

# The Logic of Annotated Portfolios: Communicating the Value of ‘Research Through Design’

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## ABSTRACT

This paper examines Research Through Design as an orientation to so-called ‘Third Wave’ Human Computer Interaction (HCI). A number of recent critical reflections are reviewed and the ‘disciplinary anxieties’, which this approach to HCI has aroused, are discussed. Drawing on Feyerabend’s philosophical scepticism over methods and contributions to the Sociology of Science, it is suggested that design research might build its own ‘limited rationality’ rather than be brought in line with supposed norms for good research or criteria for rigour and relevance of unfamiliar provenance. To this end, a concept of ‘annotated portfolio’ is advanced, and detailed, as a means for capturing the family resemblances that exist in a collection of artefacts, simultaneously respecting the particularity of specific designs and engaging with broader concerns. The concept is demonstrated through annotating nine well-known pieces created by the Goldsmiths Interaction Research Studio. Treating this collection as an annotated portfolio highlights, formulates and collates interaction design issues in this work in a novel manner. On this basis, annotated portfolios are proposed as a viable means for communicating design thinking in HCI in a descriptive yet generative and inspirational fashion, without having recourse to standards of ‘theory’ which fit design practice uncomfortably.

## Author Keywords

Research through design, Third Wave HCI, annotated portfolios, interaction design, philosophy of design, sociology of science and technology.

## ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous - Design.

## INTRODUCTION

Writing in 1995, Cooper and Bowers [7] characterised Human Computer Interaction (HCI) in terms of two

conceptual and historical ‘waves’. First Wave HCI was seen as having a technological focus on interactive applications running on workstations engaged with by individual users. First Wave HCI predominately used the methods and theories of experimental cognitive psychology to understand such scenarios. First Wave HCI tended to be critical of perceived tendencies in ergonomics and software engineering to not take the user seriously as an active cognizing individual. In contrast, according to Cooper and Bowers, Second Wave HCI was critical of the First Wave for not capturing the social identity of the user, the social organization of the user’s activities, and the social context of computing technology. The growth of Computer Supported Cooperative Work (CSCW) as a research field was cited as emblematic of Second Wave concerns.

Over the last few years, a number of authors have sought to add a Third Wave to this historical and conceptual picture. For Bødker [4] and Bardzell and Bardzell [2], the Third Wave is characterised by non-work settings and topics such as lived-experience, intimacy, pleasure and embodiment. It is commonplace to periodise computing development in three waves too: from the mainframe, through the era of the personal computer, to a time of ubiquitous computing [cf. 34]. For many writers, this combination of ubiquitous technology and interest in user-experience requires a reorientation of our research methods.

## Research Through Design

In particular, we have seen the emergence of a growing body of contributions which draw on various design traditions for their overall sensitivities and concerns, their methods and their scholarly and aesthetic values. The primary research output of such work tends to be artefacts and systems, sometimes worked through to a high degree of finish, sometimes accompanied by accounts of field studies, and typically presented as illustrating possibilities for HCI which would be unlikely to be explored from existing (e.g. First or Second Wave) perspectives. In addition, we have witnessed a number of ‘manifesto’ pieces urging us to engage in, for example, ‘ludic design’ [13], ‘reflective design’ [31], or to explore provocative ‘ambiguities’ [14]. With ‘Third Wave HCI’ developing a broad technological remit and a concern for lived human experience, an intersection with the world of design is hardly surprising.

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Indeed, several writers [e.g. 12, 37] identify their work as ‘Research Through Design’ (henceforth RtD). This phrase has its origins in Frayling [11] and denotes “research where the end product is an artefact – where the thinking is, so to speak, *embodied in the artefact*, where the goal is not primarily communicable knowledge in the sense of verbal communication, but in the sense of visual or iconic or imagistic communication.” [11, emphasis in the original]. That is, whatever artefacts or systems are made, they are to be regarded as bona fide research outputs, indeed the ‘primary stuff’ of research, with verbal accounts even being in some sense derivative.

As part of a critical examination of RtD in HCI, Zimmerman et al. [38] interviewed 12 leading practitioners and found three commonly cited projects/research groups which they deem ‘canonical’: the Maypole [23] and Equator [e.g. 18] projects, and the work of Technical University Eindhoven’s Designing Quality in Interaction group [e.g. 35]. Zimmerman et al. write: “All of the projects employed a RtD approach, creating artifacts that included products, prototypes and models that illustrated future visions, uses of new materials, and potential ideas. All of the projects generated guidelines and sensitizing frameworks to provide the design research community with information about how to design. Finally, aspects of all projects were documented, ranging from methods and design processes to work that generated scholarly publications with the goal of multidisciplinary outreach.”

### Inter- and Intra-Disciplinary Critique

Cooper and Bowers [7], however, note that such ‘multi-disciplinary outreach’ is often a source of dilemmas. HCI can easily become enmeshed in inter- and intra-disciplinary critique. Cooper and Bowers document how different ‘waves’ of HCI argue for their legitimacy through critiquing other disciplines (be they computer science, ergonomics or cognitive science) for their limited view of HCI issues (inter-disciplinary critique) or, other waves of HCI for their failings (e.g.) to characterise ‘the user’ in ways deemed important or essential (intra-disciplinary critique). On this view, while HCI might benefit from being a melting pot of different disciplines, one cannot typically expect peace between them. Not surprisingly, then, the Third Wave contributions of RtD have found themselves embroiled in what Fallman and Stolterman [8] call ‘disciplinary anxiety’ which occurs when “heterogeneous ways of doing research lead to diverse assumptions about what constitutes legitimate research... where notions of legitimacy are being thrown around without being paid enough attention [and where] these notions tend implicitly or explicitly to be on loan from other disciplines”.

