Trigger Shift: Participatory Design of an Augmented Theatrical Performance with Young People

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ABSTRACT
Trigger Shift was a project that involved collaborating with a group of young people to explore the ways commercially available technologies could be appropriated into performance art. The project led to the production of an augmented theatrical performance using the Microsoft Kinect sensor that was presented to live audiences six times over two days. In this paper we describe the bottom-up, 11-month long participatory design process conducted with our young participants. We describe the manner in which the project was introduced to our participants and the techniques used to help them actively make decisions about the design of and role of technology in the final performance. We candidly report on the problems encountered during the design process and how the project team had to be reflexive to the needs of participants and the single predefined end-goal of the project. A number of strengths and weaknesses of bottom-up participatory design with young people are highlighted, and we reflect upon these to provide guidance for future researchers undertaking work in this domain.

Author Keywords
Kinect; participatory design; performance theatre.

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

INTRODUCTION
Since its introduction in November 2010, Microsoft Kinect [30] has become a popular consumer gaming technology. Beyond commercial gaming applications the technology has proved to be provocative for hackers, artists and computer scientists, who have explored the use of Kinect in contexts such as education, medicine, music, dance and interactive visual art [6,10,16,35,37]. In this spirit, we describe a project that led to a theatrical performance augmented by Kinect technology (Figure 1) developed via open source tools. The performance was designed in collaboration with a group of young people in Northern England and was the outcome of 11 months of participatory design workshops. At the outset there was no defined end-goal other than a commitment to produce an artistic performance for a showcase event. Rather, there were two broad aims. First, we wished to provide the conditions for a group of young people without technological or hacking expertise to explore Kinect as a creative tool. Second, through a long-term engagement we wished to enable the participants to take ownership over the design of the final performance and the decisions over its implementation.

In this paper we describe the process of collaboration with the group of young people. We explain the challenges we (both project team and participants) came across in navigating each other’s interests and skills, and the key stages in our design process that led to the creation of the final theatrical performance. Our contribution is thus three-fold. First, we provide insight into the strengths and weaknesses of proceeding from a bottom-up participatory process, particularly with groups of people who were inclined to treat the project team as experts and authority figures. Second, we describe the specific features of Kinect technology that captured the imagination of the participants and the challenges this technology brought in terms of being integrated into a theatrical performance with novice performers. Third, we provide guidance for future
researchers and practitioners wishing to use art projects as a vehicle to enable young people to learn new technological and creative skills.

**KINECT, HACKING AND DIGITAL ART**

The development of interactive and media art in the later 20th Century has a rich and varied history where different approaches to augmenting or reacting to body movements has been explored. Canonical examples include the use of electromagnetism [11], image processing [36] or electrical muscle signals [40]. The Kinect is a recent addition to this corpus of techniques and technologies. The release of software development kits and frameworks such as the Microsoft SDK [31] and openNI [33] and their integration into popular programming projects such as Processing [34], Cinder and openFrameworks [32] has meant that fast, reasonably reliable point cloud, depth plane and skeleton tracking has become available for the first time for less than $150US. As a consequence, a subculture of creative Kinect hacks has flourished across sites such as YouTube and Vimeo and has given rise to dedicated websites and collections [14,20,21].

The support gained for the Kinect within open-source and hacking communities has motivated a number of novel uses of the technology in artistic performance. For example, a number of projects have appropriated the technology as a form of on-screen puppetry that performers interact with using their hands and bodies [23,25,35]. Open source software such as ‘Animata’ [22] provides a simple way for users to create jointed 2D puppets and has inspired a number of Kinect-based usages in recent years [23,38]. The technology has also been used in expressive musical interfaces, where bodily movements are used to modulate audio parameters [37,42]. Past work has also focused on the use of Kinect as a way of supporting both professional and playful forms of dance, exploring the effect of seeing oneself as an avatar on-screen [6] and supporting error correction in learning dance movements [29]. Within the field of Human-Computer Interaction, a growing body of work has focused on re-appropriations of Kinect to collect novel forms of sensor data [5] and integrating it with novel output devices [17]. Beyond the technical opportunities presented by Kinect, a number of researchers have explored how the touchless and whole body interactions offered by this technology may impact upon its use [9,12].

Primarily, however, the focus of much Kinect-based research has been on the development of gaming software. This is particularly so in the context of using Kinect with children and young people, where the focus has been on its potential for encouraging exercise or rehabilitation (so-called exergames [10]) or in education [18]. There is comparatively little exploration of the possibilities of Kinect for creative play or performance for its own sake.

