Waves: Exploring Idiographic Design for Live Performance

Jonathan Hook, John McCarthy*, Peter Wright, Patrick Olivier

Culture Lab
School of Computing Science
Newcastle University, UK
{j.d.hook, p.c.wright, patrick.olivier}@ncl.ac.uk

*People and Technology
Department of Applied Psychology
University College Cork, Ireland
john.mccarthy@ucc.ie

ABSTRACT

We explore whether idiographic design, a category of interaction design that focuses upon responding to detailed personal accounts of individuals' practices, can be used to support interaction designers in responding to the complex and multifaceted design space posed by live performance. We describe and reflect upon the application of an idiographic approach during the design of Waves, an interface for live VJ performance. This approach involved a close and dialogical engagement with the practices and experiences of an individual live performer, during a series of semi-structured interviews and then the discussion and iteration of an evolving prototypical design. Reflection on the experience of applying this approach highlights idiographic design as a practical means to support interaction designers in proposing innovative designs that respond sensitively to the kinds of subtle and complex issues that underpin people's lived and felt experiences of live performance and, potentially, many other domains.

Author Keywords

Experience-centered design; idiographic design; interaction design; liveness; live performance; multi-touch; VJing.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Live performance remains an important activity in our society and culture. Performances such as music, theatre, stand-up comedy and dance continue to attract large audiences, while notions of liveness, performativity and interactivity have become common values of contemporary arts practices. Furthermore, the erosion of the traditional revenue streams of performers due to the advent of easily and infinitely replicable digital media is set to make live performance an increasingly prevalent form of expression, as artists seek alternative sources of income from their practices. Meanwhile, technology has become a progressively significant aspect of live performance. The advent of new technologies and forms of digital media have

transformed how traditional live performances are presented and consumed [1] and led to the development of emergent performance practices such as laptop music performance [23], VJing (video-jockey) [9] and digital live art [25]. The combination of live performance's growing popularity with the burgeoning role of technology in the domain is set to make live performance an increasingly important concern for interaction designers and researchers.

Designing the interactive technologies that will support and enhance these emergent and evolving practices and experiences of live performance stands out as a particularly complex challenge for interaction designers. Artists' and audiences' experiences of live performances are defined by a plethora of subtle and multifaceted issues that range from the co-presence felt between performers and spectators [10] to the spontaneity [2] and ephemerality [21] of a live show. Furthermore, performers' use of technology in live performance has been found to extend beyond tool use, with interfaces playing a crucial role in supporting and developing the creative and expressive goals of individual live performances and artists' longitudinal practices [12].

If interaction designers are to successfully design interfaces for live performance, it is anticipated that approaches will be required that equip them to engage with, understand and sensitively respond to these kinds of delicate and complex issues [13]. In this paper, we explore whether idiographic design, a category of interaction design that focuses upon responding to detailed personal accounts of individuals' practices, can support designers in understanding and responding to live performance. We describe and reflect upon the use of an idiographic approach during the design of Waves, a multi-touch interface for VJ practice. This idiographic approach involved an in-depth and prolonged engagement with the practice of one individual VJ, initially during a series of semi-structured interviews and then through the iteration of a design response to his practice.

By describing and reflecting on this case study of idiographic design, we show how the approach supported the development of an innovative interface, which responded sensitively to a detailed account of one live performer's practice. Furthermore, we show how the approach's individual focus facilitated a strong empathic and dialogical relationship between designer and performer that supported a deeper understanding of live performance. Consequently, we argue that idiographic design offers a way to avoid the abstraction and codification of experience

that often arises when attempting to design in response to a more general picture of the subtle and complex issues that underpin domains like live performance.

IDIOGRAPHIC DESIGN

We use the term idiographic design to refer to interaction design that draws insight from the detailed and particular consideration of individuals' practices and experiences. The approach is derived from idiographic research methods, which are used in the humanities and social sciences to understand in-depth the particular qualities of an individual or single case and typically involve extended interviews with, or observation of, a single person. While idiographic design is not widely adopted amongst the CHI community, a number of examples exist in the literature that highlight how the approach's focus upon the individual can enable the designer to engage in-depth and detailed understandings of practice and experience in design.

Wright, Wallace and McCarthy employed an idiographic approach to the design of digital jewelry, which involved in-depth and prolonged engagement with individual subjects. This approach was found to facilitate empathic engagement with the personal histories of her subjects, which allowed notions of beauty and personal significance to be considered in the proposal of bespoke jewelry pieces [31]. Lindsay et al. adopted an idiographic approach to design for people with dementia, finding that tailoring design to the needs of the individual allowed the designer to engage empathically with people's personal views and experiences during the design of assistive technology [16]. Other idiographic approaches have explored whether "extreme" [11] or "lead" [29] users can provide unique, inspiring and informed perspectives that can guide the design of interfaces for a broader group of users. Finally, a number of case studies of autobiographical design illustrate how an idiographic consideration of one's own practices can offer the designer rich insight into the experience of a domain, for which they have particular expertise or knowledge [5, 20, 24]. This method has been particularly prevalent in design for musical performance [e.g. 14, 28]. The approach explored in this paper differs from autobiographical design, as it seeks to support the designer in responding to another person's practice, while still offering a depth, detail and particularity of insight that is comparable to that found when designing in response to one's own experiences.