A panel at CHI 2011 [10] claimed that “fundamental differences in the development of design knowledge as compared to scientific knowledge and knowledge about human theories of behaviour” have limited the integration of design research methods into HCI. Following on from

their interview study, Zimmerman et al. [38] critique RtD against the background of “more recognised and established research approaches” and set “major challenges includ[ing] successful methodology development, research examples, theory critique, and evaluation criteria”.

Gaver [12] expresses unease “that such standards might lead to a form of self-policing that would be overly restrictive of a form of research that I value for its ability to continually and creatively challenge status quo thinking”. Like Fallman and Stolterman [8], Gaver warns against importing inappropriate standards from other disciplines, but unlike them, he does not map design research so as to develop anxiety-relieving ‘criteria for rigour and relevance’. Instead, he is concerned to head off a creeping ‘scientism’ he fears may lurk behind such anxieties or be crudely seen as their remedy. He does so, notably, by utilising various perspectives from the Philosophy of Science to see if RtD could ever develop ‘design theory’ in the same sense as the sciences develop theoretical knowledge. Gaver gives various characterisations as to what design theory could be – “generative”, “suggestive”, “provisional”, “aspirational”, “annotative” – which point to a very different identity from the explanatory and testable theories which dominate thinking about science.

### The Trouble With Critique

Although he does not cite Feyerabend [9] in his treatment of the Philosophy of Science, Gaver’s strategy for dealing with theory in design has many echoes in that writer’s work. Feyerabend’s *Against Method* is a subtle philosophical argument against adopting universal standards for conduct in the sciences. The history of the sciences is replete with examples where a ‘rationalist’ (for Feyerabend, an adherent to a particular universal standard) would have made a poor judgment call. Theories have been (rightly) held onto in the face of falsification. Theories of lesser explanatory content have been preferred over richer ones. Theories with many conceptual complexities have been preferred over simpler ones. And so on. Feyerabend’s book is often misunderstood as a call to epistemological anarchism (‘anything goes’) but he explicitly argues against this too as it would comprise another rationalism and universalism which could be open to the same critical treatment. Rather, Feyerabend is urging us to be aware of the limits of all rationalisms.

This, then, allows us to open up a space in which we can ask: *what could be the limited rationalism(s) of RtD and its theories?* And we can ask it in such a way that we need not expect the same answer as for the sciences or any “more recognized and established research approach”. The question would then be less *how can RtD adopt criteria for rigour and relevance to make it a more integrated part of HCI?* but *how might HCI incorporate the limited rationalisms of RtD alongside all the other limited rationalisms it has a home for?* Asking this question is to linger a little longer with RtD *as practiced* and *as*

*articulated on its own terms* before adopting a position of (inter- or intra-disciplinary) critique. It is a matter of working up positively what can be found in relevant work and holding the disciplinary anxieties at bay for a while.

My argument is certainly *not* to say that there is any kind of naïve scientific ideology in those who seek a more mature contribution from design research. Indeed, I have sympathies for the writers I have cited and in the details of their proposals [e.g. in 8, 37, 38] – proposals which I do not have space to review here. The current paper intends to add to the mix with an exploration of a different way to go about a similar goal. My intention is to offer from RtD a contribution to HCI which does some of the work of ‘theory’ but is still articulated in the lingua franca of design, and which hopes to gain its legitimacy from its truthfulness to the artefacts and systems it discusses.

### INTRODUCING ANNOTATED PORTFOLIOS

Designed artefacts lie at the intersection of multiple considerations. Some of these concern the functionality of the design (what should it do?), some the aesthetics (what form and appearance should the artefact take?), some concern the practicalities of its production (what materials, skills and tools are needed to make it?), others concern the motivation for making (why are we doing this? what are we trying to show?), yet others concern the identities and capabilities of the people for whom the artefact is intended (what will our users make of this? how can we best design for them?). Law [28] describes science as ‘heterogeneous engineering’ where multiple considerations are mobilised and played off against each other – considerations which are very different in kind from each other – an emphasis which certainly is also appropriate for the products and practices of RtD. Carroll and Kellogg [4] make a similar point when they see artefacts inhabiting a ‘theory nexus’, embodying multiple ‘claims’ about the psychology of their users. Through Law, however, I would generalise this: the ‘claims’ are not just psychological in nature but can concern any of the heterogeneous concerns of design.

If, as Frayling [11] claims, our artefacts in RtD embody design thinking, then this thinking is typically of a very varied, multi-faceted, heterogeneous sort. Our written accounts can at best be partial views onto this nexus. They are also likely to be incomplete in another respect. Collins [6] argues on the basis of a number of studies of replication that scientists are very rarely able to repeat an experiment (or reconstruct an engineering artefact) on the basis of published accounts alone. Much of our knowledge-of-making is tacit, cf. Schön [30]. As such, it need not appear in written texts, either because it is taken for granted as a matter of common professional knowledge, or because direct contact between researchers to resolve uncertainties is common community practice anyway.

Textual accounts (published papers, documents, descriptions, catalogue entries, whatever) in RtD have an

*indexical character*. That is, they *point to* features of artefacts of interest and connect those features to matters of further concern. They *highlight* features and make them *topical for discussion* within a given community. It is not that the artefact demonstrates points made more precisely in the textual account. Rather, the textual account is given its sense and relevance by virtue of its indexical connection with an artefact which serves, in Stolterman’s [33] phrase, as the ‘ultimate particular’ of design. Barthes [2] made analogous points about how photographs and text (e.g. captions) interrelate in newspaper and magazine articles. The text points to features of interest and establishes ‘connotations’ with other concerns not explicitly depicted.

Gaver [12] puts it that textual accounts of artefacts, including any theoretical pronouncements about them, are to be seen as *annotations*. He continues: “Beyond single artefacts, however, *annotated portfolios* may serve an even more valuable role as an alternative to more formalised theory in conceptual development and practical guidance for design. If a single design occupies a point in design space, a collection of designs by the same or associated designers – a portfolio – establishes an area in that space. Comparing different individual items can make clear a domain of design, its relevant dimensions, and the designer’s opinion about the relevant places and configurations to adopt on those dimensions.”

