# Unintentional intrusive participation in multimedia interactive environments

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## ABSTRACT

This paper presents data from two independent case studies, a 15 year old female with Cerebral Palsy and related profound and multiple learning difficulties and a 7 year old male with extreme behaviour associated with Autistic Spectrum Disorder. An audiovisual immersive interactive environment was developed to encourage creative interaction and expression from the participants. There were support workers present in both case studies and it is the interventions of these support staff which are the main focus of this paper. Results indicated that profuse but unintentional interventions from the staff may have distorted interaction with, dissuaded or diverted participants from meaningful engagements with the reactive feedback provided by the system.

## 1. INTRODUCTION

There is an expanding body of research into the uses of multisensory multimedia environments (MMEs), and their implementation in the (re)habilitation of people with intellectual and physical disabilities (e.g. Williams et al, 2007). These multisensory environments can vary greatly in design and content from the traditional *Snoezelen room* concept using lighting effects, colours, sounds, scents and so on, to virtual reality (VR) environments (e.g. Standen & Brown, 2005) and other environments incorporating state-of-the-art multimedia technology (e.g. Hasselblad et al, 2007). The author constructed a multimedia environment using various items of technology along with a graphical programming environment, *Eyesweb©*[1] that created visual and auditory feedback according to the gestures or movement of the person within the environment.

Within these environments, the participants' actions and interactions are usually the point of focus, enabling the participant to engage with and creatively connect to the content the medium/media provides. Often, where the participant has severe motor function or verbal communication impairments, a facilitator (often the researcher) can also be present within, or in close proximity to the active multimedia space. The facilitator provides the necessary scaffolding (Wood et al, 1976), such as placement of the sensors, or guiding limb movement to maximise the interactions of the participant. This paper discusses the external interventions of support staff in two studies of pupils with learning disabilities using the MME *Picturing Sound*. In the first study, the author acted as facilitator in close proximity to the severely disabled participant, in the second study, the author could facilitate by gesturing and verbal intervention. The system aimed to provide an environment where minimal external interventions occurred. This approach follows Ellis' work with the *Soundbeam©*[2] device and children with special needs (e.g. Ellis, 1995). Ellis stresses that his approach is non-interventionist as it '*allows children to operate from the inside – out, to resonate individually and personally with sound itself*' (Ellis, 1995, p.59).

This work is based on studies carried out over a period of several sessions in a special school. All of the pupils at the school had a range of physical and/or intellectual impairment from moderate to profound. It is the author's assertion that these people have much to gain in that they are the least independent of all society, and that these multimedia or virtual reality environments can stimulate independent creative activities and/or autonomy not possible in everyday situations or environments.

## 2. BACKGROUND AND PURPOSE

Many people with complex disabilities can live passive lives due to their perceived non-communicativity (e.g. Basil, 1992). They also often appear to demonstrate minimal spontaneous interactive behaviour (Carter,

2002). A plausible reason for this is the increased dominance and 'directiveness' given by the mother or caregiver in early interactions due to the perceived non-responsiveness of the infant child (e.g. Pennington and McConachie, 1999), this can foster a feeling of 'Learned Helplessness' (Seligman, 1975). This 'Learned Helplessness' is a state whereby a person feels they have no control over their environment or situation and that they have no power to change anything, even if they could. Many studies however have shown assistive technology (AT), and associated multimedia environments to be motivating (e.g. Goldenberg et al, 1984).