The above context—where Kinect offers a number of opportunities for hacking and re-appropriation—significantly informed our work on Trigger Shift. We aimed to introduce young people to Kinect and the open source community that has appropriated the technology as a creative tool, allowing them to help hack and re-appropriate this common consumer technology. What these hacks and re-appropriations would be, however, was left open to emerge from a participatory process. In the following sections we describe how these ideas became embedded in our participatory design approach.

**OUR DESIGN APPROACH**

Participatory Design (PD) has a basis in the democratization of design processes where potential users of an end-technology are treated as partners in the decision-making process [13]. Prior work has also highlighted how performance and artistic approaches used in participatory design work can support imaginative (and implementable) visions of future technology [27]. Therefore, PD fitted well with this project’s agenda of allowing young people to take the lead as much as possible in defining the project outcome. Furthermore, PD also implies those taking part ‘gain’ from their participation in the form of new skills, new life experiences, and opening up opportunities for the future [4,13]. As such this identified with our aim to provide the participants with experiences that supported new skills and learn about alternative approaches to using common technologies.

The workshops commenced in October 2011 and ran through to August 2012. Over this time we met with the participants every two or three weeks; fifteen times in total. The workshops ran for two hours. As is the case with such long-term engagements, over this time the workshops focused on different themes and incorporated many different activities. While the development of a performance that made use of the Kinect technology was the only end-goal, many of the workshops deviated from this and were instead just demonstrations of technologies or watching videos of artists work in order to derive inspiration. At key points more design-oriented activities were performed, such as storyboarding and acting out interactions and gestures. The early workshops were documented via detailed notes and in part with video and photographs. The later workshops leading to the final work were all audio and video recorded and anonymised.

In the following sections we describe the key points in the PD process. We focus on 5 key phases of the project that significantly impacted upon the dynamics of the workshops, the relationships between participants and project team and shaped the decisions we made and the final artistic outcome. These phases are: 1) the recruitment of participants, 2) introductory workshops where examples of hacking consumer technologies and open-source production tools were demonstrated, 3) content workshops that focused specifically on defining the topic and themes to be explored in the final artwork, 4) design workshops that defined the form of the final work, and 5) participant feedback and rehearsals for the final performance.
Participant recruitment and the team composition
The project required participants to commit a significant amount of their free time over nearly a yearlong period. Therefore, in order to ensure all prospective participants understood this commitment and were interested in the overall topic we asked them to make an application to the project team. An advert was disseminated through a number of arts organization mailing lists, youth organisations, schools and colleges around the region. In total, the team received 30 applications from people aged between 13 and 21. As this application was to ensure interest (rather than exclude certain applicants) all of those who applied were invited to the first workshop. Over the first three workshops many participants dropped out of the project either due to changes in circumstances, other commitments or because of a lack of interest. At its completion 7 young people remained, who were aged between 13 and 20 years of age.

Most of the participants who remained could be identified as of middle socio-economic status. They were far from homogeneous as a group however. As will be discussed later, their personalities and individualities became very apparent during the project, both in the design of their part in the performance and their acting as part of the final performance. A quality shared by all participants however was that they had no prior experience of programming and hacking, and little knowledge about design or artistic practice beyond their high school education. Indeed, only one of the participants had used Kinect before taking part in the project. The fact that our participants were novices in this area very much shaped the opening workshops of the project, described in the following section.

The project team initially comprised of two artist/programmers, a producer, and a musician. As the content and approach to the workshops developed over time, the team expanded to also include two theatre directors and a researcher in participatory design.

Introductory workshops
The structure of the first four workshops reflected the exploratory and open-ended nature of the project. The sessions were very loosely planned and introduced the participants to the ethos of the project and the Kinect technology. This introductory phase was deemed important as in British high-school education, students are rarely faced with examples of new media or digital art even if art or design are chosen as subjects. Therefore, we began our workshops by introducing the participants to some examples of new media art involving responses to bodily movements in order to defamiliarise [2] them from expected conventions of art and technology. Examples included Messa di Voce [24], a vocal and physical performance where voice tones and body movements become generative drawing tools. Others focused on the use of sensor technologies, such as a performance of 'Body Paint' by the dancer/choreographer Miss Martini [1]. We also introduced the work of the magician Marco Tempest [28], whose augmented reality magic performances (e.g.[41]) proved to be a significant influence on the final design (discussed in the following sections).

