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INTEGRATING DANCE AND COGNITIVE SCIENCE: TOWARD EMANCIPATORY RESEARCH

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While interdisciplinary dance research is said to be flourishing, most research linking experimental psychology and dance reveals suppressive economies of methodology, ideology, and institutional support, which have resulted in impoverished exchanges of information between researchers in dance and the cognitive sciences. Recently, however, a number of joint research projects, with scientists and dance artists collapsing the boundaries between studio and laboratory, have produced highly integrative theoretical and applied dance research aiming to serve both the scientific and artistic communities while still preserving the integrity of the different approaches brought to bear. This paper examines several of these projects, considering how their structures, strategies, goals, and results reflect both persistent barriers to interdisciplinary engagement and ambitious motion toward more competent and balanced communication between the arts and sciences.

In March of 1999, a three-day symposium titled “The Meeting of Art and Science” was held at the October Gallery in London. Organized by theoretical physicist David Peat and sponsored by the Arts Council of England, this meeting brought a group of artists and scientists together in a closed format with no stated goals or final public presentation of results. The meeting was intended to provide an environment where scientists and artists could communicate openly and freely with each other, to encourage the expression of risky or speculative ideas, and was also to “...conduct an experiment to see just what a highly creative group of artists and scientists would talk about when gathered together in a congenial environment.”¹

Perhaps predictably, there was a lot of complaining – about frustrations with institutions and commercial markets, funding and support agencies, administrative hurdles in each group’s respective workplaces, about impasses in advancement in both the arts and the sciences, and about the lack of progress both groups perceived in art-science collaborations. However, the meeting also fostered discussions of creativity, of commonalities and differences in approaches and working methods in the arts and the sciences, and on the effects of art and science in the world. Also, several research collaborations were initiated between artists and scientists who attended the Meeting.

Since around the time of the October Gallery meeting, we have seen both the emergence of the sci-art movement, in which scientists and artists collaborate with the goal of producing works of art, and a flourishing of interest in collaborative science-based arts research. This increase in research projects linking dance to science has occurred primarily in Britain, France, Germany, and Australia. A number of publications have been produced which focus on cognitive analyses of dance performance and dance spectatorship, including a yearbook by the German

Society for Dance Research² and articles on dance perception that have appeared in numerous cognitive science journals and other publications.³ There has also been an increase in public events, including a symposium titled “Dance and the Brain” that was coordinated by researcher Ivar Hagendoorn and sponsored by choreographer William Forsythe in Frankfurt in 2004. This new research considers such topics as the perception of dance movement, motor imagery, bodily memory, crossmodal processing of music and dance movement, and the cognitive processes underlying the creation of choreography and improvisation.

Though cognitive dance research is taking numerous forms, from experimental psychologists collecting empirical data on dance movement and perception to choreographic projects focused on the how the mind perceives the dancing body, it is especially pleasing to see research being undertaken in which dancemakers are engaged in active collaboration with scientists, or where individuals with backgrounds in both dance and science are carrying out cognitively-oriented dance research projects. This research makes a move away from models of engagement between dance and the sciences that constitute what Julie Klein calls an “interdisciplinary archipelago,”⁴ in which dancers serve only as “guinea pigs” and dancemakers derive little more than novel forms and images from their exposure to scientific theories and technologies. Following Klein, I cite Richard Pring’s distinction between interdisciplinarity and the *integration* of disciplines: while the former term implies the inclusion of more than one discipline in a research program, the latter denotes an actual uniting of disciplines and knowledge forms to produce hybrid knowledge and research results.⁵

Since its emergence as a subfield of dance studies in the early 1980s, dance science has largely been synonymous with “dance medicine.” The mission statement of the International Association of Dance Medicine and Science reads “IADMS promotes medical, scientific, and educational activities aimed at enhancing the treatment and training of dancers with the ultimate goal of improving dancers’ health, well-being, and performance.”⁶ Dance medicine scientists apply biomechanical and psychological research with the goal of optimizing performance and dancer health through the study of the therapeutic or educational applications of dance, training and performance methods and experiences, the emotional impact of injuries, and issues of abnormal psychology such as eating disorders. Such psychological research is of obvious value to funding institutions which promote the health and well-being of artists and athletes. The value of theoretical research on the cognitive psychology⁷ of dance, however, is less clear.

Whatever its form, cognitive research on dance performance and spectatorship expands the discipline of dance science by offering theoretical insight into how dancing minds, dance-making minds, and dance-viewing minds work, rather than focusing exclusively on the therapeutic applications of empirical research. It is valuable both for dance science and for the larger discipline of dance studies to include within dance psychology approaches to the study of dance, choreography, and dance spectatorship which acknowledge both the complexities of liveness and the influence of culture on dancemaking and dance spectatorship, and which view dance behavior as more than a source of injury, anxiety, or pathology.