The rest of this paper will elaborate and exemplify the concept of annotated portfolio as a means for explicating design thinking in RtD that retains an intimate indexical connection with artefacts themselves while ‘connoting’ broader concerns in the research community.

### THE COLLECTION

In so doing, I will make repeated reference to a corpus of work associated with the Interaction Research Studio at Goldsmiths, University of London. The artefacts I shall discuss are well-known in the HCI world and have each been published through the CHI or DIS conference series. Several of these pieces were developed within the Equator project which, as noted in [38], is a canonical source for RtD. As such, they comprise a highly pertinent collection of works for testing out the annotated portfolio notion<sup>1</sup>.

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<sup>1</sup>It is important to emphasise that my purpose is neither to criticise nor celebrate this body of work. Rather, it is to use it to exemplify the concept of an annotated portfolio. Accordingly, I take existing descriptions of these pieces and the published evaluations of them broadly for granted. This is certainly *not* because I hold the work to be above criticism. Rather, it is because mixing the criticism of the Studio’s work with the explication of annotated portfolios would confuse the picture. Even so, I hope this ‘distanced’ approach can help us see new things in the work I discuss. It should also be noted that the author has been a participant in the creation of many of these artefacts in various roles from conducting ethnographic fieldwork to writing software and making general design contributions. However, no special

Let me briefly list nine artefacts that comprise the bulk of the Studio's work to date. Reasons of space prohibit more than a single sentence résumé of each – formulations taken from published summaries, abstracts, and so forth. While these designs are anticipated to be familiar to many readers of this paper, further details can be found by following the definitive references given.

- The Drift Table (2004) displays slowly moving aerial photography controlled by the distribution of weight on its surface [18].
- The History Tablecloth (2006) is screen-printed with electroluminescent material forming a grid of lace-like elements so that when objects are left on the table, cells beneath them form a halo that grows over a period of hours, highlighting the flow of objects in the home [19].
- The Key Table (2006) is a surface sensitive to the impact with which objects are placed upon it, the greater the impact the more a picture tilts on a wall close by [32].
- The Home Health Horoscope (2007) and Home Health Monitor (2009) combine data from several sensors to depict the 'health' of a home, which is then output in the form of a horoscope or short aphorisms [20, 21].
- The Local Barometer (2008) displays online text and images related to the home's locality depending on the local wind conditions to give an impression of the sociocultural surroundings [17].
- The Plane Tracker (2008) tracks aircraft passing overhead and imagines their flights onscreen to resource an understanding of the home's global links [17].
- The Prayer Companion (2010), designed to resource the spiritual activity of a group of cloistered nuns, displays a stream of information sourced from news feeds and social networking sites to suggest topics for prayers [15].
- The Photostroller (2011), designed for a residential home of older people, shows a continuous slideshow of photographs using a set of predefined categories modified by a tuneable degree of 'semantic drift' [16].

### ELABORATING THE CONCEPT OF AN ANNOTATED PORTFOLIO

In this section, I elaborate a meaning for 'annotated portfolio' in terms of seven features (constitution, relationships, communication, perspective, mutual informing, shaping and materiality). These features are not to be read as ordered in importance but rather as jointly working to give an intended sense which should show how

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'authority' is claimed on this basis. The analyses I offer here are based on, and criticisable against, existing published accounts in the literature and the artefacts themselves. While it can be argued that this moderates my 'distance', let me emphasise again that my primary purpose is to exemplify an annotated portfolio, not celebrate the Studio's work. Dealing with work I know well is sensible from this point of view. Extending the work to other studios is naturally a next step beyond this paper (also see Gaver's [12] analysis of Dieter Rams' design work).

the notion of an annotated portfolio can be put to use in RtD in HCI. An extended worked example using the Goldsmiths Interaction Research Studio's collection is in the next main section following this one. To ease presentation let me give a single sentence formulation for each feature of 'annotated portfolios' immediately.

### Overview

- Annotations make a collection of designed artefacts into a portfolio. They bring together individual artefacts as a systematic body of work.
- Annotations capture family resemblances between designs in a mesh of similarities and differences.
- Annotations communicate the nature of the portfolio and enable its comparison with others.
- Typically a portfolio can be annotated in several different ways reflecting different purposes and interests and with different audiences in mind.
- Annotations and the designs they annotate are mutually informing. Artefacts are illuminated by annotations. Annotations are illustrated by artefacts.
- Annotations can shape how artefacts are used, how they might be appreciated and understood, and what scientific and aesthetic value artefacts can have, as well as suggesting future research and design possibilities.
- Any material form can be considered for an annotated portfolio including an illustrated monograph, a scientific paper, a curated exhibition and so forth.

### Constitution

Annotations make a collection into a portfolio. A collection might be from a single designer, project or studio, though it need not be. Portfolios are typically more than just a collection of works. Works are organised, categorised and otherwise arranged in their presentation to have or illustrate a point, or several points, and through doing this to reveal or make clear something of the design identities in the work and the nature of the contribution being made. Annotations are a major resource for creating a portfolio. Works do not speak for themselves. They are annotated so as to show how they fit into a portfolio of related endeavour.

For example, I analyse many of the artefacts of the Goldsmiths Interaction Research Studio in terms of the annotation *multiple outcomes through minimal methods* to highlight how typically very simple interaction methods are employed which, nevertheless, can give rise to quite varied behaviour (for details, see next main section). This is not a unifying point which appears in any of the published papers I have just cited (as they tend to focus on just one artefact at a time, telling the story of its motivation, making and use) but it expresses a common feature in the portfolio and contributes to the identity of the Studio's work.