According to Brooks and Petersson (2007) facilitator intervention is critical in successful sessions of ludic or non-formal rehabilitation sessions within multisensory environments where often, incidences of *aesthetic resonance* (e.g. Ellis, 1997; Brooks et al, 2002) occur. They state that an intimate knowledge of the participant allows for 'breathing spaces' within the session to allow reflection and choice-making (Brooks and Petersson, 2007). The author adds that this intimate or long-term knowledge of a subject is not always necessary as a precondition of a successful session when the sheer novelty to a new user generates full engagement in the system, often with profound results (e.g. Williams et al, 2007). What is necessary though is a learned awareness of, and sensitivity to subtle vocal or non-verbal communications or gestures that could convey meaning. With this in mind it is important to acknowledge that in research, for example action research, there is inevitably researcher influence in outcomes. This study takes the principles offered by action research to be its baseline, but that the facilitator intervention differs from other researcher influence thus; it differs in that it does not expect an answer to a predefined set of questions, it does not predict a set of outcomes and it marries the role of researcher and subject so they co-exist as components of the research. The facilitator however fundamentally intervenes only when absolutely necessary and this intervention is at a sometimes literal, sometimes metaphorical arm's length. The facilitator withdraws or steps back (Brooks and Petersson, 2007) at *any* possible opportunity to allow the user to control and experience the responsive environment for themselves.

# 3.  METHODS

Initially, after Yin (1994) and Tellis (1997), a 4-step method of qualitative enquiry was adopted.

- Design the case study
- Conduct the case study
- Analyse the case study evidence
- Develop the conclusions, recommendations and implications

Further investigation into action research models however indicated that for this particular study, there appeared to be a shift towards researching 'with' the subject, rather than 'on' the subject in the MME as the other staff present, by their behaviour, became the focus of the data study, so a hybrid approach of case study and action research evolved.

## 3.1    System design

As this was a new exploratory study, children were selected by a contact at the school and observed using the *Picturing Sound* MME. The environment encourages the children to create sounds and images through camera-tracking technology. The system uses the *Eyesweb©* graphical programming software. The camera tracking captures gestures and converts these into visual and audio feedback. The gestural feed-forward triggers the multimedia components and this feedback can be seen to be intrinsically motivating for the participant, encouraging further movement and engagement (e.g. Azeredo, 2007). A sound-processed (Korg Kaoss pad[3]) microphone provided audio feedback; an Alesis® Airsynth[4] provided further audio feedback and an Aura Interactor™ (obsolete product) cushion was used to provide vibro-acoustic feedback (e.g. Skille, 1991).

The diagram illustrates a typical layout of the system, the capture camera converts movement into various data to trigger the visual and MIDI (Musical Instrument Digital Interface) feedback. School support staff were present at all sessions conducted and were asked to be passive observers whilst the pupils were in the 'interactive space' created by the camera scope. The complex nature of the physical or intellectual impairments of the pupils participating would deem this ethically correct and for health and safety compliance. Video footage of the pupils was recorded for analysis purposes after two qualitative methods, Ellis (1996) and Brooks & Petersson (2005). As well as illuminating examples of pupil interaction and engagement in the environment, the footage revealed instances where the interactions of the participant were 'directed' by support staff present. The results look at two examples of seemingly excessive interventions.
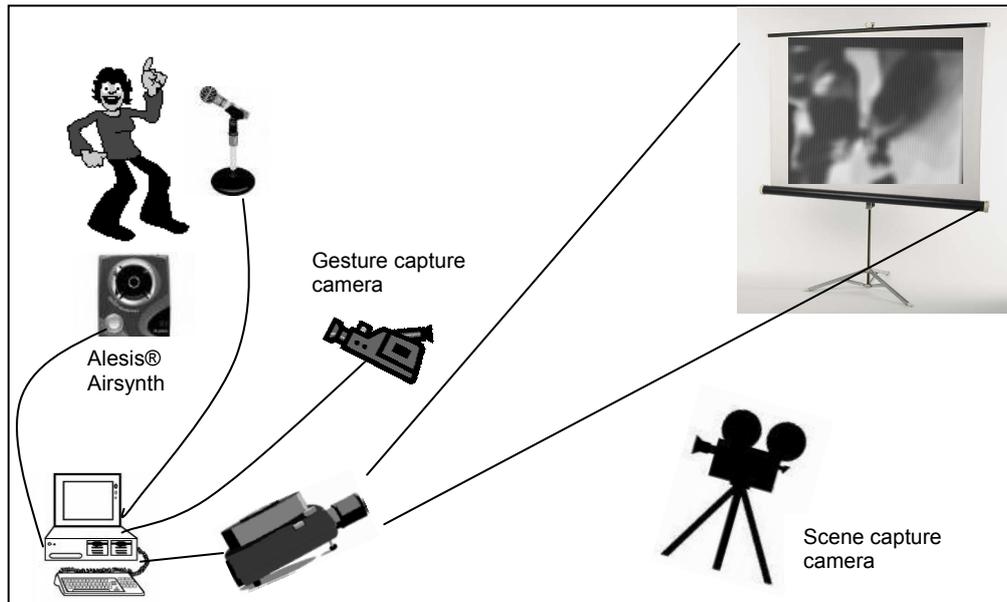
**Figure 1.** *Diagram of the system set-up.*

