Effects of observer experience on continuous measures of engagement with a contemporary dance work

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Abstract
Dance is multifaceted and interculturally complex. Empirical approaches to investigating the ways in which observers respond to dance offer a potentially productive means of understanding the cognitive bases upon which these responses to dance are generated. This study demonstrates one such approach, by measuring the responses of two groups of observers to a single dance performance continuously, as the performance unfolded. Specifically, we asked a group of dance students and a group of dance professionals to record their engagement with the same professional solo contemporary dance performance as a means of investigating whether and how the responses of dance students and professionals differ. Our analysis of these measurements demonstrates both similarities and differences between the two groups. On the basis of this analysis, we speculate that both students and professionals respond to choreographic ‘disjunctures’ in which expectations are overturned, which we term ‘gem moments,’ and that mature artists’ responses to dance differ from those of students through a change in degree – an increased ability to respond to ‘gem moments’ – rather than through a shift in the kinds of choreographic structures that elicit increasing engagement.

Keywords: dance, audience response, dance and cognition, cognitive science.

Introduction
In studying how observers respond to dance, a key question is, what do people respond to? What kind of conceptual organization underpins people’s ability to engage with and respond to dance? Choreographic practice could be thought of as a process of experimentation in which different configurations of movement are developed and tested, in performance, to see whether and how they elicit audiences’ engagement. As Hagendoorn suggests “… every solo performance can be seen as an attempt to answer the question of how a single body can capture and hold the audience’s attention (Hagendoorn forthcoming, 5).” In other artforms, such as music, there are relatively well defined components such as harmony and rhythm, that contribute to the structural framework. Even if these frameworks do not fully encapsulate or define the experience of listening to music, they provide established conceptual principles through which studies in Western music reception might be productively organized. The picture in dance is less clear, as the conceptual basis on which movement might be parsed into meaningful units, and, given the inherent analogue structure of movement as continuous flow, even the notion that meaning in dance depends on dividing dance stimuli into meaningful units, is highly contested (Calvert et al 2005, deLahunta & Barnard 2005).

The ambiguity surrounding the conceptual bases of dance reception suggests a case for the use of empirical methods to investigate how audiences respond to dance. Dance scholarship has a long and rich tradition of generating cultural readings of dance practices, which might be described as an ‘intertextual turn’ in dance scholarship (Melrose 2003). However, these readings are not necessarily available to all members of a dance audience, which is typically composed of mixed groups of people, some of whom have extensive dance expertise or experience while others have little or none. Further, the intertextual and culturally specific nature of intertextual analyses mitigates their validity in the different cultural and personal contexts a typical audience might bring to their experience of watching a dance. Investigating the bases on which dance audiences construct their responses to a dance, cannot, therefore, proceed entirely through a consideration of the readings of dance produced through dance scholarship, but must look to more empirical methods that can interrogate the process of responding to dance without assuming we know the conceptual basis upon which this process takes place.

A number of studies have investigated responses to dance by developing post-performance assessment tools (Glass, 2005), and by addressing audience development from a marketing perspective (James, 2000; Walker-Kuhne, 2005). While post-performance measurement tools probe audiences’ responses to a dance work as a whole, moment-
by-moment responses to choreographic form and structure are more difficult to investigate because they are necessarily subsumed in the process of generating a cohesive response to a dance work at its conclusion. However, understanding how responses to dance are generated by specific and cumulative choreographic structures and devices throughout a dance is critical to understanding how dance elicits cognitive and emotional responses.

In previously reported work, we have used the portable Audience Response Facility (pARF) – PDAs that record audience response continuously – to measure audiences’ ‘engagement’ with a dance work, sampling the responses of up to 20 observers and plotting the average engagement response time series. We have identified what we term ‘gem moments’ in observers’ responses to dance, in which average engagement increases fairly suddenly across a group of observers. We have also analysed the agreement between observers, and found that a ‘gem moment’ is often associated with a drop in agreement between observers. By analysing what kinds of choreographic structures coincide with these kinds of responses, we have hypothesized that periods of high engagement often follow choreographic ‘disjunctures’ or surprises, and that periods of high agreement tend to be associated with more predictable dance structures (Vincs et al 2007, Vincs et al 2009).