### Relationships

Annotations capture family resemblances between designs. In a portfolio, different works have a resemblance to one another but it need not be the case that one single feature

has to run through all works in a portfolio. It might be the case, but it need not be. Wittgenstein [36] made this point about our ordinary language categories, writing especially about ‘tools’ and ‘games’. It is not the case, Wittgenstein claimed, that all games or tools share a single feature that could serve as a definition and delimitation of the category. Rather, on this view, our natural language categories are organised according to features of family resemblance much as we can see that different family members have a resemblance to each other. A portfolio of designs can be thought of similarly. I do not expect all artefacts in a portfolio to share any particular defining and delimiting feature. I expect rather a distribution of features of similarity and difference across the portfolio which enables us to characterise the place and identity of the works within it. This work may be related to that one by virtue of them sharing this feature but be different from this third one in terms of another feature. To annotate a portfolio is to chart the similarities and differences between works so as to give the portfolio its (familial) identity.

For example, I argue that many of the artefacts in the Interaction Research Studio’s portfolio can be analysed in terms of the annotation *autonomous and user-driven behaviour combined*. That is, the artefacts often have their own behaviour even if unsupervised and yet a user can typically intervene and direct things more attentively. This is true to how the Drift Table, History Tablecloth and PhotoStroller work, for example, but it is less apposite to the Home Health systems which have a regular output at a time of day which is fixed or to the Plane Tracker whose behaviour is set by planes not people.

### Communication

Annotations communicate the nature of the portfolio and enable its comparison with others. Portfolios are annotated so as to communicate them. Annotations can be seen as answers to the question: what is this portfolio like? asked by someone unfamiliar with it. In addition to doing justice to the collection of work making up the portfolio by providing a characterisation of the family resemblances expressed in it, annotations have a complementary ‘outward-looking’ aspect. The inner-organisation of the portfolio is annotated to make it communicable to other people (researchers, designers, users, whoever). Effective annotation will also enable comparative work. This portfolio can be compared with that one by means of how they have both been annotated.

### Perspective

Typically a portfolio can be annotated in several different ways reflecting different purposes and interests. This follows very closely from the last point. We communicate things with our audiences in mind, a phenomenon Goffman [24] called recipient design. If our audiences vary, it is natural that we would vary how we would communicate a portfolio through annotation and also what we would select

for inclusion. How we assemble and annotate a portfolio will be variable in terms of our interests and purposes, as well as in terms of the understood or expressed interests and purposes of those we are communicating with.

For example, in the next main section, I focus on annotating the Goldsmiths Studio’s portfolio to highlight interaction design affairs. But this is not the only way in which these artefacts could be, of indeed have been, annotated. The Prayer Companion was published at least in part as a contribution to HCI’s concern for spirituality and computing for older people, the latter concern shared with the PhotoStroller. The Plane Tracker and Local Barometer were characterised in their original publication as ‘threshold devices’ enabling linkage between home and the local surroundings. Very commonly the Studio connects its work to larger agendas of ludic design or design for ambiguity. Much of the work concerns devices intended for domestic settings and it would be entirely possible to annotate the collection as a portfolio of ‘designs for domestic computing’. Each of these would be valid perspectives, each with different audiences and impacts in mind.

### Mutual Informing

Annotations have an indexical relationship to the artefacts they are relevant to. Annotations depend on traceable connections to design for their significance, just as designs are illuminated through annotation. Annotations and the designs they annotate are mutually informing. One cannot fully understand one without the other, or at least not as a contribution to *this* portfolio, constituted *this* way. To understand an annotation one must be able to trace back its connection to actual concrete works. Reciprocally, to understand or appreciate the works in this portfolio, one needs to see how they have been annotated. This is not to say that works cannot be understood under different auspices. I have already said that will occur as interests and purposes vary. Rather the point is that works and annotations have a mutual dependence within a portfolio. To put this point another way, if an annotation seems unclear or is in some way challenged, one can get back to the design very readily. The artefact is at-hand to make sense of the annotation. Reciprocally, if the identity or purpose of an artefact is unclear, annotations are at-hand to give the design a point and a place within the portfolio.

For example, the annotation *multiple outcomes through minimal methods* only really gains its sense if one looks at the artefacts in the portfolio it is true of – nearly all of them in one way or another. The Drift Table is true to this in a different way from how the PhotoStroller is. Equally, the annotation *autonomous and user-driven behaviour combined* is just an abstraction without seeing how it fits with and is embodied in the portfolio, for example, through some kind of behavioural ‘drift’ that the user can intervene upon (Drift Table and PhotoStroller) or through a process with an interruptible time-course (e.g. how illumination spreads on the History Tablecloth).

### Shaping

Annotations can configure use, appreciation, aesthetics, and scientific value, as well as suggesting future research and design possibilities. An annotated portfolio is a pragmatic thing. It is not an abstractly organised collection of work. I have already said that how we annotate and how we select works for inclusion in a portfolio reflects interests and purposes. Interests and purposes are future-looking. They shape what we can expect people to do with designs (questions of use and usability), how they will appreciate and value designs (questions of aesthetics), and what knowledge we can expect to derive from all this (questions of science, broadly construed). Annotated portfolios are proposed as a major way in which RtD might cash out its value for the communities we typically engage with (users, designers, scientists, but there are others of course). Annotated portfolios do, on this view, much of the work traditionally expected of ‘theory’ – a topic that will be returned to at the end of this paper.

### Materiality

What material form should an annotated portfolio take? I have remarked that annotations are mindful of the identities and concerns of particular audiences. From this point of view, it seems reasonable that an annotated portfolio could be materialised in a variety of ways depending on the audience one has in mind, the resources available, and the dissemination channels that seem appropriate. An academic paper might provide the right form for annotations. This is, of course, a traditional way to communicate with academic researchers. Alternatively, a set of annotated photographs edited into a monograph with an introductory essay might situate the portfolio more appropriately for some design audiences. An exhibition might be organised as a kind of annotated portfolio. Indeed, much of the job of exhibition curation can be compared to the work of annotating a portfolio so as to bring out thematic relationships within a body of work. So, naturally and reciprocally, an exhibition (and its catalogue and any other tie-in events) can be thought to do annotation-work. While this paper sketches an annotated portfolio as part of its textual academic business, I think it unwise to say that an annotated portfolio has to be materialised this, or any other, specific way. For annotations which are more visually organised, see [22]. As long as the principles articulated above (relationships, communication, mutual informing and the rest) are attended to, any material form can be considered, from documents to dramaturgy, from SQL to light opera.

