential reproduction (refining, editing or re-making a work) allows the ‘congealing’ of more insights around the cluster of iterations of ‘materialized questions’ (to use Rheinberger’s terminology). Ultimately, this paper has ventured an extension of Rheinberger’s experiment into creative arts research, and in doing so, has provided a new model for the consolidation of knowledge within material parameters, and the necessary materialization of questions that provoke surprise, and thus are fashioned into ‘future-generating machines’.

References and Notes


**Biographical information**
ASH TOWER is a researcher, artist, and tutor within UniSA: Creative at the University of South Australia. He received his PhD in art theory and cultural studies for his dissertation on laboratory cultures and communities of practice in art/science work.

**Tables and charts**

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