In the experiment reported here, we compared continuous responses recorded from two distinct kinds of dance observers, dance experts and tertiary dance students, to a solo work by a professional contemporary dance artist. Our aim was to see whether there were any distinctions between the two groups. We hypothesized that any differences in the responses of the two groups would indicate ways in which dance artists’ approaches to apprehending dance change over the course of their transition from student to professional artist, and therefore yield information about the specific ways in which dance artists construct their responses to dance. We used video recordings of the performances to correlate the kinds of choreographic structures that were associated with specific aspects of the responses, and motion capture to determine the dynamic characteristics of movement passages associated with areas of increased engagement.

We have been able to identify some differences and similarities in the responses of dance students and dance professionals when watching the same dance. Dance professionals responded with more ‘gem moments’ during which their engagement rose quickly. The findings provide a basis from which we argue that dance training does affect the ways dance students see, understand and respond to dance. We suggest that responding to dance is an active process, and that the shift from student to dance professional may entail a heightened ability to actively engage with a dance rather than necessarily a fundamental shift in the conceptual frameworks upon which observers respond to dance.

**Method**

**Materials**

The dance stimulus we used was a six-minute contemporary dance work by a contemporary choreographer-performer. The work was a solo performance, drawn from a longer work the artist had recently presented publically and re-choreographed by the artist to present a cohesive performance. She performed it once without music and once with music for two sets of observers. The music was a sparse, atmospheric, musical score with textural sounds interspersed with periods of silence rather than a consistent rhythmic structure.

**Participants**

This dance work was observed by 7 dance professionals and 12 dance students from Deakin University’s dance program in the first session, and by 3 dance professionals and 14 students in the second session. For the purposes of this paper, which is to compare the responses of dance professionals and dance students, only the results of the first session, and the performance without music are analysed because these give a reasonable sample size of both professionals and students,1 and eliminate the possibility that the musical score elicits responses independently of the dance movement.

**Procedure**

Observers were asked to record their ‘engagement’ on a 0–10 scale using the pARF measurement tool. (Glass et al. 2007, Stevens, Glass et al. 2007, Stevens, Schubert et al. 2009). The pARF consists of 20 hand-held palm pilot (personal digital assistant – PDA) computers. The PDAs record the path of the stylus along the horizontal axis, and measurements are transmitted to a central computer server and sampled twice per second. The observers were given the following definition of ‘engagement’;

compelled, drawn in, connected to what is happening, interested in what will happen next’. This term is often used by choreography teachers because it implicitly directs students towards evaluating a dance’s ability to employ structural logic and movement imagery to draw an audience’s attention, rather than towards its ability to ‘entertain’ (although the two are not mutually exclusive).

The observers were then asked whether they had any questions about the definition of engagement. When all questions had been answered, the observers were asked to watch the dance performances and to move the stylus along the horizontal axis of the PDA to indicate their engagement with the dance work. The scale ranged from 0 – 10, where 0 was completely unengaged, and 10 was very engaged.

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1 If subsequent phases of analysis demonstrate sufficient similarity in responses between dance professionals and dance students, respectively, across the two sessions, it may be possible to pool the results across sessions. Further analysis will examine whether the two sets of results are similar enough to do this.
Equipment
The dance performances were videoed and motion captured using a 24 camera Motion Analysis optical motion capture system, a 40–marker standard animation marker set and a sampling rate of 60fps.

Results
Average engagement was graphed for each group (Figure 1). Video analysis of the dance was scrutinized to identify dance structures associated with sudden rises in engagement. We determined the ‘gem moment’ responses by identifying any time points at which the average engagement increased by a minimum of 0.1 points in one second for one or more seconds (on the 11 point Engagement scale used by the observers, which translates to 1.74 points per second on the 191 point pARF scale shown in Figure 1). We eliminated from this set the time points where this increasing engagement was followed in the next second by a decrease in engagement. We chose this method so that we could identify moments in the dance that marked the beginning of a period of rising engagement, and eliminate moments where, while engagement increased quickly, it then oscillated or quickly decreased. Motion capture data were used to calculate the sum of the absolute velocities of all markers, to gain a measure of the overall dynamic level of the movement. When any of the markers moved more quickly, the sum of the absolute velocity of all the markers will increase. We did this to examine whether increasing movement velocity would be associated with increasing engagement. The result is graphed (Figure 2).

Figure 1: Average engagement across time (seconds): dance experts and dance students, session 1, no music, n=19.