In this paper I address the following questions: What does recent dance research which integrates dance and cognitive psychology offer the discipline of dance science? What forms is this integrative cognitive dance research taking? What helps and hinders such projects? What persistent issues confront them? Is there an ideal form for integrated dance/cognitive-psychology projects? I will describe some features of recent projects and discuss how these reflect a highly desirable release from constraining methodologies and ideas regarding the practices of both scientific and dance research, as well as an ambitious and productive move toward balanced collaboration, with reference to Habermas' communicative model of emancipatory interests. Because of format constraints I focus here primarily on two projects: the *Choreography and Cognition* project,⁸ organized in 2003 by Scott deLahunta and Wayne McGregor, and the two recent three-year projects generated by Australian contemporary dance pioneer and scholar Shirley McKechnie titled *Unspoken Knowledges: Expanding Industry Productivity and Value through Strategic Research Into Choreographic Practice* (1999-2001), and *Conceiving Connections: Increasing Industry Viability through Analysis of Audience Response to Dance Performance* (2002-2004).⁹ Given McKechnie's admittedly superstitious preference for thirteen-word project titles, I will refer below to these two projects as "the Australian projects" for convenience. I will focus on three crucial aspects of these collaborative projects: industry-directed research vs. "blue-sky" projects, project facilitation, and the effects of project sizes and scopes on cross-disciplinary communication, research structure, and project outcomes.

"Blue sky" vs. industry-directed research

In an interview, Scott deLahunta used the term "blue-sky research" in reference to the *Choreography and Cognition* project.¹⁰ deLahunta's usage of this term, which is typically used to refer to projects deemed either impractical or not financially sound, was not wholly meant in this sense but was instead intended to indicate his

project's lack of industry-stipulated direction.¹¹ This usage nonetheless points out an important concern for integrated research projects. *Choreography and Cognition* was a milestone in dance research not only because of the extended period of exchange of ideas between dancers and scientists, as has been noted by Johannes Birringer,¹² but also because the project was not tied to financial goals such as audience increase or the improvement of dancer's health. deLahunta and choreographer and co-organizer Wayne also sought to eliminate the influence of the dance performance market by requiring McGregor to produce movement material solely for use within the project during the project phase and to postpone the development of any new performance choreography until after the collaborative work. deLahunta also wished "to avoid the piece standing as evidence of an engagement with science."¹³ McGregor's subsequent piece *AtaXia*, which investigates the experience of incoordination, was nonetheless directly influenced by his engagement with the scientists.¹⁴

In contrast to the *Choreography and Cognition* project, both of the Australian projects were structured around specific industry-directed questions. *Unspoken Knowledges* sought to examine 'choreographic cognition,' the complex thought processes underlying dancemaking, with an aim toward enhancing both industrial understanding and the cost-effectiveness of choreographic processes.¹⁵ The process involved scientists observing several choreographers during the creation of new works for performance. *Conceiving Connections* was an examination of audience responses to contemporary dance works with the goal of audience development. This was accomplished through the development of a detailed questionnaire which was administered to selected audiences before and after performances. The data collected yielded information on how observers interpret and respond to contemporary dance and on the effects of background information and viewer expertise on audience response.

Both industry-driven and open-ended research offer potentially valuable insight into dance-making and dance-viewing experiences. However, the availability of funding for "blue sky" research opens the door to research questions on facets of dance which are not of particular interest to shareholders, but which are of great interest to dancemakers and cognitive dance researchers. For example, Tony Marcel and Phil Barnard of Cambridge's Cognition and Brain Science Unit collected data on how dancers parse dance movement phrases, as well as on what units of movement dancers perceive as the smallest phrasal constituents within movement passages. Fellow researcher Rosaleen McCarthy, who has a primary research interest in the nature of cognitive representations, employed a dual-task interference paradigm¹⁶ to study the effects of cognitive disruption on dancers' mental imagery and memory processes. The potential of cross-cultural study of such issues is intriguing, to say the least,

but the point here is that such experimental designs offer little of interest to industry-driven funding models with an aim of generating either economic or therapeutic benefit.