## 4. RESULTS

The results indicate that in both case studies, there were a significant number of commands, requests and directions from support staff, and also the author was party to some of these interventions, (however it must be noted the author was acting primarily as facilitator in the first case study, see conclusions). In case study 1, analysis revealed more than a hundred commands, directions and communications from the author and support staff. One reason for the proliferation of interruptions was possibly the curiosity of the staff towards the technology. It should be remembered that staff were briefed as to their passive role within the vicinity of the system.



**Figure 2.** *This picture illustrates the conversational background present during much of the session. Note the look of enjoyment of the activity on the participants face.*

In the first case study there were several main interventions and interruptions of note. The principal ones were:

- The members of staff who were present talking to each other audibly enough to warrant the label 'background interference noise'. This was probably due to the novelty of the system and the curiosity surrounding the technological equipment, therefore
- Members of staff calling out to the participant to interact with the processed microphone sound.
- Several members of staff calling out at the same time 'instructing' the participant to call another member of staff via the microphone.
- Staff commenting on the images the participant created through her (facilitated) movement, this was perceived as a distraction from the participant's engagement.

Further analysis revealed dialogues indicating support staff expressing 'ownership' of the communicative capabilities of the pupil. To expand on this suggestion one of the support workers stated that because the author was unknown to the participant, she would respond better to them than to the author. This cosseting approach would seem to close off or minimise any chance of widening the social interaction available to the person. The same participant's positive interactions within the same environment in a second session, reported in Williams et al (2007) would suggest the external interventions in this first session closed down any expressive intentions the pupil may have had. This observation highlights the importance of understanding the role of the facilitator in gently guiding or *scaffolding* (Wood et al, 1976) the experience of the participant rather than openly directing or initiating the interactions.

In the second case study, there was a single classroom assistant present during the session; again the assistant had been briefed to be as unobtrusive as possible during the session. The support assistant intervened more 30 times during a period of 4 minutes and 4 seconds with direct commands and gestures. The table below records indicates the frequency and type of intervention given and annotations based on the video analysis are given after the table. The Anvil software was used to encode the various interventions and the following table illustrates the frequency and type of intervention.

**Table 1.** *Frequency in minutes and seconds of spoken or gestural interventions from support worker.*

| '07 | Who's that? | '10 | Freddy that's you! | '16 | Look! | '35 | Incoherent remark |
|---|---|---|---|---|---|---|---|
| '37 | Look, where's your shoes? | '39 | Look! | '41 | Look at your shoes | '44 | Sit |
| '47 | Sit down | 1'25 | Sit there | 1'41 | Incoherent remark | 1'55 | No, sit down |
| 2'01 | Sit down then | 2'11 | Speaks with me | 2'27 | Look , that's you | 2'36 | No! |
| 2'51 | Sit down | 3'00 | Don't bite it (the mic.) | 3'05 | Don't bite it | 3'11 | Don't bite it |
| 3'12 | I tell the support worker it's ok for him to use the mic. | 3'20 | Moves hand off the mic. | 3'26 | Moves hand off the mic. | 3'30 | Wohoo! |
| 3'33 | Say, say car | 3.35 | Come on , say car | 3'37 | Touches face | 3'40 | Come on Freddy |
| 3'43 | Don't wet it | 3'46 | Say train | 3'48 | Wohoo! | 4'04 | Session ends |

The table reveals a number of different kinds of intervention or interaction, some are very easily explainable, and others need further expansion for the lay reader.

