Where Did It All Go Wrong? A Model of Error From the Spectator's Perspective

A. Cavan Fyans, Michael Gurevich, Paul Stapleton
Sonic Arts Research Centre
Queen's University Belfast
BT7 1NN
UK
{afyans01, m.gurevich, p.stapleton}@qub.ac.uk

Abstract

The development of new interfaces for musical expression has created a need to study how spectators comprehend new performance technologies and practices. As part of a larger project examining how interactions with technology can be communicated with the spectator, we relate our model of spectator understanding of error to the NIME discourse surrounding transparency, mapping, skill and success.

Keywords: performance, skill, transparency, design, HCI

1. Introduction

A primary goal of NIME is to foster performances with new technologies that are judged to be as skillful and expressive as those of traditional music. Yet the need to address both the performer-system interaction and the spectator's cognition of that interaction is often overlooked. NIME tends to treat musical expression as an extra-musical quantity contained within a work or performance, with little regard to the audience's role in the greater ecology [1]. Past literature generally priveleges the performer-system interaction focusing on issues of skill, expression, mapping and gesture recognition [2, 3, 4], while leaving undefined the systems through which the spectator assesses and understands performative interactions. It is also commonly assumed that expression and skill are measurable quantities inherent in and dictated by the interface [5, 6] rather then a subjective assessment made by the spectator of the performer-systen interaction. Without considering the spectator's cognition of such interactions, it is difficult to understand how judgements about skill and success are made.

1.1. Five Issues for Spectators

Bellotti identified five issues for designers of interactive sensing systems using a human-machine communication approach [7]. Reconsidering these from the spectator's perspective forms the basis of this project [8]. The initial stage of this project addresses the issue of *accident*: How the spectator gains an understanding of error between a performer and system, its influence on the spectator's assessment of performance (including skill and success) and how an understanding of these may inform future design.

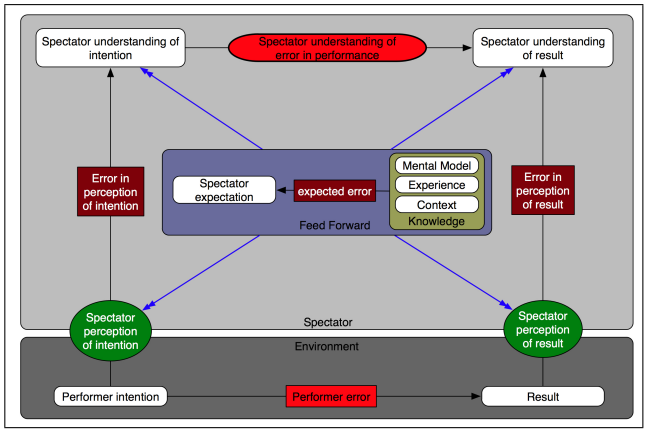

Figure 1. Model of spectator understanding of error.

1.2. Model of Spectator Understanding of Error

Previously we developed a model of how spectators understand error in performance [8]. The model (Fig.1) describes how different sources of error judgement contribute to an overall understanding of error in observed performative interactions.

2. Mental Models, Transparency & Mapping

A user interacting with a system forms a mental model of how the system works [9]. We assume that a spectator similarly forms a mental model as the basis for understanding an observed interaction (performance). It is also shown that mental models directly affect our ability to solve problems and assess observed physical actions [10, 11]. In past NIME literature the concept of a user's or spectator's mental model of an interaction with a system has been mostly lost among notions of transparency and cognition of the technicalities of gesture to sound mapping [5, 12]. Transparency, considered initially as a quality of the mapping [5], describes the level to which a performer or spectator can understand the relationship between the input (gesture) and output (sound). It is

postulated that an instrument's capability for expressive performance is dependant on transparent mapping for both the performer and spectator [12]. However, the systems through which the performer and spectator acquire an understanding of the mapping of an interface are not defined or explored. Further, it is assumed that the level of transparency is directly proportional to the degree to which a spectator can understand the interaction (performance), with no distinction given to the mechanisms by which the spectator gains this understanding. In traditional music literature, it is commonly assumed that the spectator relies on prior knowledge and understanding of both the idiom and instrument in order to assess a performance [13]. Similar generalisations are brought forward into new digital instruments [6]. However, these generalisations do not necessarily apply due to the nature of rapidly emerging performance technologies, instruments and practices in this field. We argue that rather than transparency, a more useful tool for examining cognition of interaction is the spectator's mental model, which has been shown to directly affect understanding and the ability to assess an interaction, and is strongly rooted in HCI and cognitive science literature.