### A WORKED EXAMPLE: ANNOTATING THE WORK OF THE GOLDSMITHS INTERACTION RESEARCH STUDIO

In this section, I work through the Goldsmiths Interaction Research Studio’s collection and sketch an annotated portfolio in terms of what I call the *interactional qualities* which are embodied in the designs. This focuses on, and analyses out under eight themes, the kinds of interaction and engagement that the designs foster. It is a way of

annotating the portfolio which highlights interaction design issues which have not before been collated in the one place, and provides simple phrases to encapsulate the Studio’s preferred style. As such, this can serve (in part) as a brief review of the work of the Studio over the last ten years or so – only partially, of course, as only one perspective (what I am calling interactional qualities) is being highlighted here. As remarked already, the same collection could be annotated in a number of other suggestive ways to create differently organised portfolios: as ‘domestic computing’, as ‘ludic design’, as ‘threshold devices’ (e.g. the Prayer Companion and Photostroller could be added in to a threshold device portfolio, see also [22]). I am highlighting the interactional qualities in the collection as, first, I think the work has a characteristic contribution to make to interaction design which has not been fully articulated to date and, secondly, this is a good way of demonstrating the relevance of creating an annotated portfolio to broader HCI concerns. Most of the points I make can be warranted by reference to the ethnographic research conducted by members of the Studio during the trials the artefacts partook in, though spelling that out would take me beyond the space I have. Again to ease presentation, let me immediately list the interactional qualities I annotate the portfolio with before explicating each in turn.

### Overview

- Multiple outcomes through minimal methods
- Autonomous and user-driven behaviour combined
- Pacings and temporal layering
- Edge of control
- The path and the destination
- Physicality
- Juxtaposition and interfacing
- Interpretation and appropriation

### Multiple Outcomes Through Minimal Methods

All of the artefacts in the portfolio require little of their users by way of acquiring a repertoire of specific interaction methods. The Drift Table, History Tablecloth and Key Table involve moving or positioning everyday objects. The Photostroller works with a simple controller to select photo category from six options and then a degree of semantic drift around that selection. The Local Barometer, Plane Tracker, Prayer Companion and both the Home Health systems support little (or no) manipulation of a traditional interaction design sort. They pick up on the user’s environment or surroundings autonomously, with users viewing and interpreting the results given. The intention, though, is that out of what little can be done many different kinds of outcomes or behaviours can still be observed. For example, a range of emergent patterns can occur with the History Tablecloth, some of which were scarcely explicable to the designers. The Drift Table is put to many and varied uses as different trips are planned. The Prayer Companion, Photostroller, Local Barometer and Plane Tracker gain through the richness of the worlds

(news, photography, local adverts, plane data) they open out onto. Remember this annotation helps create a family resemblance amongst artefacts in the portfolio. It is not equally true of every one of them. The Key Table, for example, is rather ‘thin’ in its outcomes (a varying degree of tilt to a picture).

### **Autonomous and User-Driven Behaviour Combined**

The artefacts typically have an autonomous behaviour. They do things when users do not attend to them or interact with them. The Drift Table and the Photostroller manifest different kinds of ‘drift’. The History Tablecloth spreads its patterns of illumination after an object is placed on the table and slowly darkens when an object is removed. In each of these cases, when a user attends to the artefacts and engages with them, this has the character of an *intervention* or a *shaping* of the autonomous behaviour. It does not have the character of a supervision over, or a defeating of, autonomous behaviour. That is, users do not do radically different things than what the system is working with anyway. In the Drift Table and History Tablecloth, the user shifts weight around (the system is used to weight). In the Photostroller, the user shapes the semantic drift which the system is otherwise doing of its own accord.

### **Pacings and Temporal Layering**

The designs tend to favour a slow paced unfolding of what they have to show. The Drift Table drifts *slowly* over aerial photography. The History Tablecloth *slowly* changes its pattern of illumination. In other cases, displays are adjusted to a comfortable reading or viewing speed, one much slower than a faster browsing or searching speed (see Local Barometer, Prayer Companion, Photostroller) with content often being looped or otherwise repeated (the Plane Tracker loops the flight of the last detected plane until a new one is picked up). Generally, forms of engagement such as ‘browsing’ or ‘skimming’ are not available. A slow and system-imposed ‘reading pace’ is required. Sometimes this means that abrupt changes when they do occur are significant and noticeable. For example, when the Plane Tracker detects a new flight overhead, the view on screen changes to where the plane set out from and the small globe inset next to the screen audibly whirrs round. This quality sometimes works with the above point: autonomous behaviour can be slow and gentle while user-driven interventions are intended to be striking.

The designs can also manifest something that can be characterised as *temporal layering*. The artefacts are sometimes sensitive to multiple timescales. The Plane Tracker, for example, behaves differently at different times of day, of week, of year and under different weather conditions. The Local Barometer also has a sensitivity to weather conditions. The Prayer Companion was explicitly ‘choreographed’ to show a variety of temporal behaviours. Items can be shown fast or slow with varying degrees of repetition. This choreography is implemented in terms of

layering different timescales, e.g. how frequently items are shown, how frequently item selection and display criteria change, how frequently the whole corpus of items available to the Prayer Companion updates.