The verbal interactions can be broken into;-

- **Positive directions** – these are interventions that could be seen as encouraging the participant to engage in the environment, e.g. 'Who's that?', 'Freddy that's you!', 'Say car', however video analysis suggests that the participant in the case study was already engaging with the visual feedback created by the environment or already exploring the sonic feedback created by the processed microphone sonic feedback.

- **Imperative directions** – these are interventions where the assistant directs or orders the participant to do something, e.g. 'Look at your shoes', 'Sit!'.

- **Negative directions** – interventions where the assistant directs or orders the participant not to do something e.g. 'Don't bite it', 'Don't wet it'.

The non-verbal interventions can be classed into two categories;-

- **Non-tactile** – interventions where the assistant moves into the *kinesphere* (Laban and Lawrence, 1974) of the user, which is the space surrounding the body that one can touch without moving. Figure 3. Illustrates the participant's unwanted interference from the support worker by his physical movement away from the assistant as she moves his hand away from the microphone.

- **Negative-Tactile** – interventions where the assistant physically intervenes by moving the participants hand away from the microphone.

The analysis of the session using the authors intrusive interventions coding system within the Anvil Video Analysis Tool[5] illuminate the depth of the unintentional but nevertheless intrusive interventions to the extent that;-

- The interventions affected Freddie's interaction with the visual feedback.
- The interventions directly curtailed Freddie's interaction with the microphone.

It must be stressed that the analysis shows these interventions occurred *after* the subject was already engaged

in an activity and not to encourage engagement in an activity.



**Figure 3.** *The support worker moving the participant's hand away from the microphone during vocal interaction with it.*

## 5. CONCLUSIONS

The findings corroborate with researchers who have found that there can be an excess of interventions or dominance in shaping events from caregivers in interactions with people with intellectual and physical impairments (e.g. Nind & Hewitt, 1994). There appears to be an inherent wish to 'jump in too soon' if a participant does not 'perform' to a pre-conceived idea of what they are supposed to do (Brooks and Petersson, 2007) also a unintentional cosseting of activity such as the 'aww bless' mindset (Williams, 2004). An assertion is made here that some of these interventions are a kind of projected positive outcome that the assistant may want to achieve or experience themselves rather than allow the participant to experience some independent activity or connection with the *aesthetic resonance* (Brooks et al, 2002) that may occur as a result of intense engagement with the environment.

The results of case study 2 would indicate a counter example of the findings of Petersson (2006) and Brooks and Petersson (2007). They posit that time to reflect on dialogues, whether verbal or non-verbal is necessary from facilitators acting within the interactive spaces. The author posits that interactions within such multimedia environments should be grounded in responses rather than initiations which has implications for training potential facilitators and those other people present at such sessions. It would be appropriate to add that further research in designing improved systems and methodologies is necessary to develop this area of research. The continued employment of expert gesture analysis tools such as the Anvil Analysis Tool in tandem with adaptations to tools based on the *Component Process Model of Emotion* (Scherer, 1993) and techniques such as *Recursive Reflection* (Brooks and Petersson, 2005) should ensure further inroads into the theory, understanding and knowledge base of multimedia multisensory environments.

## 6. REFERENCES

M Azeredo (2007), Real-time composition of image and sound in the (re)habilitation of children with special needs: a case study of a child with cerebral palsy, *Digital Creativity*, **18**, 2, pp. 115-120.

C Basil (1992), Social Interaction and Learned Helplessness in Severely Disabled Children, *Augmentative and Alternative Communication,* **8**, 3, pp. 188-199.