Experiencing Kinect
As well as video examples of other projects, the second workshop gave participants an opportunity to try some whole body interaction scenarios first hand. At this second workshop there were approximately 20 participants and they visited each demonstration in small groups. For example, the team created some simple puppetry examples using Animata and Osceleton [19,22]. In the same session, the participants also interacted with a webcam-based version of Body Paint [1]. This artwork turns gestures into splatters of paint and several users can collaborate, creating layers of splashes and blotches. These examples were chosen to represent contrasting ways of interacting with onscreen visuals. Animata exploits a user’s previous experience of string puppetry to familiarize the experience, while the fast haptic feedback from Body Paint encourages a playful expressive interaction. Both of these interactions are distinct from the predominant mimetic paradigm present in commercial Kinect games [12]. Rather than using the body to control an on-screen avatar they borrow particular kinds of expressive interaction people may be familiar with and explore how the affects of that interaction can be given new kinds of freedom.

After trying out each example some of the participants were reluctant to move on to the next and wanted to continue discussing the installments in more detail. The demonstrations provoked a great deal of surprise and curiosity from the participants. An often repeated comment was that they were previously unaware that it was possible to even “plug a Kinect into a computer”.

The third workshop focused on different ways to manipulate images. Here we wished to further defamiliarise the participants from gaming contexts and imitating sports actions by focusing on very specific interactions, one at a time. We introduced the concept of ‘mapping’ to participants. One of the basic programming tasks when working with Kinect is to mathematically translate the scale in which the Kinect operates to other ranges—for example, to match 2D or 3D screen space. We demonstrated this by designing an application where hand positions could stretch, rotate, tint or pixelate an image. By doing so we aimed to highlight the fact this mapping is a design decision. By changing the mathematical properties of a mapping, for example by using a logarithmic rather than linear relationship, we can strongly influence the ‘feel’ of an interaction. Participants commented on the “natural feel” of interactions where positions related to physical movements of the image such as rotation and scale. Conversely they described the difficulty in feeling a sense of connection when the mapping was less direct or physical, for example in tinting an image. Their experience in this exercise suggested favourability for linking body
movements to changes in scale and movement in the graphics rather than more abstract properties such as controlling the speed of an animation.

Defining roles and skills
As a response to interest from a number of participants in how the demonstrated interactions worked, at the forth workshop we introduced them to some basics of programming. This was not to teach the participants how to code but to allow them to understand some of the fundamental concepts of how the technologies worked and what was and was not possible with them. The participants were introduced to popular environment and language Processing [34] which provided a basic understanding of ‘behind the scenes’ aspects of the interactions demonstrated to them at the earlier workshops.

At this stage we were prepared to start devoting future workshops to learning to program had there been a strong interest in this from many of the participants. We also considered splitting the group into clearly defined project roles according to their interests so that some participants would have become programmers, others musicians or visual artists. This plan was abandoned for a number of reasons: first, there was not a clear enough picture of the performance to suggest what the project roles would be. Second, the group were enthusiastic about learning a range of skills and we felt that to restrict them to roles defined by their existing competencies would unnecessarily limit their participation at an early stage. Clearly, at this stage it became necessary to reconsider our approach.

Definition and design workshops
The introductory workshops provided a means for the participants to start to understand the aims of the project and provided an opportunity for them to have direct experience of novel uses of the Kinect technology. One of the concerns for the project team was that although the initial workshops were playful and led to rich discussions, there was very little sense of what the final performance might end up being. Therefore, the second phase of workshops focused on exploring what the topic and content of the final performance might be. During the following 6 workshops ideas about what the final performance might comprise of both in terms of subject matter and augmentation emerged and were iterated.

Defining the topic
Over the first development stage the initial members of the project team became aware of a gap in their skills and experience, which had the potential to affect the project. Across the team there was expertise in interaction design, art, music and working with young people. Yet we were concerned that the strong focus on body movement, suggested by the use of Kinect, implied the workshops should be structured around the participants studying how to use their bodies in creative ways for performance. There was recognition that except for practical examples most workshops had been conducted sitting down and that we would benefit from expertise in body movement.

For workshop 5 a theatre director (“TD”), who had previous experience leading projects with children and young people, was introduced to the participants. The rationale for inviting TD was her significant experience in doing performance work with younger people based around exploring issues and concerns that were personal to them through their bodies. It was felt that working this way would provide some structure to the workshops in terms of what the subject matter of the final performance could be. For example, in workshop 5 TD grounded the participants’ discussion by asking them to consider what stories they wanted to tell others. Through a series of dramatic exercises, the young people were encouraged to identify aspects of their daily experiences that they wished to change. In one activity participants were given five minutes in groups of two or three to plan two tableaux (static poses of grouped figures), which they would subsequently act out. The two tableaux would be a ‘before’ and an ‘after’ scene. For example, Robert arranged his ‘before’ scene to represent late night drunkenness in his local city centre. The ‘actors’ in this scene were frozen in poses of exaggerated drunkenness. The ‘after’ tableau showed the same people engaged in a healthy game of table tennis.