Idiographic design differs from more traditional nomothetic approaches to interaction design, which focus upon designing in response to a more general or abstract understanding of the user. It is this difference that would seem to imbue idiographic design with its most beneficial quality: rich and detailed attention to experience as lived and felt through individuals' practices [18]. While nomothetic approaches to interaction design are useful in many settings, questions have been raised about their appropriateness in contexts such as live performance, where the success of a design might depend on the designer's ability to engage with subtle and complex aspects of people's lived experiences. Sengers [24] argues that attempts to base design upon objective and formal accounts of practices might result in designs that disregard the inherently idiosyncratic qualities that underpin people's experiences of interaction; therefore, resulting in designs that fail to "enrich our everyday quality of experience". Furthermore, Boehner, Sengers and Warner [5] argue that the ineffable qualities of experience are defined through and are hence inseparable from their instantiation in individuals' lived experiences. They contended, therefore, that approaches to design based upon the "codification and generalization" of people's experience will not allow a designer to engage the kinds of personal and tacit knowledge that might be definitive of artists and audiences' experiences of live performance.

We hypothesize that taking such an idiographic approach to interaction design for live performance will assist designers by allowing them to consider the subtle and complex issues that underpin the domain in the detailed context of an individual's lived and felt experiences and practices, rather than in the abstract. Furthermore, we anticipate that the intimate relationship between the live performer and the design situation afforded by the individual nature of the approach might let the performer become involved in the design process to an extent; therefore, allowing their knowledge and aspirations as a creative practitioner to be used as further design insight.

DESIGNING FOR AN INDIVIDUAL'S PRACTICE

In the remainder of this paper, we describe and reflect upon the application of an idiographic approach during the design of Waves, an interface for VJ practice. This idiographic approach involved a close, design-led engagement between the first author (referred to from here on as the designer) and Andrew (a VJ with over 10 years of professional experience). This design process commenced with three semi-structured interviews. These interviews led to the development of a preliminary understanding of Andrew's practice, which guided and inspired the design of an initial prototypical interface. This design was then further developed in response to Andrew's experiences of incorporating it into his practice and, finally, developing a performance that was presented at a public event.

Each of the initial semi-structured interviews lasted approximately one hour and followed a script that addressed a number of topics uncovered in a previous qualitative study of VJ practice [12]. These topics related to the creative aspirations that guide VJ practice and performance, the effect of particular qualities of interaction techniques and technologies on both performers and audiences' experiences of performance and the importance of a sense of liveness to VJ practice. Using these topics as the starting point for the interviews allowed the designer to broach issues relevant to Andrew's practice and,

consequently, inspired in-depth discussion of how those issues related to his personal experiences of VJing.

In addition to exploring Andrew's existing experiences of VJ practice, it was intended that the interview process would provoke him to reflect upon how design could respond to, and support the future development of, his practice. The interview process was configured in a number of ways to inspire such reflection: questions were focused upon eliciting views about how specific technologies might support and respond to particular issues of VJ practice; a number of visual aids were used (images and videos) to broach discussion of potential design ideas in relation to novel technologies and, finally, a sketchpad and pen was made available to facilitate the quick illustration and development of design concepts.

Analyzing Andrew's Responses

Transcripts of the interviews were analyzed using IPA (interpretive phenomenological analysis). IPA is a particularly suitable method to develop the detailed and idiosyncratic understanding of an individual's practice required of the idiographic approach, as the method specializes in developing an understanding of the experiences of an individual [26]. According to a procedure for IPA set out by Smith [Ibid.], the transcripts were first open coded to highlight excerpts that offered insight into the relationship between the topics of VJ practice discussed in the interviews and Andrew's personal experience of VJing. These codes were then iteratively grouped into a set of themes, which are described in the following sections.

Salient Interaction

Andrew stressed how important it was for the audience to experience his performance as a live occurrence. However, he questioned whether the tools of his current practice – a laptop computer, which runs the commercial VJ software Modul8 – would be supportive of the "audience's ability to recognize and experience [his] action as being live". He expressed an anxiety that in the worst case a member of the audience might ask: "Well, is he doing anything"? By contrast, he imagined the design of tools that might convey a "sense of really controlling". Andrew's concerns are characteristic of the laptop performer problem. Prior research that addresses this problem in VJ practice has proposed that interfaces should be made transparent so that the audience might "see the performer's actions and understand what is happening behind the scene" [15].

Andrew exhibited resistance to the notion of a transparent interface, stating that he did not want the audience to see his practice in "every detail" as he feared this might make his performances too "descriptive and literal". Instead, he imagined the creation of a dynamic, which he compared to that of a "stage magician", where just enough is revealed to allow the audience to grasp how a trick might be done, but enough is hidden to evoke a sense of intrigue and mystique. Similar notions have been proposed under the label of magical interaction "where effects are revealed but the manipulations that caused them are hidden" [22]. However, Andrew's proposal was different as he wished for managed partial obscuration of interaction; whereby a subtle revelation may evoke a sense of enchantment amongst the members of an audience.

Coalescing Interface and Performance

While Andrew resisted notions of literal transparency, he expressed a desire to bring the GUI (graphical user-interface) into the audience's view, so it might become an integral visual element of his performance. Ideas such as the projection of the GUI behind the performer or its replication on a large multi-touch screen were mooted. However, concerns with such approaches related to whether interaction with interfaces composed of knobs, buttons and sliders would be of interest to an audience (as they are "just control") and if exposing the mundane nature of certain aspects of his performance might take away some of "the mystique".

Andrew's concerns pointed to the possibility of having a GUI that could in its very essence (i.e. form, aesthetic and use) be a captivating visual element of a performance in its own right. He imagined an interface that had visual beauty, but also physicality on the part of the operator, analogous to that of a skilled turntablist's manipulation of vinyl records (i.e. a technology-centric interaction that is visually compelling to an audience). Andrew's views, therefore, suggested a form of interaction whereby the GUI is more than simply a means of control, but coalesces into the performance and is experienced as part of its core aesthetic.