Figure 2: Time series of all marker absolute velocities summed, for session 1, n = 19.
Using the video footage of the dance, we were able to identify changes in dynamic within the dance that preceded the hypothesized gem moment responses. We have previously reported similar associations between movements that disrupt observers’ expectations and the generation of gem moment responses (Vincs et al. 2007, 2009). The dance used in this study consisted of subtle movements that involved precise and often unexpected changes in the performer’s gaze and spatial orientation, and used abstracted conversational gestures to create variation between movements. Gem moments seemed to be associated with sudden, if often subtle, shifts in movement dynamic, and with the sudden introduction of new gestural material.

Visual inspection of the mean response time-series plots of the participant groups in session 1 (12 students and 7 experts) revealed that the general profile of the responses seems to follow a similar pattern of rising and falling over time (Figure 1). However, dance experts exhibited more gem moment responses than dance students: Dance experts had 29 gem moments and students 21. Eleven of these gem moments were shared by both groups. There were 39 gem moments overall. 46% of these gem moments were recorded by experts, 26% by students, and 28% were recorded by both groups. Rises in the absolute velocity of motion capture markers were not associated with gem moments.

**Discussion**

In this study, we investigated whether the continuous responses of dance students and dance professionals to a dance differed from each other. While engagement varied over time in similar ways in the response patterns of students and professionals, we found that ‘gem moments’ – moments in the responses during which average engagement increased quickly – dance experts responded with more of these rises in engagement than did the students.

Are gem moment responses learned as part of dance training and hence indicative of a maturing artistic perspective, or are gem moment responses a more widespread response to dance shared by experts and novices? If responding to gem moments is learned as part of the process of becoming a dance artist, we would expect to see a difference between experts and dance students’ responses. If responding to gem moments is a more widespread mode of dance response within the general (non-expert) community, we would expect to see either similar responses to gem moments between students and professionals, or more gem moment responses from students. Our results support the idea that gem moment responses are a part of mature artists’ responses. We speculate that the professional artists in our study might have responded with more gem moments because they are more active and skilled observers of dance, able to see and appreciate more subtle movement detail than the students.

Motion capture data were used to see whether any of the gem moment responses could be associated with whole body increases in movement speed or dynamic, which would be reflected in the combined absolute velocity of the markers. There was no consistent association between increased all-marker absolute velocity and increasing (or decreasing) engagement. One reason for this might be that the motion capture data reveals very small changes in movement velocity at a higher sample rate (60hz) than the pARF data (2 hz), and therefore records changes in the dance movement at a higher sensitivity than that which elicits changes in average engagement in a group of observers. In addition, it could be that changes in movement trajectories are more closely linked to gem movements, suggesting that further analysis should examine differencing of absolute velocity, or identifying periods of rise and fall in movement. For example, the large peak in motion at around the 51st second (Figure 2), matches with corresponding peaks in engagement responses (around sample 410 of Fig 1, the 205th second elapsed). It may also be that the context of the changing dynamics – the shift or disruption in expectations in the dance movement that were found to be associated with gem moments – occurs at a conceptual level rather than a movement one. That is to say, disruption of expectation in dance movement cannot be completely defined in terms of movement speed, but must also be defined in terms of the overall and cumulative conceptual organization of movement within a dance. It may be, in fact, this cumulative conceptual organization of the movement, and, more specifically, the relationship of specific movements to the higher order structures that organize the dance as a whole, that the experts in our study were more adept at recognizing and responding to.

**Conclusions**

Our results show some similarities between the responses of dance experts and dance students to a dance as it unfolds in that both groups responded with increased average engagement that seemed to be associated with moments of surprise or disruption of expectation, and in that the general rise and fall of engagement across time follows a similar pattern. However, dance experts respond with more frequent ‘gem moment’ responses in which average engagement rises quickly, than students when watching our dance stimulus for the first time, and without music. While gem moments represent only one of many possible ways in which continuous audience response data could be analysed, our results provide us with a basis upon which to speculate that mature artists’ responses to dance are characterized by a change in degree – an increased ability to respond to ‘gem moments’ – rather than shift in the kinds of choreographic structures that elicit increasing engagement. We also demonstrate, through this study, an approach to investigating audiences’ responses to dance that is empirical, and which, with further development, has the potential to probe the ways in which our conceptual understanding of, and hence responses to, dance are structured as a dance unfolds.
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References


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