The living picture exercise was helpful in that it started to get the participants discussing issues that concerned them beyond that of the themes of the project. Through these dramatic activities, participants began to share with one another their main concerns about where they lived and what they might change to improve this in the future. The types of concerns and future visions varied considerably across participants. For example, Robert had a strong concern about the unhealthy lifestyles he felt were common in the city. Mary’s concern was about a lack of cultural vitality, in terms of the amount of music and art venues in the city. This discussion was mediated and encouraged by TD. The plurality of visions here became a talking point and started to suggest directions for the performance.

In workshop 6 the group reflected on the dramatic exercises and identified a number of commonalities in the different stories the participants shared with one another. While the specific content of the stories would often be dramatically different, they shared the desire to alert people to problems they saw in their lived environment. TD asked participants to create lists of positive and negative aspects of their environment using the previous tableaux exercise as a starting point. One by one the lists were read out, often provoking agreement, disagreement or hilarity from the other participants. Such list items included the tendency for the city centre to be crammed with shoppers all weekend (Mary), obesity among residents (Becky) and a lack of non-chart music in venues across the city (Leanne). Following a suggestion from one participant (John) that the lists sounded like a political manifesto, participants were asked
to work at home on combining some or all of these items into a speech. This resulted in a series of monologues that would act as the starting point for exploring how the Kinect and the body could support telling these stories.

**Designing the performance**

Having started to bring definition to the topical elements of the performance, we returned to the Kinect technology in order to establish how it might support or be a hindrance to performing the written monologues. At this point (workshop 7) we re-visited some of the early examples of stage performances with interactivity to gain inspiration, such as Mesa di Voce and the augmented magical performances of Marco Tempest. Again, our intention was to illustrate to the participants the ways that whole body interaction could initiate ideas rather than simply end up mimicking real world actions. In particular, revisiting Tempest’s [41] work made a particular connection with the participants and the stories they wanted to share. Tempest uses techniques such as projection mapping to blend live video and physical objects, appearing simultaneously on a screen and live on stage. He would perform gestures on the live stage that would subsequently appear on the display augmented with visuals and sound effects. His shows were particularly interesting to the group because they represented a solid example of using abstract gestural interactions to support telling a story to the audience. The creativity of his work is in the visual detail drawn from his narratives and the interaction ideas that this generates. This approach of linking narrative to image to interaction provided inspiration for where to go next in the process.

In order to start generating specific ideas about how the participants saw their monologues being acted out on stage, two workshops (8 and 9) were spent developing storyboards of each monologue. First, the participants were asked to examine each other’s monologues to identify visual features that were both literal and non-literal. For example, Carla's speech contained references to the “ticks and the hours” of a clock, as well as “the countless pages of our history”. These provided cues for quite literal animations or interactions; a ticking clock and a book that Carla could use hand gestures to ‘flick through’. Other images identified were more metaphorical. Becky related the line “the whole world accepts love of any kind” from her narrative with an animation of a paper chain of men and women holding hands. At the same time the participants discussed how audio effects could be incorporated into the story and how they would be triggered. The premise of this design strategy was that the interactions would be led by the images and sounds, which in turn were in debt to the narratives.

After group feedback on the images alone, the whole group discussed possible bodily interaction scenarios for each scene. It was at this point that more detailed storyboards were drawn by one of the project team (Figure 2) responding to the suggested visuals, bodily actions, and the extract of the monologue these referred to. During this process the project team kept as minimal a role as possible.

These development sessions were perceived by the facilitators to be litmus tests of the success of earlier sessions in how they provided the participants’ confidence and judgment in designing interactions. In these sessions, participants would be asked to illustrate with their bodies what they imagined to be gestures and movements relevant to specific lines and scenes. Often, the group would debate how clear some of the gestures would be to the audience and sometimes participants would change their gestures in response. On other occasions, gestures and movements necessitated being changed as they were too subtle or complex for the Kinect sensor to differentiate. This included Maya’s, who had an interaction in which she turns over a number of playing cards by a flicking hand gesture. Other participants and members of the team suggested that this might be difficult for the Kinect to recognise reliably. Alternatives were suggested and the interaction was modified to causing the card to flick when the hand was ‘over’ the card, like a mouse-over interaction.