Generative Manipulation

Andrew exhibited a desire for an experience of creating visual media live during performance, rather than editing content that was made before. Due to their reliance on pre-rendered video media, Andrew's existing tools primarily supported the latter editing-like interaction, with the ability to apply effects and rearrange video frames. Andrew described how such editing-like interaction restricted the potential for experimentation and improvisation and led to an imbalance between the amount of creative work done before and during performance. Consequently, he felt that the liveness of his performances was diminished and even went as far as suggesting, that if the majority of the creative work was completed before he gets on the stage: "is it not just better to make it into a film"? In response to these concerns, Andrew envisaged forms of interaction that would allow him to feel as if he was "creating the actual visual content bit, the source sample" or "painting from scratch". He suggested that algorithmic generation and direct manipulation of CGI (computer-generated imagery) might be more conducive to interaction during performance that is experienced as an act of creation rather than editing.

The Interface as a Medium

Technologies were said to pose opportunities that inspired new directions in performance and longitudinal practice, while technological limitations were perceived as a

valuable mechanism for guiding and grounding creativity, in the context of the overwhelming space of potential directions that a VJ's performance and practice could take. Furthermore, discussion highlighted the value of the tight feedback loop that arises when complex, precise and high fidelity control is coupled with tools that afford an immediate response. Andrew described the importance of immediate feedback from an action and how this allowed him to "constantly build on something" while experimenting.

Andrew's desire for tools with defined interaction possibilities, which could be explored through a tight feedback loop during performance, was interpreted by the designer as a call for an interface that had properties of McCullough's notion of a "medium", which considers technology as if it were the "material" or "instrumentality" of a craftsperson [19]. McCullough defines a medium in terms of a range of possibilities, which has constraints that guide creativity and a "density" that allows the craftsperson to flow continuously between possibilities during practice, as if they were "coaxing a material". Therefore, Andrew's comments were understood as a desire for interfaces that would allow him to sense and respond to the technical possibilities and limitations posed by his tools and media in a continuous and dialogical manner.

THE DESIGN OF WAVES
In the next stage of the idiographic approach, an interface for VJ practice, Waves, was designed to specifically respond to the issues and design ideas raised in the preceding engagement with Andrew's practice. This design process was conducted in two stages. First, an initial prototypical design was developed by the designer, as a personal response to the idiosyncratic perspective on VJ practice that had been uncovered by the interview sessions and subsequent analysis.

To commence this process, the designer proposed and sketched a number of alternative designs for interfaces that would respond to the understanding of Andrew's practice developed during the interviews. These designs included a gestural interface that would offer literal and hands on control of CGI visuals, an interface that would allow the VJ to manipulate the environment of the nightclub or venue (i.e. lights, sound and audience members' mobile devices) as part of a performance and a semi-transparent multi-touch screen that would afford a direct and visible link between gestural interaction and the underlying media of a performance. Developing and exploring these initial sketches led the designer to conclude that the semi-transparent multi-touch screen would be the most fertile starting point for a design that would meet the needs, and support the creative development, of Andrew's practice.

Subsequently, this design idea was iteratively developed into an initial functional prototype of Waves. During this process the in-depth understanding of Andrew's practice, developed as a result of the idiographic nature of the

interviews, played an essential role in guiding the designer's creative ideation and decision-making. That is to say, choices made at each stage of the process were guided by the designer's in-depth, tacit understanding of how particular design ideas and possibilities would relate to the subject's existing creative practice and its potential future development.

Following the development of the initial prototypical design, Andrew was then invited to experiment with and contribute to the iteration of Waves. The series of functional prototypes developed throughout this process allowed both the designer and Andrew to refine their understandings of how design could and should respond to the issues uncovered by the IPA and feed this further insight into the evolving design.
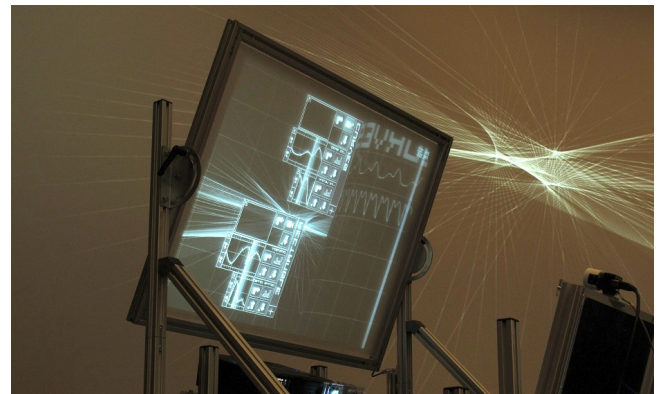

Figure 1: Waves from the perspective of the audience

The Waves design comprises three main elements: a large multi-touch surface, a bespoke GUI and visual content that is projected on a large screen behind the performer (Figure 1). The rear of the multi-touch surface is left open, so the audience can view the performer's manipulations of the GUI. In the following sections, we describe in detail the design of Waves alongside explanations of how aspects of the design, from its hardware form factor to individual interaction techniques, responded to Andrew's practice.

Multi-touch Interactive Surface
The Waves design is based around a large (800 × 600mm) double-sided multi-touch screen, which is mounted in an aluminum frame at a 22.5˚ angle to the vertical for both the performer and audience to view. This multi-touch hardware configuration was a key element of the design response to Andrew's desire for salient interaction. Its large and distinctive form factor, which differs substantially from the laptop computers typically used during VJ performance, was chosen to draw the audience's attention to the performer and, therefore, to amplify his presence on the stage. By designing the screen so that the GUI was visible to the audience, it was hoped that the performer's interactions would be exposed so they might be experienced as a live element of the performance. The multi-touch hardware configuration was vital in this respect as unlike, say, the duplication of the GUI on a large projection screen

the performer's touches are naturally coupled with the interface. Therefore, audience members can observe the direct relationship between gestural interactions and elements of the interface. Furthermore, the striking presence of the large double-sided screen was designed to realize Andrew's desire for a GUI that was not only a controller, but also an element that is experienced as a compelling aspect of his visual performance (i.e. coalescing interface and performance).