Sometimes an artist's interests lead to a situation in which unpredictable collaborations with industry emerge on their own. Kitsou Dubois, a French dance artist who choreographs in situations of altered gravity, teamed up with astronaut training organizations in the United States and Europe so that she could conduct choreographic research in zero gravity conditions. Discussions with astronauts and observations of accompanying astronauts-in-training on board the "Vomit Comet," a plane specially outfitted to perform parabolic flights for the purpose of astronaut training in zero gravity, led Dubois to conclude that astronauts were not being ideally trained to move efficiently in weightless conditions. In tandem with her own choreographic project, she developed an astronaut training regimen which reflected both her specific physical knowledge as a dancer and her experience and observations within the astronauts' work environment.¹⁷ This dual-outcome research program greatly facilitated her access to opportunities for parabolic flight, while also generating publicity for her choreographic projects. Both sides thus benefited from her presence in this most unusual of laboratories.

Facilitation

Both Scott deLahunta, organizer of *Choreography and Cognition*, and Shirley McKechnie, organizer of the two Australian projects, refer to their roles in the projects as "facilitator." These individuals not only coordinated their respective projects but also educated both the dancers and scientists involved and facilitated communication between them. deLahunta first developed the idea of a collaborative dance-and-science research project with choreographer Wayne McGregor, then set up meetings between McGregor and a total of 12 scientists before the two of them selected final project participants. During the course of the project, he coordinated grantwriting, helped to refine the collaborative research themes and procedures and facilitated ongoing communication between the choreographer, dancers, and scientists, and facilitated the ongoing communication within and between the groups. After the collaborative research phase was completed, deLahunta co-authored papers with collaborating scientists and spoke on panels with them, occasionally joined by McGregor and dancers from the project. Shirley McKechnie's facilitation of the Australian projects took a similar form as she pulled together an interdisciplinary team comprised of Kate Stevens and other scientists, arts scholar Robin Grove, and professional and student choreographers and dancers, as well as coordinating logistics and grantwriting and later publishing papers on her

own or in collaboration with other scientific participants. Stevens, whose research focus is primarily in auditory cognition, notes that it was McKechnie who got her interested in dance research in the first place and who introduced her to the literature on dynamical systems theory, which would become their common theoretical ground.¹⁸

McKechnie and deLahunta are both characterized by backgrounds which span dance, science, and technology, their fluency in interdisciplinary discourses, and their interest in collaborative research between dancemakers and scientists. It is noteworthy, though, that both during and after the project phases, deLahunta and McKechnie both clearly have often served as representatives for the choreographers and dancers in publications and discussions with scientists and the public. The fact that communication is mediated by the facilitators in this way indicates an imbalance in communication, in the form of a persistent fetishization of scientific discourse, between these two groups and with their audience. It can be hoped, though, that as dancemakers' engagements with science increase and deepen, such mediation may someday no longer be necessary. As deLahunta states, "If the collaborators themselves possess the willingness and empathy, and have an understanding of inter-profession issues...then it may not be necessary to create an additional job within the framework."¹⁹

McKechnie and deLahunta also regulated initial project planning and the discourse between the choreographers and the scientists in ways which further highlight a communicative imbalance. In initial meetings with scientists, deLahunta and McGregor decided first to give the floor to McGregor to describe his projected activities with the dancers before permitting the scientists' input.²⁰ McKechnie, for her part, had already been warned by choreographer Anna Smith that she "did not want to be told what to do" by the scientists. They were therefore permitted only to observe her rehearsals and had no input in her choreographic process. However, over time a scheme emerged in which Smith communicated with the scientists about her thoughts and activities by speaking to them on the videotapes used to record her rehearsals. In addition, Smith made her working journal available to the scientists, as did two of the student dancers.²¹

A further indication of the persistence of fetishization of scientific discourse in collaborative dance/cognitive-psychology research contexts is given by the fact that the grants for both of these projects were held neither by the facilitators nor choreographers, but by one of the collaborating scientists. Shirley McKechnie, a dance artist and scholar who has had a lifelong interest in the sciences, brought Kate Stevens onto the Australian project team to provide, as McKechnie puts it, the "graphs, statistics, and figures" she felt necessary to ensure that

the proposed project could address the rigorous empirical standards of the Australian Research Council's grant program.²² Similarly, though deLahunta wrote the bulk of the application for the *Choreography and Cognition* project, the award holder is Rosaleen McCarthy, a Senior Lecturer in the Department of Experimental Psychology at the University of Cambridge who participated in the project as a collaborating scientist and who provided feedback on the application.²³