Having defined the content for the performance and the onstage interactions with Kinect, a period of intense development activity commenced between workshops 9 and 10. The interactions outlined by the participants presented a significant technical challenge to the two artist-developers on the project team who would bring participants' ideas to life. Although using the processing wrapper for openNI [39] gave easy access to user point cloud, depth plane and joint position data, the sheer volume of interactions was daunting. A final count of the storyboards revealed that 47 distinct interactions had been described by the participants and although many had common features, no two were identical. The development period was also very short (three weeks) but still, all interactions were implemented.

As well as ensuring the technical architecture of the performance was in place, the team also had to complete a set of 47 unique and visually consistent graphic assets that would appear in each scene. One of the participants, Amanda, was studying graphic illustration, and created all of the assets for the team. Amanda had no previous experience in producing work for integration in computer
software, and so it was necessary to be in frequent contact to explain the importance of file types, alpha channels and image sizes and positioning, to name a few examples.

For workshop 10, the participants were asked to explore the newly developed system and visuals and gather feedback and critique. Participants expressed positive feelings about the interactions and after testing had some specific criticisms. They were very quick to focus on any deviation from their initial designs. Some interactions were rejected and redesigned and further creative ideas emerged through this process. For example, the paper chain of men and women mentioned previously was originally designed by Becky to stretch between the hands and then fall when the arms were fully spread. While experimenting, Becky decided that she wanted to be able to draw a heart shape. The interaction was changed so that the chain appeared as she started to make the shape and fell when she finished drawing the heart shape. Similarly, the interaction feedback workshop further influenced the development of the monologues—sections were edited out that the participants perceived to be too long or lacking enough interaction.

Feedback and rehearsal workshops
The final set of workshops (11 to 15) of the project saw a significant change in the previously loosely structured nature of the group sessions. Now, the participants and the team faced the task of rehearsing and remembering lines and bodily interactions. If actions were forgotten on stage, then the imagery and sounds would not appear on screen and the relationship between what is spoken and what is visualised would break down. An added complexity was also linking the participants’ individual stories to one-another and frame the performance as a single overriding narrative rather than a series of independent monologues. It was not until workshop 14 that the overall sequence of the final performance was defined by creating an additional ‘compère’ role for one of the participants, Leanne.

During these final sessions the design of the stage setup was also finalised. The stage was simple, without any props or scenery (Figure 3). A single Kinect at waist height on a stand was positioned at the front of the stage. The stage was lit from above with spotlights and a large projection screen was positioned behind the performer. Below the Kinect was a slave monitor, allowing the participants to see the projected image without turning round. Although all of the participants taking part in the on-stage elements of the performance would be on stage at the same time, only the performer presenting their monologue at the time would be stood in front of the Kinect.

Rehearsal time was mostly spent with the TD drilling lines and practicing interactions. The TD conducted exercises in which the participants spent as much time as possible on stage with the intention of becoming comfortable and familiar with that space. This familiarity would serve two purposes: to relax the performing participants and to develop an instinctual awareness of the technical setup in particular the range and angle of view of the Kinect.

FINAL PERFORMANCES: “CHANGING THE WORLD”
Over two days the show was performed six times. Each show contained six monologues, each performed by the participant who wrote it and designed the interactions. Each showing lasted approximately 20 minutes and was attended by between 20 and 40 members of the public. In this section, we provide an overview of the 6 showings, the roles of each participant in the final performances and problems encountered over the two days.

Participant roles
Although the intention had been that all the participants would perform their monologues, during rehearsals it was decided to change this plan. Rather than appearing on-stage, Robert controlled the music and scene transitions from a mixing desk and computer behind the scenes. Although Robert had written a monologue and interactions, he felt happier working behind the scenes (which mapped to his interests in programming and engineering). Another participant—Leanne—was unable to take part in the storyboard workshops and therefore did not have a monologue to perform. She still wanted to be on-stage and serendipitously this fitted perfectly with the need for a ‘compère’ that linked the monologues together. The remaining 5 participants performed their monologues on-stage as part of the performance.