Visuals

The visual content (Figure 2) of a Waves performance comprises a set of interactive CGI. The underlying implementation of the visuals as CGI was essential to the design of generative manipulation. The tools for VJ performance that Andrew had experienced in the past were primarily based upon the manipulation of rendered video clips. Ignoring the complexities of compression, video clips are represented in the computer's memory as a grid of pixels, which each store a color value. As these pixels store no semantic information about what is displayed in each frame, manipulation beyond the application of filters or the re-ordering of frames is non-trivial.
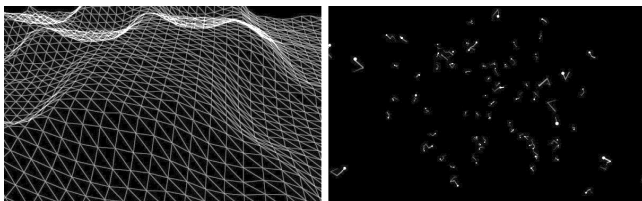

Figure 2: Waves visuals, (left) terrain and (right) particles

In contrast, each CGI visual in Waves is represented as a set of parameters that control how it is rendered, from scratch, in real time. Consequently, the essential semantic information about the contents of the visual is made available for complex manipulation during live performance. In the case of a visual that displays a mesh-like terrain on the screen, these parameters might typically control the transformation of vertices. Additionally, more complex "algorithmically mediated interaction" [7] is made possible by allowing the performer to manipulate the parameters of processes that generate the form of a visual, such as a particle system. By extending the VJ's vocabulary of interactions, to include complex and intricate manipulations of the structure, form and behavior of visuals, it was intended that interaction akin to "creating the actual visual content bit, the source sample" or "painting from scratch", which Andrew stated to be the essence of generative manipulation, would be afforded.

In the current implementation of Waves, the visuals are created in the programming language C++, using the graphics library OpenGL. This programmatic method for creating visuals was chosen in response to Andrew's desire to learn these technologies during the course of the design process. However, the system could be adapted easily to

function with one of the many tools that provide a simpler non-programmatic framework for the composition of CGI.

Graphical User-Interface

The GUI is composed of two main elements: Wave Objects and the Wave Cylinder (Figure 3). These are described in the following sections.
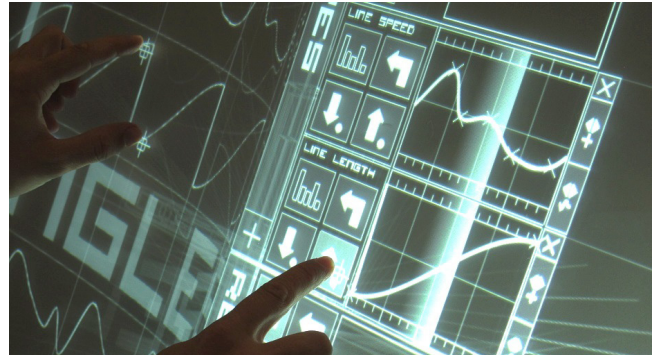

Figure 3: The GUI, with Cylinder (left) and Object (right)

Wave Object

Wave Objects are the basic element of the GUI and each is directly associated with a visual in the performance. A Wave Object is comprised of a number of tracks, which each allow the performer to control a parameter of their associated visual by manipulating a spline curve that represents parameter values over time (where time is plotted in units of musical beats). To change the shape of a curve, the performer holds a finger against it; a control point then appears that may be moved using a dragging gesture. If a single control point is added to the line, the value of the parameter can be controlled in a manner similar to a fader on a mixing desk. However, if multiple control points are added, the curve will smoothly interpolate a set of parameter values.

The aesthetic of interaction with the Waves Object was a key consideration when responding to Andrew's desire for a GUI that was both salient and coalesced into the performance. It was intended that as the audience see the VJ directly manipulating simple spline curve forms, they would be able to grasp that the actions of the performer are having an effect upon the CGI visuals of the performance. In making this connection, it was expected that the audience would draw upon their prior knowledge of curves as mechanisms for representing continuous ranges of values (e.g. line graphs). Furthermore, the complex gestural manipulations of the spline curves were designed to have a beautiful, skillful and fascinating aesthetic that would transition the actions of the VJ from just controlling to being an enthralling display of its own; therefore, further coalescing Andrews' interactions into his performance.

The design of the Waves Object also responded to Andrew's desire for an interface that shares qualities with the continuous and detailed, yet constrained, interaction between craftsman and medium. By directly exposing

parameter values as a malleable form with a shape directly related to the parameters of an underlying visual (i.e. the spline curve), it was intended that a sense of directness of interaction would be afforded, which would enable him to enter into a dialogue whereby the state of parameters are sensed and responded to in a precise and continuous manner. This approach is referred to as data-centric interaction with a medium, as the underlying parametric representation is considered the medium with which interaction occurs, rather than a visual's rendered form.

Wave Cylinder

The Wave Cylinder (Figure 3) is a large rotating column on the left side of the interface. When one or more Wave Objects are dragged onto the cylinder, their spline curves are rendered onto its outer face and their associated visuals are shown on the large screen. The Wave Cylinder was designed to make interaction with the Wave Objects even more salient to the audience, by providing a visible link between the form of the spline curves and the temporally progressive nature of the performance.