### **Edge of Control**

Rarely is there anything random or aleatoric in the designs. The algorithms in the weight-responsive designs (Drift Table, History Tablecloth, Key Table) are deterministic. The Plane Tracker doesn’t make a random decision between planes it knows about. The sourcing programs in the Photostroller which collect images from the web are deterministic. However, the worlds over which these computations take place are frequently changing. New images and news items are always appearing on the web giving unpredictability to the Prayer Companion and Photostroller. The wind direction is always changing giving unpredictability to the Local Barometer. Indoor environmental conditions are in flux giving unpredictability to the Home Health systems. Alternatively, the world the artefacts deal with is adequately complex so that small changes in initial conditions can lead to big changes in outcome, lending unpredictability to the Drift Table and History Tablecloth. This means that interaction is often a matter of steering at the edge of control. Sometimes users can get what they want but if so they may have to work at it. Again, this is a feature which forms part of the family resemblances within the portfolio, as some of the systems do not admit of any form of steering from users.

### **The Path And The Destination**

Relatedly, it’s sometimes the work of getting to the outcomes which is the point, not necessarily (or not just) the outcomes themselves. What a user sees along the way in the Drift Table or Plane Tracker and how emergent patterns change in the History Tablecloth are as important, if not more so, than the achievement of any explicitly defined ‘goal state’. Throughout the collection, there is little in the way of support for explicit goal-directed searching. In the Drift Table and Plane Tracker, it is not possible to input a place and get teleported to it. It is not possible to get the Prayer Companion to search for specific news items or for the Local Barometer to get adverts of a specific type. While the Photostroller supports the selection of broad categories of image, this is nothing like an image search facility. Instead, it is setting a starting point for a semantic drift process which can take you far away from what you have on the dial-controller.

### **Physicality**

The artefacts often work with a physical world which is made detectable at the interaction surface or within sensor range. Only the Photostroller and Prayer Companion with their sourcing of content from the web are exceptions to this. Physical manipulations are often supported (shifting weights) or physical phenomena (planes going past, the wind blowing, domestic environmental changes) are

detected or transduced to drive the artefacts. Physical features of the world at and beyond the surface/sensor range can then become relevant to the overall behaviour of the design. If the weather closes Heathrow airport, then the Plane Tracker will show no new activity. The artefacts have also been designed with traditional affordance concerns in mind. Many of the designs have a recognisable physical form (e.g. as tables or TV-like displays or cruciform shapes) and relate to what that will afford or provoke.

### Juxtaposition and Interfacing

The designs often contain multiple elements which can serve as different ‘interaction loci’. The Key Table comprises a table and a picture. The Local Barometer has multiple small displays and the Home Health systems multiple sensor units distributed around the home. The Drift Table has a viewport through which the aerial photography is shown and a small LED display showing the name of the approximate location. The systems also encourage the use of other resources in coordination with whatever the systems provide (atlases, maps, newspapers, websites and so forth). This means that we are dealing with varied shifting configurations when considering how interaction takes place. The designs do not so much present a unitary interface at which interaction occurs as providing an occasion for *interfacing* between multiple resources.

### Interpretation and Appropriation

It is intended that the designs are not clearly for any one particular thing that could serve as their sole ‘function’. Rather, they are available for interpretation and appropriation in varied ways. The varied character of the configurations they are part of, the varieties of behaviour they are capable of, their openness to the physical world, indeed *all* of the above qualities perhaps contribute to this. Gaver and colleagues have repeatedly argued that it is desirable to explore designs which are open-ended and amenable to a variety of interpretations and uses. The analysis I have given, in terms of the interactional qualities the portfolio exhibits, makes it possible to unpack this interest in interpretation and variable appropriation *as an interaction design concern*. It is the interactional qualities I have analysed out, I would claim, that make it possible to do the interpretation/appropriation work the designers desire, at least with these artefacts. The artefacts are ‘non-teleological’ in many respects (i.e. they do not gain their sense from a particular purpose or single trajectory towards achieving that purpose) but this typically doesn’t seem to make them uninteresting or useless. To the extent that users are able to engage with the interactional qualities that the portfolio embodies, they seem to find usefulness, pleasure and aesthetic value in the artefacts.

### The Added Value of Annotated Portfolios

I have worked through a collection of artefacts created by the Goldsmiths Interaction Research Studio so as to characterise it as a portfolio of work annotated through a

series of interactional qualities. Doing this is not a mere taxonomic or classificatory exercise as it involves an analysis of what the designs are offering from an interaction design point of view. While this analysis takes as its starting point the descriptions and evaluations of the artefacts as already published, I think the exercise demonstrates some instructive added value for how we can appraise this body of work. Let me sketch a few points.

- The annotations give a characterisation of the design style of the Studio from an interaction design point of view, something which is not gained in its entirety from looking at the collection through existing publications. This design style is something which could well inspire or serve as a reference point for future design work.
- The previous sub-section suggests that the annotations give content to proposals [e.g. in 32] that we should design for interpretation and appropriation. The annotations should not be read as a recipe for creating successful systems but they do point to interaction design affairs which have been negotiated in the portfolio in instructive ways. Again, these negotiations may be a source of inspiration or guidance for future design work.
- The annotations provide critical points of contact with other tendencies in HCI at large. For example, the style of interaction in the portfolio has an identity which is different from orientations to HCI such as software agents, direct manipulation, ambient computing, emotional computing and many other tendencies both fashionable and traditional. Analysing this out in terms of separate annotations would enable these comparisons to be made in a detailed and grounded point-by-point way.
- Not all of the designs I have discussed are presented by Gaver and colleagues as success stories. Notably, the Home Health systems were evaluated explicitly as ‘failures’ [20] and the Key Table was not found to provoke multiple interpretations in the manner intended [32]. It is worth noting that these designs seem to be less well incorporated into the portfolio than others. Their outcomes are rather simplistic. They do not integrate autonomous system behaviour with user-intervention. They do not offer interactive ‘steerage’. They do not offer interesting ‘paths’ just, it turns out, uninteresting ‘destinations’. While they are open to the physicality of the world, they tend to reduce it in a trivialising manner. While I will warn again against taking the interactional qualities I list as a recipe for successful design, they may help us understand what *tends to* work better in *this* portfolio annotated *this* way.