The performances
Each performance began with Becky introducing the show to the audience. She explained: “all the effects you will see here were designed by us and are performed live using a motion sensor”. Leanne began the main performance by welcoming the audience to a fictional game show “Planet Ideas”. The participants were introduced as competitors who would pitch their worldviews on the ‘show’. Following this, participants performed their monologue and interactions that appeared above them on the projected display. Each of the participants’ narratives were unique and it is not possible to describe all of them here so we will restrict ourselves to one monologue as an example:

Mary begins her story by describing her surroundings as a “grey dull city”. She is surrounded in the projection by
cartoon office buildings. "Moving forward" she gestures outwards with both hands and this causes the buildings to shrink backwards out of sight and replaced by a colourful cityscape and blue skies. Pointing with her finger causes flowers to grow from the edge of the screen in the area at which she points. She describes a scene of "hiphop breakdancing basket-ballers" and a basketball bounces on to the scene. A basic physics engine was implemented to allow her to bounce the ball with her hands or feet on stage. Following this, she extends her arms and makes a cartwheeling motion, which causes the background to spin, and day is replaced with night. She finishes the scene by adding stars to the sky by drawing with her hands.

Between monologues there was a linking ‘game show’ section with some audience interaction. For example in the first of these linking sections the audience were given writing materials and asked to write something which the world needed more of. Later, the audience ideas were read out and an onscreen ‘clapometer’ gave an indication of the idea’s popularity. Some of the ideas were very fanciful such as ‘elephants with jetpacks’. The show ends with Leanne giving a short speech in which she professes to being unable to choose a winner between such exciting ideas.

Stage fright and distractions
During the performances, a number of problems occurred with the smooth integration of the Kinect technology into the actions and monologues of our novice performers. A number of the on-stage interactions with Kinect proved difficult due to some of the participant’s nervous energy. Compared to some of the other performers, Becky’s planned bodily movements were relatively small. This was compounded by stage fright that meant she did not perform her bodily expressions as confidently as rehearsed. This had the effect of causing the Kinect to not respond, leading to Becky moving less and waiting for the system to ‘catch up’ with her. This further compounded the situation as the Kinect was no longer able to calibrate her skeleton since the Kinect identifies moving figures more easily. This occurred several times during the early performances.

Thankfully the situation was always remedied after a short period of time and the opportunity was afforded to Becky to do her performance again. In later shows Becky became more confident, and she ensured that she added specific actions into the performance (such as stepping forwards and backwards at key intervals) to ensure the Kinect kept in calibration. Although this was effective in enabling the Kinect to maintain her skeleton, it did not add to the performance in dramatic terms.

Some of our design decisions in the final stages of the project also had a significant impact upon how the participants engaged with the audience when acting out their monologues. Many of the participants would look at the slave monitor situated in front and below them to ensure they were performing the actions correctly and the visuals were appearing on stage. While this often meant each individual scene was completed, the maintenance of eye contact with the audience and the projection of their voice forwards were often affected.

Spontaneity and audience engagement
Although we encountered a number of practical problems with the use of Kinect during some performances, most of the participants experienced no issues. Many had created monologues that meant they were in almost continual movement on stage, meaning they did not experience the same problems as Becky. Furthermore, some started to push the boundaries of the Kinect technology while on stage with spontaneous alterations to their bodily actions and performances. For instance, as noted Mary’s story was about her walking through a city. Her story was light-hearted, and in many performances Mary would spontaneously add additional movements to gain a reaction from the audience. She mimicked striding through town and dancing to music being played in the street. The performance was fun, jovial and in many ways a public expression of Mary’s sense of humour.

Furthermore, while there was occasional unreliability and lack of refinement of some of the interactions, the audience was friendly and supportive throughout. Often the audience were unaware of the problems being experienced by the performers, and when they were they waited patiently for the scene to be restarted. While we did not set out to measure audience responses to the performances—and as such cannot make any specific claims to its success in this respect—at no point was there any apparent negativity towards the problems faced on stage.

CHALLENGES FOR LONG-TERM PD PROJECTS
The primary aims of this project were loose but ambitious—to engage young people with few technical or hacking skills in the creative appropriation of Kinect as a performance tool, and for the participants to take ownership over the direction and decisions made in the development of the final performance. Here we reflect on how well these initial aims were met based upon the various strengths and weaknesses of the long-term PD approach we proceeded with. We focus on three main issues: the need to both lead and seed the PD process, the problem of having multiple activities occurring simultaneously, and issues related to depth of creativity and quality of the final performance.

Leading instead of seeding
We aimed to provide a process where the participants felt able to control the design of the final performance and make key decisions as a group along the way. Undoubtedly however the project team had great agency in influencing the outcome. Perhaps the most explicit of these was the introduction of TD in workshop 5. TD was introduced to the process by the project team because of her experience in exploring creative processes collaboratively with young people. By introducing elements of narrative to the process she allowed the participants to explore how their own lived experience could be incorporated into the content of the
final outcome. This process was delicate but TD’s guidance allowed participants to articulate and develop their theme of changing the world and also to decide the format. It is also true however that by bringing her into the process the performance outcome was implicitly directed to being theatrical. As TD continued to participate small theatrical activities continued to be performed with the participants alongside the design work for the final performance. While an aim of user/participant involvement in design processes is often to ‘seed without leading’ [26], there is little doubt that the presence of TD heavily led the project outcome.