Values for each parameter are extracted as the intersection between the spline curve and the play-head, a vertical line that spans the center of the cylinder. In this way, the different parameter values in a pattern are recited at a speed governed by the rotation of the cylinder in beats-per-minute, where one full rotation of the cylinder represents the passage of 64 beats. The smooth rotation of the splines overlaid on the cylinder was designed to contribute to the enchanting and intriguing visual aesthetic of the Waves interface, furthering the level to which it is coalesced into the core visual elements of performance.

Design Iteration and Participation

As functional prototypes of Waves were developed, Andrew was invited to experiment with the design on multiple occasions. The design was found to act as a probe during these meetings, which inspired Andrew to reflect upon the relationship between the design and his practice. As a result, a number of design ideas were proposed during discussions with Andrew, which were then rapidly implemented and presented back to him during subsequent experimentation with the system. Many of these ideas involved the addition of simple features, which supported Andrew's evolving method of working, and eventually performing, with Waves. Examples of these subtle design alterations included the need for cueing functionality, to allow a visual to be previewed on the interface but not on the large projection, and the ability to replicate a pattern of control points when extending the length of a Wave Object's track. Two further substantial changes to the design resulted from Andrew's participation in the design process, which are described in the following sections.

Cataloguing

Andrew expressed a desire to catalogue pre-set spline curve forms (e.g. a sine wave) that could be called upon at specific moments during the course of a performance or in response to an error or unexpected change in music. To support such cataloguing, functionality was added to the Wave Object that allowed Andrew to call upon a range of pre-sets spline curves from a simple menu. These pre-sets could be defined, before or during a performance, by configuring the spline curve to a particular form and pressing a save button.

Tighter Coupling between Audio and Visual

Andrew noted that on occasions he would require a tighter connection between the visuals and the musical soundtrack of a performance, than would be possible by setting patterns in the spline curves alone. To achieve this, Andrew suggested a mechanism whereby particular frequency bands of an audio stream (e.g. from a DJ's mixer) could be mapped to parameter values. As a result, Andrew hoped that he might be able to directly associate elements of a track (e.g. a particular snare drum) with aspects of a visual.

In response to these ideas, an additional mode was added to the Wave Object, whereby a fast Fourier transform was used to divide an audio input signal into a set of frequency bins. A track's spline curve could then be used to set an envelope that defines the frequency ranges to which the parameter responds (Figure 4).
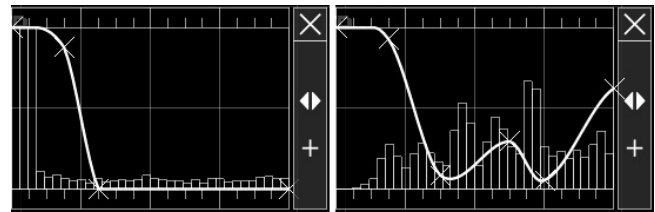
Figure 4: Audio-reactive Wave Objects (left) reacting to bass and (right) reacting to a more complex frequency spectrum

EVALUATING WAVES DURING LIVE PERFORMANCE

In order to explore whether the idiographic design approach had led to a design that sensitively responded to Andrew's practice, we evaluated his experiences of using Waves during the creation and performance of a live show. Over the course of a month, Andrew and another VJ, with whom he often collaborates, created a catalogue of visuals and a soundtrack to accompany them with tracks selected to match the aesthetic of each. During many hours of rehearsal, these elements were brought together to form a 10-minute piece, which was performed by Andrew and his collaborator, alongside a range of other audio-visual performances at a pay-to-enter public event.

As many of the design goals of Waves related to the audience's experience of performance, we conducted a set of semi-structured interviews (approximately 45 minutes) with selected spectators, who had responded to an advert posted to the same email lists that had been used to advertise the event. An interview script was followed that sought to probe each spectator's personal experience of the Waves performance. The spectators, whose names have been anonymized, were Richard (aged 51) a media arts

student, Kate (aged 27) a play therapist and Tom (aged 26) a musician who was also performing at the event. Each was given free entry to the event and two free drinks as compensation for their time.

To elicit Andrew's experiences of creating and delivering a performance using Waves, two semi-structured interviews (approximately 45 minutes each) were conducted with him following the performance. The first interview, which took place in the week following the performance, addressed the general experience of performing with Waves and included questions that sought to uncover the relationship between the design and the aspects of his practice that it was designed in response to. In the second interview, additional questions were posed that attempted to address points raised in the first interview in more depth. Additionally, Andrew was shown an initial anonymized account of the spectators' responses to the performance. It was hoped that by showing Andrew the spectators' responses, he might be inspired to reflect further upon his own interpretation of the performer-audience relationship, and general audience experience, of a Waves performance.

We anticipated that during these interviews Andrew and the spectators might not be able to reflect adequately upon the experience of the performance when questioned out of its immediate context. Consequently, interviewees were shown a video prompt that served as a reminder of the performance. Two different video prompts were created from footage of the performance: one for the spectators, which showed a shot of the performance from the audience's perspective; and another for Andrew, which showed both the audience's view and also a close-up shot of Andrew's (and his collaborator's) interactions with the interface. IPA was used to analyze these post-performance interviews. While there is not space to include a full account of our findings, we provide a subset that we hope will provide an ample picture of both Andrew's and the spectators' experiences of the Waves performance.