### CONCLUSION

Having situated Research Through Design (RtD) as a characteristic contribution to Third Wave HCI, this paper has noted the disciplinary anxieties [8] that this research tendency has given rise to. A number of contributions urging a greater concern for rigour and relevance in design

thinking were discussed. Extending Gaver's [12] use of the Philosophy of Science in addressing these issues, it was argued, following Feyerabend [9], that we should be cautious about applying any rationality for RtD beyond its limitations. Instead, it was suggested that an approach to communicating the value of design thinking which is self-conscious of its limited rationality should be explored.

The concept of an annotated portfolio was offered as a way of organising what can be learned from design in terms of annotations which formulate and highlight features of interest in a portfolio, while reciprocally gaining their sense and significance from their connection to the artefacts themselves. Annotations were characterised as indexically connected to artefacts, while connoting topics of broader interest to whatever the intended audience might be. A set of annotations was deemed to make family resemblances within a portfolio visible and enable the communication of a body of work and elucidate its research, and other, values. This was exemplified by analysing the collection of work associated with the Goldsmiths Interaction Research Studio as an annotated portfolio. So doing enabled new insights into that body of work and its situation in HCI, thereby suggesting the general utility of the annotated portfolio concept as an analytic tool for HCI.

An annotated portfolio has a *self-conscious logic of limited rationality*. Any particular set of annotations is perspectival, allowing other annotations to be made. Annotations allow family resemblances to be reasoned about, rather than deductions made. Annotations help us understand what has made a body of work characterful. This may help us understand its successes and failings and inspire future work, though naturally there are no simple recipes.

It is moot whether we would want to see a particular annotated portfolio as a contribution to 'theory'. Annotations have weak explanatory and predictive power and tend to be local to a particular portfolio of work. This is a (welcome) feature of their limited rationality. It may be possible to inductively build some kind of design theory for HCI on the basis of multiple interlocking annotated portfolios but this would look rather different from the kinds of abstract generalities about design which commonly pass as Design Methods [26], or Pattern Languages [1], or design manifestos, or the models for design in HCI offered by [37] amongst others.

Annotated portfolios relate to past occurrences and future possibility in a different fashion than that suggested by the notions of explanation and prediction commonly discussed regarding theory. Annotated portfolios are *descriptive* (of past occurrences) and intended to be *generative-inspirational* (of future possibility) with their primary business constituting a portfolio in close contact to the existing 'ultimate particulars' [12, 33] of design – the actual artefacts themselves. This dual of descriptive/generative is, perhaps, a more truthful designerly orientation to past/future than explanatory/predictive.

However, annotated portfolios may well do some of the work that 'theory' is often invoked to do including addressing criteria of rigour and relevance [8]. One does not *necessarily* need the concepts of an overarching theory to be able to describe the world with clarity and rigour, nor is a (explanatory, predictive) theory *necessarily* required to make one's work relevant to the concerns of users or researchers or anyone else. Similarly, it should not be thought that being loyal to ultimate particulars *necessarily* means we have to make enemies of generality. Annotated portfolios are, perhaps, a way of modestly and speculatively reaching out beyond the particular without losing attachment. No more or less limited rationality is claimed for here. But this might be enough to provide the generative, suggestive, provisional, inspirational and aspirational qualities Gaver looks for in design theory [12] as well as giving a more positive outline than Frayling [11] himself provides for what else (other than artefacts which covertly embody design thinking) can be found in the outcomes of RtD.

The concept of annotated portfolios joins other approaches to advancing the value of RtD in an open, summative fashion. For example, annotated portfolios have some features in common with [25]'s concern for 'practically resonating' 'ideal-type' theories in design. Similarly, Löwgren [29] advocates, with due acknowledgment to Alexander [1], 'inspirational-patterns' in which "the core idea, the recurring and perhaps essential elements of a specific example or class of examples... are somewhat abstracted and purified". Careful comparison requires much more detailed discussion than there is space for here. But a potential key difference between these approaches and annotated portfolios seems to be over the kind of *abstraction* seen to be necessary to design theory or to communicating the upshots of design work. Annotated portfolios insist on the indexical ties between texts about designs and the designs themselves. Annotations and actual artefacts are seen as mutually explicating and illuminating. In this sense, *annotations are not abstractions* as they cannot be 'dragged away from' the particularities of actual artefacts (abstraction deriving from the Latin *abtraho* meaning 'I drag away'). They retain their attachment.

As a final remark, concepts doing work like annotated portfolios might offer ways of realistically relieving the disciplinary anxieties of which Fallman and Stolterman [8] speak. As [7] argued nearly 20 years ago, HCI is often marked by harsh inter- and intra-disciplinary critique as different constructions of the subject of research and criteria for adequacy are pitted against each other. Latour [27] goes so far as to castigate critique as having a 'barbarity' and Gaver [12] is suspicious of the potentially coercive disciplinary politics behind attempts to normalise design research through a more 'scientific' construal of what HCI should be about. The approach suggested in the current paper is of a modest reformation of RtD in HCI that builds upon existing styles of design thinking and practice, that

sees no shame in producing an endless stream of design examples, and that appreciates its own limitations of rationality and requests no more or less from others.