Project size and communication

Choreography and Cognition and the two Australian projects were of substantial scale, each involving one or more choreographers, several dancers, and several scientists. The projects were able to attract large sums of money, in no small part due to their large scope. *Choreography and Cognition* was awarded a grant of £29,925, or around US \$57,000 from the Arts Council of England and the Arts and Humanities Research Board, for a seven-month period.²⁴ *Conceiving Connections*, the second of the two three-year Australian projects, was awarded grant funding and in-kind support totaling over \$1,000,000 Australian, or US \$770,000.²⁵ The scope of the projects enabled the production of a diversity of results in terms of research questions, approaches, and level of analysis. The scientists chosen to participate brought a broad range of research focuses and methodologies to the projects, including the cognitive analysis of dancer's notation systems (Alan Blackwell), the parsing of dance phrases (Tony Marcel, Phil Barnard), the phenomenology of choreographic process (Tony Marcel), the neuropsychology of movement planning (Alan Wing & Kristen Hollands), and measurement of audience members' psychological responses to contemporary dance (Renee Glass and Kate Stevens). The high level of financial support also enabled the Australian organizers to contract choreographer Anna Smith to work on a single choreography for a full nine months, an arrangement pleasing to choreographer and cognitive researchers alike.

Such long-term engagements create situations in which sensitive dialogue can emerge as individuals learn about and come to value the language, processes, and goals of each others' disciplines. Sometimes the scientists derived little or no value from studio exercises whose outcomes were very satisfying to the dance artists. In turn, some of the articles produced by the scientists were of limited value to the artists, particularly those relying heavily on statistical analysis of small movement data units. Other papers, meanwhile, have proven valuable for both dancers and scientists. Commenting on the varying research processes and outcomes, deLahunta makes it clear that

though the analysis of the data collected took divergent directions according to the specific disciplines of the participants, all the groups involved derived a great deal of value from the collaborative work in the studio.²⁶

Reflection on the manifold and varied results of such projects opens a reconsideration of ideas about what constitute ideal collaborative and communicative arrangements. Jürgen Habermas developed the idea of “emancipatory interests” as a model for communicative competence and as a preferred alternative to the systems of technical interests, which are primarily concerned with prediction and the possibility of technical control of the environment, and practical interests, which focus primarily on intersubjective understanding as the principle means of generating knowledge. Emancipatory interests focus instead on the formation of reason through interaction, a process which, according to Habermas, can deconstruct the ideological force of technical interests and offset their tendency to fetishize empiricism.²⁷ Communication is essential to Habermas’ critical project because it is through language that the emancipatory interest is fulfilled. In Habermas’ ideal communicative situation, there must be freedom of speech, all individuals must be empowered to speak, and power must be distributed equally to all strata in the society.²⁸

When groups working within a collaborative community have the desire, time, and facilitation to share each others’ environments and technologies, and to experience each others’ cultures of theory and practice, processes of reflection and learning can take place that foster awareness of discursive ideologies and offset the dominance of empirical discourse. If the members of both interest groups feel empowered by, and satisfied with, the communicative history of the project as time passes, spaces of confidence can emerge in which discursive boundaries, along with the boundaries between the studio and the laboratory, can be confronted and crossed as the idea of balanced communication is viewed in a longitudinal manner, rather than solely in terms of individual short-term project interests. When production or publication quotas are either met or eliminated, and when each group feels that their methodologies and experiences are understood and validated by the other, scientists can feel more at liberty to speculate and reflect on empirical standards and biases, and choreographers and dancers can participate in empirical study without assuming that objectification and exploitation by a fetishizing technical interest is the only participatory option available. When this happens, rather than having as a goal a single, ideal model of communication and engagement throughout the project, collaboration becomes fluid, flexible, more broadly productive, and mutually satisfying for its participants. This seems to have been the case in both the *Choreography and Cognition* project and the Australian projects, though over different time frames. deLahunta was able to create

a research community which immediately began producing dialectic, self-reflective research, with each side learning about and from the other from the earliest stages of the collaboration. The two initial Australian projects remained more results-oriented due to their guiding research questions; however, they are now followed by a third project led by Kate Stevens which is guided less by shareholder interests than its predecessors.²⁹

Emancipatory exchange of course does not have to take place solely on the level of verbal discourse, but can also include shared experiences of dancing. At the October Gallery meeting described above, two invited contact improvisation dancers conducted a movement exercise which, according to organizer David Peat, “helped to disperse feelings of skepticism and distrust, establishing an environment which was conducive to enlightening discussion.”³⁰ Kate Stevens has already conducted a workshop in the initial phase of her new Australian project in which the participating scientists have learned about improvisational dance by doing rather than simply by observing.