Experiences of Salient Interaction
Comments from the spectators suggested that Waves was successful in making the performers' actions salient, yet elusive and enchanting. There was a consensus that while the performers' contribution was evident, it was not fully understood. Kate thought the performers' "focus" and "cognitive involvement" were apparent while both Richard and Tom believed that there was a degree of improvisation taking place. Kate and Tom sensed that the performers were being creative; Tom thought being able to acknowledge that a creative process is taking place is more important than understanding it.

Despite the specifics of the performers' actions being unclear, the spectators were positive in their remarks about what was described as the "open" nature of the performance. The spectators described how they enjoyed speculating about the exact nature and consequences of the performers' interactions with the interface. Richard described the allure of being able to observe the performers' communicating while using an interface that he could also see, while Tom valued the visible GUI for providing "insight into the process behind the sort of finished product". Kate stated that, because of the open design of Waves, she felt the audience participated as a collective in an experience of curiosity and wonder about the performers' actions. In this respect, the Waves performance was said to present a greater sense of being involved in the performance than an interactive piece shown later in the event, as the lack of explicit interaction between performer and audience meant that no one was excluded and, therefore, the whole audience could participate on an equal footing.

Bases for Generative Manipulation
Andrew said that he felt Waves achieved the goal of generative manipulation, as he was given the ability "to almost draw and literally control things completely live". When viewing the prompt, Andrew expressed his satisfaction with the resulting visual aesthetic; suggesting that despite the increased scope for complex and creative manipulation of visuals during the moment of performance, he was still able to produce visuals that met the high standards of his practice. He attributed this combination of live creativity and high quality visuals to elements of the Waves design that provided a basic level of control, which more complex and experimental manipulation could be built upon during the moment of performance.

Andrew described how a performance based purely on the manipulation of spline curves to set parameter values might prove too complex, as "you'd have too many parameters to try and manipulate at once". The audio-reactive mode of Wave Objects was said to circumvent this problem, by providing a basic level of activity for a visual that could be attained instantly and then built upon using the original, temporal, mode of interaction with the spline curves. This notion of a basis for manipulation also arose with respect to the catalogued visuals, which were said to provide starting points from which Andrew could experiment and improvise in the moment of performance. Andrew applauded both of these mechanisms for making manipulation manageable, during the moment of performance, without becoming overly "predefined" and, consequently, limiting.

Data- vs. Form-Centric Interaction with a Medium
The approach to designing medium-like interaction in Waves was based upon a mapping between the visual form of the Wave Object's spline curves and the underlying parameters of the visuals. In this way, it was hoped that Andrew would both sense the manipulation possibilities of the visuals and respond as part of a tight and dialogical feedback-loop. This form of interaction was referred to as data-centric interaction with a medium. While Andrew said that this method of interaction with the underlying parametric data of the visuals was "quite intuitive and the best way of doing it", he stated that there were times during

the performance where he wished for more literal and direct interaction with the rendered form of the visuals. In response to this desire, he proposed design alterations such as adding handles onto the form of the visuals so they could be directly grappled with as if they were physical objects (i.e. an alternative form-centric approach).

Andrew's comments suggest a shortcoming in the data-centric design approach to medium-like interaction, in cases where the performer constructs a mental model of interaction possibilities in terms of gestural manipulations that could be made directly to the rendered form of a visual. However, Andrew concluded that he would not wish the design of Waves to be altered in this respect, stating that if a more literal mechanism of control was utilized to manipulate the parameters of a visual, interaction with the more abstract visuals, such as those based upon algorithmic generation, might become impossible. Interestingly, Andrew commented that these more abstract visuals, which suited the data-centric interaction paradigm, were the most satisfying to interact with as direct control over a static form might have quickly become boring.

REFLECTION ON THE IDIOGRAPHIC APPROACH
In the following sections, we reflect upon our experiences of applying idiographic design, in order to explore whether the approach is a viable strategy to support designers in understanding and sensitively responding to the kinds of delicate and complex issues that underpin people's experiences and practices of live performance.

An Idiographic Perspective on Wider Issues
The decision to design for just one live performer, made it possible to maintain an idiosyncratic focus on lived and felt experience during the design of Waves. The individualistic nature of the idiographic approach allowed practices and experiences of VJing to be considered with a detail, depth and, most crucially, a particularity that it is unlikely would have been possible if a general understanding of multiple performers had been sought. The detailed and specific account of Andrew's practice uncovered by the approach was found to provide a concrete perspective on issues of wider concern to those designing interfaces for VJing and other forms of technology-mediated performance. For instance, notions of saliency and the coalescing of interface and performance, highlighted particular and concrete angles on issues related to the performer's presence during performance [c.f. 15, 27]. Such individual perspectives were found to be invaluable when proposing a design response to the complex, subtle and multifaceted issues faced when designing for live performance. Focusing on one performer's detailed personal experiences of such issues demarcated a concrete space for the designer to work in; consequently, replacing the challenge of engaging many potentially contrasting views and experiences in design with the more tractable task of proposing a bespoke design in response to an individual's concrete perspective.

These findings tally with previous discussion of autobiographical design, which has argued that designing for one's self can support the designer in responding to complex aspects of experience, while avoiding the abstraction of the design space that might result in the idiosyncratic essence of experience being lost [5, 24]. Our case study extends this discourse by showing that an idiographic approach can allow a designer to gain a similarly concrete and unreduced understanding of experience, while designing for another person's practice. Consequently, we argue that the idiographic approach has the potential to form the basis of design for live performance that is based on in-depth and particular insight into an artist's practice, but also draws upon the skills, knowledge and perspective of an external designer.