3. Error, Success and Skill

When observing a performance with a new instrument or in an unknown idiom it is likely that the spectator will form mental models based on generalisations from context and past experience. These models may be inaccurate due to inadequate sensory information, lack of knowledge [14] and inappropriate attention distribution [15]. The spectator's expectation will also be based on similar generalisations creating inaccurate predictions of future actions and therefore misdirected perception [16]. These consequences of novel performance situations may lead to inaccurate error assessment due to misunderstanding or misperceiving the intention and result. As NIME promotes performances that afford greater skill and expression, the challenge for designers is to ensure that these can be effectively communicated with the spectator. For a spectator, skill is a judgement based in part on knowledge, experience and assessments of the degree of difficulty and success of a performance. We define the spectator's understanding of success as the continuous proximity of the spectator's understanding of the performer's intention and the spectator's understanding of the result, the inverse of error. This project focuses on error as a starting point for understanding skill and success, defining the spectator's understanding of these as the objective judgement regardless of the emotional response.

4. Summary and Future Work

Our model shows that understanding error, and assessing skill and success are dependent on a varied set of environmental and personal factors. This model can therefore be used as a tool for assessing and designing skilful performative interactions through understanding the communication of error. We suggest this research may also be useful for system design where users are expected to learn through observing others. Future research in this project will be focused on testing the model and examining the relationship between spectator understanding of error and skill. This will be conducted through iterative digital instrument design, performance research and human subject experiments.

References

[1] M. Gurevich and J. Treviño, "Expression and its discontents: toward an ecology of musical creation," in *Proc. of the Conf. on New Instruments for Musical Expression (NIME)*, 2007, pp. 106–111.

[2] C. Dobrian and D. Koppelman, "The 'E' in NIME: musical expression with new computer interfaces," in *Proc. of the Conf. on New Instruments for Musical Expression (NIME)*, 2006, pp. 277–282.

[3] S. Benford, "Expected, sensed, and desired: A framework for designing Sensing-Based interaction," *ACM T Computer-Human Interaction*, vol. 12, no. 1, pp. 3–30, 2005.

[4] S. Reeves, S. Benford, C. O'Malley, and M. Fraser, "Designing the spectator experience," in *Proc. CHI*, 2005, pp. 741–750.

[5] S. Fels, A. Gadd, and A. Mulder, "Mapping transparency through metaphor: towards more expressive musical instruments," *Organised Sound*, vol. 7, pp. 109–126, 2003.

[6] C. Poepel, "On interface expressivity: a player-based study," in *Proc. of the Conf. on New Instruments for Musical Expression (NIME)*, 2004, pp. 228–231.

[7] V. Bellotti, M. Back, W. K. Edwards, R. E. Grinter, A. Henderson, and C. Lopes, "Making sense of sensing systems: five questions for designers and researchers," in *Proc. CHI*, 2002, pp. 415–422.

[8] A. C. Fyans, M. Gurevich, and P. Stapleton, "Spectator understanding of error in performance," in *CHI Extended Abstracts*, 2009.

[9] J. K. Doyle and D. N. Ford, "Mental models concepts for system dynamics research," *Syst. Dynam. Rev.*, vol. 14, no. 1, pp. 3–29, 1998.

[10] S. Vosniadou, *Mental Models in Conceptual Development*. Kluwer Academic Publishers, 2002.

[11] S. Blakemore, D. Wolpert, and C. Frith, "Why can't you tickle yourself?" *NeuroReport*, vol. 11, no. 11, 2000.

[12] A. Hunt, M. M. Wanderley, and M. Paradis, "The importance of parameter mapping in electronic instrument design," in *Proc. of the Conf. on New Instruments for Musical Expression (NIME)*, 2002, pp. 1–6.

[13] S. Davies, "Philosophical perspectives on music's expressiveness," in *Music and Emotion*, P. Juslin and J. Sloboda, Eds. Oxford University Press, 2001.

[14] D. A. Norman, "Design rules based on analyses of human error," *Commun. ACM*, vol. 26, no. 4, pp. 254–258, 1983.

[15] R. Green, "The psychology of human error," *Eur. J. Anaesth.*, vol. 16, no. 03, pp. 148–155, 2006.

[16] D. Huron, *Sweet Anticipation: Music and the Psychology of Expectation*. The MIT Press, May 2006.