A L Brooks, S Hasselblad, A Camurri and N Canagarajah (2002), Interaction with shapes and sounds as a therapy for special needs and rehabilitation, *Proceedings of ICDVRAT 2002, The 4th International Conference on Disability, Virtual Reality and Associated Technologies, Veszprém,* Hungary, pp. 205–212.

A L Brooks and E Petersson (2005) Recursive reflection and learning in raw data video analysis of interactive 'play' environments for special needs health care*, Proceedings of Healthcom2005, 7th*

*International Workshop on Enterprise Networking and Computing in Healthcare Industry*, Busan, Korea, pp. 83-87.

A L Brooks and E Petersson (2007), Stillness design attributes in non-formal rehabilitation in: *Computers in Art Design and Education - CADE2007, 12-14th September. Perth, Curtin University of Technology,* Australia, pp. 36-44.

M Carter (2002) Communicative Spontaneity in Individuals with High Support Needs: an exploratory consideration of causation. *International Journal of Disability, Development and Education,* **49**, 3, pp. 225-242.

P Ellis (1995), Incidental Music: a case study in the development of sound therapy, *British Journal of Music Education,* **12**, 1, pp. 59-70.

P Ellis (1996), Layered analysis: a video-based qualitative research tool to support the development of a new approach for children with special needs, *The Bulletin for the Council for Research in Music Education, University of Illinois at Urbana-Champaign*, USA, pp. 65-74.

P Ellis (1997), The music of sound: a new approach for children with severe and profound and multiple learning difficulties, *British Journal of Music Education,* **14**, 2, pp. 173-186

E P Goldenberg, C J Carter, S J Russell, S Stokes, M J Sylvester and P Kelman (1984), *Computers, education, and special needs*, Reading, MA: Addison-Wesley.

S Hasselblad, E Petersson and A L Brooks (2007), Empowered Interaction Through Creativity, *Digital Creativity,* **18**, 2, pp. 89-98.

R Laban and F C Lawrence (1974), *Effort*, Macdonald & Evans Ltd., London, UK

M Nind and D Hewitt (1994), *Access to Communication; Developing the basics of communication with people with severe learning difficulties through intensive interaction,* David Fulton, London.

L Pennington and H McConachie (1999), Mother–child interaction revisited: communication with non-speaking physically disabled children, *International Journal Language & Communication Disorders*, **34**, 4, pp. 391-416.

E Petersson (2006), *Non-formal learning through ludic engagement within Interactive environments*, PhD Thesis, Lunds University, Malmö Studies Educational Science, Sweden

M Seligman (1975), *Helplessness: Depression, Development and Death.* W H Freeman, New York.

K R Scherer (1993) Studying the emotion-antecedent appraisal process: An expert system approach. *Cognition and Emotion*, **7**, pp. 325-355.

O Skille (1991), *Manual of Vibroacoustics*, ISVA Publications, Levanger, Norway.

P J Standen and D J Brown (2005), The use of virtual reality in the rehabilitation of people with intellectual disabilities, *Cyberpsychology and Behavior*, **8**, 3, pp. 272 - 282.

W Tellis (1997), Application of a case study methodology, *The Qualitative Report*, **3**, 3, http://www.nova.edu/ssss/QR/QR3-3/tellis2.html

C Williams (2004), The picturing sound multisensory environment; An exploration of the potentials of the Eyesweb© software platform with pupils with SLD and PMLD, *Unpublished Masters Thesis,* University of Wales, Newport.

C Williams, E Petersson and A L Brooks (2007), The Picturing Sound Multisensory Environment; An Overview of its Efficacy, *Digital Creativity* **18**, 2, pp. 116-114.

D Wood, J S Bruner and G Ross (1976), The role of tutoring in problem solving, *Journal of Child Psychology and Child Psychiatry*, **17**, pp. 89-100.

R Yin (1994), *Case study research: Design and methods*, 2nd ed., Sage Publishing, Thousand Oaks, CA.

[1] www.infomus.dist.unige.it
[2] www.soundbeam.co.uk
[3] www.korg.com
[4] www.alesis.com
[5] www.anvil-software.de