Idiographic Design as a Dialogical Inquiry
One particularly valuable feature of the idiographic approach was the extended and in-depth dialogue with the performer that arose throughout the interviews and later stages of the design process. During the initial interview sessions, lengthy conversations provided an opportunity for Andrew and the designer to discuss his practice in detail. These conversations allowed Andrew to introduce topics, describe his experiences in his own terms and, perhaps most importantly, acted as a scaffold for Andrew's reflection about how the potentially intangible and tacit values that shape his practice might be instantiated in a design. Consequently, the designer was able to unlock a range of in-depth knowledge about the histories, preferences and creative aspirations that shaped what he did, and how he made sense of what he did, as a performer. For example, throughout the course of the interviews it became clear that Andrew's aspirations for a more salient form of interaction with his tools did not relate primarily to desires for personal acknowledgement or attention, but rather to the unique and enchanting experience he felt audiences of live performances should, but often did not, have when watching live VJing. The in-depth and holistic understandings of Andrew's practice developed through these dialogues were found to be particularly valuable as a means to support the designer in picturing how particular design decisions would fit with the creative aspirations and experience of Andrew's practice. These experiences reinforce previous work that has found the empathic dialogue afforded between designers and subjects to be a key quality of idiographic design [16, 31].

Dialogue in the idiographic approach was found to be particularly valuable in the later stages of the design process, where the individual nature of the engagement made it possible to invite Andrew to join the creative process of iterating the Waves design. It was found that Waves provided a concrete representation of the designer's interpretation of Andrew's practice and its potential relationship with particular design ideas, which inspired in-depth discussions during which both parties interrogated and developed their understanding of VJing and the design.

These dialogues uncovered new ideas and aspects of Andrew's practice that had not been discussed in the earlier interviews (e.g. his desire for a tight connection between audio and visual elements of performance) and, subsequently, allowed the designer to leverage insight into Andrew's creative views when iterating the design, which would have been difficult to uncover in the earlier, detached, context of the interview sessions. Consequently, we argue that our case study extends previous discussion of idiographic design by highlighting it as a particularly valuable approach for designers working with live performers and other creative users, as our findings suggest that the approach can support a designer in unlocking insight into the creative ideas and aspirations that emerge when an artist considers how the qualities of an evolving design could shape the development of their practice [12].

Innovation through Idiographic Design
The Waves design comprises a number of innovative forms of interaction. Many of these innovations were inspired by subtle and delicate variations upon common issues affecting live performance, which were uncovered by focusing specifically upon Andrew's perspective. For example, previous designs have sought to address the degraded presence of the live performer, which results from using digital technology during a show (i.e. the laptop-performer problem). Prior responses to this issue have often focused upon simply amplifying the prominence and legibility of the performer's actions [e.g. 8, 15]. By responding to Andrew's particular creative aspiration for an interface that subtly balanced legibility and mystique to evoke an experience of enchantment amongst audience members, the gestural, yet abstract, spline-based interaction of the Waves design was developed, which represents a significant deviation from previous responses to this challenge. In another example, intimate and physically embodied interaction with digital technology is acknowledged as a vital quality of interaction in the literature of electronic music performance [e.g. 4, 17]. By exploring how this kind of interaction could be afforded in the specific context of Andrew's practice, the notion of data-centric interaction with a medium was proposed, which enabled such physically embodied interaction to be offered in the context of abstract visual content (i.e. visuals for which a physical, form-centric interaction paradigm would not make sense).

The forms of interaction presented in these examples, demonstrate how in-depth and detailed insight into an individual's practice inspired innovative design with regard to issues faced in the wider context of VJ practice and technology-mediated live performance. It is argued, therefore, that the idiographic approach offers a valuable mechanism to inspire innovative design by allowing the designer to gain insight and inspiration from individual and idiosyncratic perspectives on issues, which might not be found during a more abstract response to multiple artists' practices.

The Wider Applicability of Idiographic Designs
It would be inappropriate to make inferences about how we should design for the general population of VJs based solely upon our idiographic study of Andrew's practice, in the way one might from a survey of a larger sample of performers. However, we argue that the Waves design, and other designs resulting from an idiographic approach, are relevant to the practices of other performers and embody ideas and techniques that will be of interest to interaction design researchers and practitioners.

Andrew's account of his practice offered detailed and concrete insight into one performer's perspective on widely acknowledged concerns of VJ practice, as opposed to introducing unfamiliar issues and challenges. Due to this grounding in issues relevant to the wider VJ community, we argue that many VJs will find Waves to be a valuable and inspiring addition to their practices. Furthermore, as the idiographic approach allowed the designer to draw insight from particular concrete aspects of Andrew's practice that might have been overlooked by a nomothetic design stance, we believe that the resulting design will also offer a more compelling and inspiring response to the issues and concerns of the wider VJ community, than if the designer had attempted to consider them collectively. In this respect, we are encouraged by the case of the reacTable, which illustrated how an interface designed in response to the experiences and concerns of a small group of musicians resonated with, and was successfully incorporated into, the practices of other performers [14]. However, we acknowledge that further iterative refinements of the design, which could be based upon idiographic studies of other VJs' responses to Waves, will be required to ensure that the design has such wider relevance.

We envisage that *moderate* generalization might form the basis of an approach through which the close and dialogical consideration of an individual's experiences, offered by idiographic design, could be put to work as a means to develop more widely applicable insight for the designers of interfaces for live performance. Moderate generalization is based upon the principle that "aspects of [a situation] can be seen to be instances of a broader recognisable set of features" and, consequently, an in-depth idiographic account of a particular situation can support researchers in better interpreting and understanding other situations [30]. If we consider interfaces resulting from an idiographic design strategy to each represent a number of distinctive responses to broader issues affecting live performance as they are embodied in the practices of individuals (as Waves did), then it might be argued that designers wishing to address similar issues might gain insight and guidance from the consideration of the perspectives that such designs embody. Annotated Portfolios [6] might prove to be particularly valuable in this context, as a portfolio of idiographic designs that each respond in different ways to a general set of issues, might provide valuable inspiration and guidance for future interaction design for live performance

and offer sensitizing concepts that present a thought provoking perspective to consider during the analysis of further empirical studies of VJ practice [3].