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## REFERENCES

- Alexander C, Ishikawa S (1977). *A pattern language: towns, buildings, construction*. Oxford University Press.
- Bardzell, J. and Bardzell, S. (2011). Pleasure is your birthright: digitally enabled designer sex toys as a case of third-wave HCI. Proc. CHI '11. ACM, New York, NY, USA, 257-266.
- Barthes, R. (1977) *Image, Music, Text*. "The Photographic Message." Ed. and trans. S. Heath. New York: Hill. 15-31.
- Bødker, S. (2006). When second wave HCI meets third wave challenges. Proc. NordiCHI '06. ACM, New York, USA, 1-8.
- Carroll, J. and Kellogg, W. (1989). Artifact as theory-nexus: hermeneutics meets theory-based design. SIGCHI Bull. 20, SI (March), 7-14.
- Collins, H. (1985) *Changing Order. Replication and Induction in Scientific Practice*. Chicago: University of Chicago Press.
- Cooper, G. and Bowers, J., (1995). Representing the user. In Thomas, P. (ed.), *The social and interactional dimensions of human-computer interfaces*. New York: CUP.
- Fallman, D. and Stolterman, E. (2010). Establishing criteria of rigour and relevance in interaction design research. *Digital Creativity*, 21 (4), 265-272.
- Feyerabend, P. (1975). *Against Method*. New York, NY: Verso Books.
- Forlizzi, J., DiSalvo, C., Bardzell, J., Koskinen, I. and Wensveen, S. (2011). Quality control: a panel on the critique and criticism of design research. Proc. CHI EA '11. ACM, New York, NY, USA, 823-826.
- Frayling, C. *Research in Art and Design*. Royal College of Art Research Papers 1, 1 (1993), 1-5.
- Gaver, W. (2012). What Should We Expect From Research Through Design? To appear in Proc. CHI '12. ACM, New York, NY, USA.
- Gaver, W., (2009). Designing for Homo Ludens, Still. In (Re)searching the Digital Bauhaus. Binder, T., Löwgren, J., and Malmberg, L. (eds.). London: Springer, pp. 163-178.
- Gaver, W., Beaver, J., and Benford, S. (2003). Ambiguity as a resource for design. Proc. CHI'03, Ft. Lauderdale. New York: ACM Press.
- Gaver, W., Blythe, M., Boucher, A., Jarvis, N., Bowers, J. and Wright, P. (2010). The prayer companion: openness and specificity, materiality and spirituality. Proc. CHI '10. ACM, New York, NY, USA, 2055-2064.
- Gaver, W., Boucher, A., Bowers, J., Blythe, M., Jarvis, N., Cameron, D., Kerridge, T., Wilkie, A., Phillips, R. and Wright, P. (2011). The photostroller: supporting diverse care home residents in engaging with the world. Proc. CHI '11. ACM, New York, NY, USA, 1757-1766.
- Gaver, W., Boucher, A., Law, A., Pennington, S., Bowers, J., Beaver, J., Humble, J., Kerridge, T., Villar, N., & Wilkie, A. Threshold devices. Proc. CHI'08, 2008, 1429-1438.
- Gaver, W., Bowers, J., Boucher, A., Gellerson, H., Pennington, S., Schmidt, A., Steed, A., Villars, N., & Walker, B. (2004). The Drift Table: Designing for ludic engagement. Proc. CHI'04 Design Expo. New York: ACM Press, 885-900.
- Gaver, W., Bowers, J., Boucher, A., Law, A., Pennington, S. and Villar, N. (2006). The history tablecloth: illuminating domestic activity. Proc. DIS '06. ACM, New York, NY, USA, 199-208.
- Gaver, W., Bowers, J., Kerridge, T., Boucher, A. and Jarvis, N. (2009). Anatomy of a failure: how we knew when our design went wrong, and what we learned from it. Proc. CHI '09. ACM, New York, USA, 2213-2222.
- Gaver, W., Sengers, P., Kerridge, T., Kaye, J., and Bowers, J. (2007). Enhancing ubiquitous computing with user interpretation: field testing the home health horoscope. Proc. CHI '07 ACM 537-546.
- Gaver W. and Bowers, J. (in press 2012). Annotated Portfolios. To appear in *Interactions*.
- Giller, V., Tscheligi, M., Sefelin, R., Mäkelä, A., Puskala, A., and Karvonen, K. Maypole highlights: Image makers. *Interactions*, 6, 6 (1999), 12-15.
- Goffman, E. (1967). *Interaction Ritual. Essays in Face-to-Face Interaction*, Chicago. Aldine.
- Goodman E, Stolterman E, and Wakkary R (2012) Understanding interaction design practices. Proc. CHI'11 1061-1070.
- Jones, J. C. (1970). *Design Methods: seeds of human futures*. John Wiley & Sons Ltd., London,.
- Latour, B. (2004). Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern. *Critical Inquiry*, 30 (Winter), 225-248.
- Law, J. (1987). Technology, closure and heterogeneous engineering: the case of the Portuguese expansion. In Bijker, W.E., Hughes, T.P. and Pinch T.J. (eds), *The Social Construction of Technological Systems*. MIT Press.
- Löwgren J. (2007). Inspirational Patterns for Embodied Interaction. *Knowledge, Technology and Policy*, 20, 165-177.
- Schoen, D. (1983). *The reflective practitioner, how professionals think*. New York, Basic Books.
- Sengers P, Boehner K, David S, and Kaye J. (2005). Reflective design. Proc. AARHUS'05, 49 - 58. 24
- Sengers, P. and Gaver, W. Staying open to interpretation: Engaging multiple meanings in design and evaluation. Proc. DIS06, (2006) pp. 99-108.
- Stolterman, E. (2008). The nature of design practice and implications for interaction design research. *International Journal of Design* 2(1), 55 - 65.
- Weiser, M. The computer for the 21st Century. *Scientific American*, 265.3, (1991), 94-104.
- Wensveen, S. A. G., Djajadiningrat, J. P. and Overbeeke, C. J. Interaction Frogger: A Design Framework to Couple Action and Function through Feedback and Feedforward. In *Proceedings of DIS, (2004) ACM Press*, 177-184.
- Wittgenstein, L. (1953). *Philosophical Investigations*. Oxford: Blackwell Publishing
- Zimmerman J, Forlizzi J, and Evenson, S. (2007). Research through design as a method for interaction design research in HCI. Proc. CHI'07 493-502.
- Zimmerman J, Stolterman E, and Forlizzi J (2010). An analysis and critique of research through design: toward a formalization of a research approach. *DIS 2010*, 310-319.