There are also examples where the project team led in terms of orienting the participants around the ‘philosophy’ of the project. Our approach in the introductory workshops, where we introduced existing examples of digital artworks and hacks of commercial technologies, may have made a number of the participants feel we were trying to educate them. Indeed this may account for the numbers of participants dropping drastically after the first and second sessions. The workshops where we demonstrated open-source tools and concepts of programming cemented this view. While at no time was the aim to provide a teaching environment in these sessions, it would not be surprising if this was how they were perceived by some.

In contrast, there were occasions where the participants looked to the project team for explicit direction and advice. There were difficulties overcoming the perception of the researchers as experts as feedback was given on the technical capacity of the Kinect to enable some of the suggested interactions. Our aim was to give the participants sufficient technical understanding of the device but not for this detail to inhibit their sense of freedom to express ideas. Indeed by the end of the project this appeared to be the case—all of the participants suggested challenging interactions for the various scenes of their monologues. During the feedback sessions where some interactions were not implemented as the participants expected the disappointment was palpable—subsequently reinforcing the team’s desire to refine the design to suit their desires. When asked to explain the project to a member of the press, John humorously stated that: “[t]he group of budding programmers and performers bossed around some professional programmers and theatre directors”. By the end of the technical development this was almost the case.

**Diverging activities and the emergent performance**

Although we had the end-goal of producing a performance the individual workshops were relatively unstructured. The lack of precise structure to the workshops increased during the middle phases of the project as we aimed to be more responsive to the input of the participants rather than demonstrating examples of various artworks, technologies and open source tools. Rather than focusing sessions on specific themes and topics, as the project went on we would mix several activities across the two-hour session (e.g., practicing speaking to audiences, selecting music for the performance, experimenting with bodily interactions). While these factors in many ways made the workshops more interactive and interesting for both the participants and the project team, they often led to activities occurring in parallel. Individual participants would become more or less engaged, and the running of parallel activities often ruptured the cooperative group dynamic that was aimed for.

Another challenge with the project timeline was the complicated and interdependent nature of the different aspects of technical development. For example the programming development could not start until the nature of the performance had emerged and been storyboarded. Once this began there was a period where sounds and illustrations could be discussed and developed. Of course, without the supporting interactions, such development was carried out speculatively, without the opportunity for testing and iteration. This had two consequences. First, the quality of individual graphic illustrations, sounds and interaction would have been improved by being designed in sympathy—as per practices in film production where musical scores are written by composers in possession of a final edit [8]. Second, the patchy relationship between the individual elements meant that late rehearsals encountered a number of challenges. These were both technical challenges—when more complex elements were found to require more powerful computers—and challenges for rehearsal, as the participants who had previously rehearsed with only some of the elements in place had to adapt their performances. For example in Carla’s narrative the scale and shape of the book that she flicked through differed from the placeholder image she had used previously. This obliged her to change her position and pose while on stage.

**Quality of creativity and the ‘art’**

Previous research has noted that while whole body interfaces such as Kinect offer new digital interaction possibilities, our lack of experience of using the body to interact in such a way limits our imagination [15]. Hansen [15] argues that most commercial games that use Kinect presents what are essentially impoverished versions of real-world interactions—such as swinging sports equipment. Therefore, a major challenge here was introducing the Kinect technology to the participants and then build up to explore what novel interaction possibilities it provided. Our way of approaching this was to defamiliarise [2] the participants via exposing them to examples of interactive art, music and dance. The interactions they finally designed ranged from the quite literal, such as manipulating an object between the hands, to ambiguous and abstract. For instance, Mary uses her arms to rotate the entire background of her scene anti-clockwise so that the daytime sky rolls around to night. In the final scene of the performance, Carla reaches into the air and throws an image of a stage surround with curtains and lights down to the floor. While the examples we still only demonstrated a limited set of examples to the participants, these were enough to begin exploring the theme of ‘changing your environment’ creatively.
A tension may be found in the perceived quality of the final performance in terms of its artistic merit and novelty. This is a well-documented issue within the participatory and socially-engaged arts literature [16]. Indeed, many a new media artist may direct attention to how the final performance repeats a number of features of canonical augmented performance theatre (as described in [7]). However, despite its limitations, the process and the final performances enabled the participants to tell a story publically that perhaps they would have been unable to present otherwise. Indeed, it was only when the participants were provided the space to talk about their stories in workshops that the final performances started to become coherent for all involved. In the end, it was the stories of the participants—and not the Kinect technology—that took centre stage in the final performances.