CONCLUSION

We have described and reflected on the application of an idiographic approach during the design of Waves, a multi-touch interface for live VJ performance. The case study of Waves illustrates how idiographic design can provide a practical way to draw upon a close and dialogical consideration of individual live performers' experiences and creative views as a source of inspiration and guidance for design. Our findings will inform interaction design practitioners and researchers who might apply the approach presented directly, or draw inspiration from its idiographic stance, when designing in response to the kinds of subtle and complex issues that underpin live performance and, potentially, the wider creative use of computers.

REFERENCES

1. Auslander, P. *Liveness: Performance in a Mediatized Culture* (2nd ed.). Routledge, 2008.

2. Barker, M. Crash, theatre audiences and the idea of 'liveness'. *Studies in Theatre and Performance*, 23, 1 (2003), 21-39.

3. Benford, S., Giannachi, G., Koleva, B. & Rodden, T. From interaction to trajectories: designing coherent journeys through user experiences. *Proc. of CHI'09*, ACM, 709-718.

4. Bertelsen, O., Breinbjerg, M. & Pold, S. Instrumentness for creativity mediation, materiality & metonymy. *Proc. of C&C'07*, ACM, 233-242.

5. Boehner, K., Sengers, P. & Warner, S. Interfaces with the ineffable: Meeting aesthetic experience on its own terms. *TOCHI*, 15, 3 (2008).

6. Bowers, J. The logic of annotated portfolios: communicating the value of 'research through design. *Proc. of DIS'12*, ACM, 68-77.

7. Bowers, J., Hellström, S. & Jää-Aro, K. The Lightwork performance: algorithmically mediated interaction for virtual environments. *Proc. of CHI'98*, ACM, 291-292.

8. *Emulator DVS.* http://www.smithsonmartin.com.

9. Faulkner, M. *VJ: Audio-Visual Art and VJ Culture*. Laurence King, 2006.

10. Gracyk, T. Listening to Music: Performances and Recordings. *The Journal of Aesthetics and Art Criticism*, 55, 2 (1997), 139-150.

11. Holmquist, L. User-driven innovation in the future applications lab. *Ext. Abs. of CHI'04*, ACM, 1091-1092.

12. Hook, J., Green, D., McCarthy, J., Taylor, S., Wright, P. & Olivier, P. A VJ Centered Exploration of Expressive Interaction. *Proc. of CHI '11*, ACM, 1265-1274.

13. Hook, J., Schofield, G., Taylor, R., Bartindale, T., McCarthy, J. & Wright, P. Exploring HCI's Relationship with Liveness. *Ext. Abs. of CHI'12*, ACM, 2771-2774.

14. Jordà, S. On stage: the reacTable and other musical tangibles go real. *IJART*, 1, 3 (2008), 268-287.

15. Lew, M. Live Cinema: designing an instrument for cinema editing as a live performance. *Proc. of NIME'04*, NUS, 144-149.

16. Lindsay, S., Jackson, D., Ladha, C., Ladha, K., Brittain, K. & Olivier, P. Empathy, Participatory Design and People with Dementia. *Proc. of CHI'12*, ACM, 521-530.

17. Magnusson, T. Affordances and constraints in screen-based musical instruments. *Proc. of NordiCHI'06*, ACM, 441-444.

18. McCarthy, J. & Wright, P. *Technology as Experience*. MIT Press, 2004.

19. McCullough, M. *Abstracting Craft: The Practiced Digital Hand*. MIT Press, 1998.

20. Neustaedter, C. & Sengers, P. Autobiographical design in HCI research: designing and learning through use-it-yourself. *Proc. of DIS'12*, ACM, 514-523.

21. Phelan, P. *Unmarked: The Politics of Performance*. Routledge, 1993.

22. Reeves, S., Benford, S., O'Malley, C. & Fraser, M. Designing the spectator experience. *Proc. of CHI'05*, ACM, 741-750.

23. Schloss, W. Using Contemporary Technology in Live Performance: The Dilemma of the Performer. *Journal of New Music Research*, 32, 3 (2003), 239-242.

24. Sengers, P. Autobiographical Design. *CHI '06 Workshop on Theory and Method for Experience-Centered Design*.

25. Sheridan, J., Bryan-Kinns, N. & Bayliss, A. Encouraging witting participation and performance in digital live art. *Proc. of BCS-HCI'07*, BCS, 13-23.

26. Smith, J. *Qualitative Psychology: A Practical Guide to Research Methods*. Sage, 2007.

27. Tanaka, A. Musical Performance Practice on Sensor-based Instruments. In Wanderley, M. & Battier, M. (eds.) *Trends in Gestural Control of Music* (2000), IRCAM, 389-405.

28. Taylor, R., Schofield, G., Shearer, J., Wallace, J., Wright, P., Boulanger, P. & Olivier, P. Designing from within: humanaquarium. *Proc. of CHI'11*, ACM, 1855-1864.

29. von Hippel, E. Lead Users: A Source of Novel Product Concepts. *Management Science*, 32, 7 (1986) 791-805.

30. Williams, M. Interpretivism and Generalisation. *Sociology*, 34, 2 (2000), 209-224.

31. Wright, P., Wallace, J. & McCarthy, J. Aesthetics and Experience-Centered Design. *TOCHI*, 15, 4 (2008).