GUIDANCE FOR FUTURE RESEARCH AND PRACTICE

Working with groups to collaboratively design is a great challenge. Our experiences on the Trigger Shift project offer insight into some of the benefits and barriers to be expected from long-term participatory processes with young people. We conclude by offering guidance for future researchers both working in the specific domain of PD with young people, identifying a number of strategies that might be useful to engage such groups in creative projects.

1. Provide multiple resources for defamiliarisation: An important element of supporting participation in work-contexts is to build up the resources that enable people to take part in a meaningful way (such as free time, information sharing, physical meeting points) [3] and this was no different in our work. But furthermore, it was necessary to present a number of examples from different art forms such as dance, music, theatre and visual art to act as resources for the imagination. In early workshops we used video and practical examples to defamiliarise participants with Kinect, separating it from its previous applications in gaming. The variety of resources implied a variety of gestural or whole body interactions. The different interactions in Body Paint and Animata, for example, were instrumental in enabling participants to structure ideas in the later workshops. Using hands on examples with simple interactions also allowed participants to think clearly about forming connections between bodily actions and some kind of visual effect. The workshop in which we explored this, through participants transforming an image in different ways with hand positions, gave us a solid talking point to refer back to in later storyboarding sessions.

2. Revisit designs with fresh knowledge: We have discussed how the short production period of the project meant that the team were not always able to wait for one aspect of development to be completed before starting the next. It is too simplistic to say that a solution to this problem would have been to start development earlier. First, to do so may have undermined some of the participatory aims of the project, particularly in allowing the participants to shape the final performance format. Second, some periods of development were technically complicated and required more time than could be reasonably left between two consecutive workshops. There is no perfect solution to this problem but a response is to ensure that later workshops place an emphasis on revisiting earlier design decisions with the added context of new technical resources. For example, some of the graphical elements could have had a more prominent role in the design of interactions had we revisited those interactions later in the project.

3. Plan in ‘undefined’ activities: Having extensive contact with the group meant it was often beneficial to not make all workshops activities focused on defining the performance. Even in the storyboarding and feedback workshops, TD engaged the participants in short activities where they did physical exercise, or learnt techniques to communicate better with one-another. The participants often saw these as superfluous to the goal of designing the performance—and in doing so reduced the perception that the project was principally about the final show. Yet these exercises came to be of some use in the final performance themselves. Therefore, there is great benefit in leaving certain activities undefined and allow them to be appropriated by the team and participants as a project moves forward.

4. Emphasise group work over individual activities: We described it was decided to not delineate specific roles such as musician, director and programmer to participants. The two exceptions to this were Robert—who acted as technical lead during the performance—and Amanda—who made the illustrations. Both participants expressed strong preferences to assume these roles since both had related career aspirations. Importantly, however, both still took part in the group rehearsals (Amanda had completed the illustrations, and Robert was needed to mix sound and manually switch between monologues). If we had proceeded with the original plan to clearly distinguish roles it is questionable how much the sense of group participation would have continued to develop. For example, the project team members completing the programming and bug fixing of the technical side of the performance were effectively disconnected from the final stages of rehearsal. If one of the participant’s took up programming as their ‘skill’ it may have lead to them becoming separated from the rest of the group. Similarly, during the workshops where activities occurred simultaneously, participants often became concerned they had missed out on something interesting elsewhere. Keeping the group together to make decisions and take part in activities is a key component to positive experiences to projects such as Trigger Shift, even if it impacts upon the learning of specific skills and the completion of tasks.

CONCLUSIONS

We have described in detail the participatory design of Trigger Shift, a theatrical performance augmented by
Kinect performed by and designed with a group of young people. We have discussed a number of challenges related to seeding creative appropriations of novel technologies, and how perceptions of researcher- and self-expertise can be a significant barrier to performing participatory research with teenagers and young people. We have highlighted how shifting the project from teaching skills and appropriating technology to revealing personal values and concerns helped us to collaboratively define the final performance with our participants. Finally, we have provided guidance for future research on non-expert participation in design.

ACKNOWLEDGMENTS
Trigger Shift was part of NE-Generation and funded by Legacy Trust UK. We would like to thank Annie Rigby for her support and invaluable input during the project.

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