Conclusion

In his essay, “A Case for Cognitivism,” film theorist David Bordwell points out that cognitive approaches share the same concerns as other theory bases more commonly employed within the arts and humanities. He advances the rather sly argument that though cognitive approaches to art are often met with skepticism, seen as limited in application, or rejected outright because of their reliance on empirical and potentially reductionist methods, the approach is nonetheless as valid as many other approaches currently being taken to the arts, and can potentially offer better explanations to some issues than other perspectives in contemporary theory, particularly problems which contemporary theory has tended to downplay or ignore.³¹

In integrative research that is not overly predetermined by industry-approved questions, methods, or agendas, new research questions can emerge and the ramifications of existing ones can be evaluated through a process of reflective critical communication, rather than being rigidly pre-scripted according to established institutional schemas. Such research can also lessen the pressure of both research and dancemaking markets by reducing or eliminating the requirement of industry-specified results. It is hoped that the value offered by cognitive dance studies will continue to be increasingly recognized not only by research funding agencies at large but also by educational institutions worldwide. Dance is a register of human behavior which, like so many others, has the

potential to illuminate ways in which individuals, influenced by both nature and culture, engage with space and time, and mind and body, to make dance and to watch it go by.

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¹Peat, David. "Report on the Art and Science Meeting." Online. 8 Aug. 2006 <<http://www.f davidpeat.com/pcnl/octreports.htm>>.

² Birringer, Johannes, and Fenger, Josephine, Eds. Tanz im Kopf: Dance and Cognition. Münster: Lit Verlag, 2005.

³ See for example Hagendoorn, Ivar. "The Dancing Brain." Cerebrum 5.2 (2003); Hagendoorn, Ivar. "Some speculative hypotheses about the nature and perception of dance and choreography." Journal of Consciousness Studies 11.3-4 (2004): 79-110; Stevens, Catherine and McKechnie, Shirley. "Thinking in action: Thought made visible in contemporary dance." Cognitive Processing 6.4 (2005): 243-252; and Calvo-Merino, Beatriz, Glaser, Daniel, Grezes, Julie, Passingham, Richard, and Haggard, Patrick. "Action observation and acquired motor skills: an fMRI study with expert dancers." Cerebral Cortex 15.8 (2005): 1243-1249.

⁴ Klein, Julie Thompson. Interdisciplinarity: History, Theory, and Practice. Detroit. Wayne State University Press, 1990.

⁵ Pring, Richard. "Curriculum Integration." Proceedings of the Philosophy of Education Society of Great Britain 5.2, Supplementary Issue (Jul 1971): 170-200.

⁶ International Association for Dance Medicine and Science Home Page. 20 Sept. 2006 <<http://www.iadms.org/>>.

⁷ Cognitive psychology is a subfield of psychology which is specifically concerned with the study of mental processes and representations. Areas of focus include sensory perception, attention, memory, learning, decision-making, language processing, and spatial cognition. In focusing on the development of abstract explanatory models of how the mind works, cognitive psychology differs from cognitive neuroscience, which is primarily focused on the development of models of mental function based on brain architecture and activity.

⁸ Project website: <<http://www.choreocog.net/>>.

⁹ Project websites: <http://www.ausdance.org.au/unspeken/index2.html> and <http://www.ausdance.org.au/connections/>. These projects are also extensively documented in Grove, Robin, Stevens, Catherine, and McKechnie, Shirley. Thinking in Four Dimensions: Creativity and Cognition in Contemporary Dance. Melbourne: Melbourne University Press, 2005.

¹⁰ deLahunta, Scott. Telephone interview, 5 Oct. 2006.

¹¹ deLahunta, Scott. E-mail to the author. 24 Jan. 2007.

¹² Birringer, Johannes. "Neurowissenschaft: the dancing brain." Ballettanz 13 (Feb 2006): 16-19.

¹³ deLahunta interview.

¹⁴ See <<http://www.choreocog.net/ataxia.html>> and <www.randomdance.org>. McGregor will continue his collaboration with neuroscientists in Spring 2006 with a residency as the first Innovator-in-Residence at Sixth College at the University of California, San Diego.

¹⁵ Stevens, Kate, McKechnie, Shirley, Malloch, Stephen, and Petocz, Agnes. "Choreographic Cognition: Composing Time and Space." Woods, C. Luck, G.B., Brochard, R., Seddon, F, O'Neill, S. and Sloboda, J.A., Eds. Proceedings of the 6th International Conference on Music Perception and Cognition. Keele: Keele University, 2000.

¹⁶ In experimental research involving a dual-task paradigm, subjects are asked to perform two different tasks at the same time, such as reading while counting or, as in McCarthy's experiment, imagining a known sequence of choreography while simultaneously performing simple motor or verbal tasks. Differences in speed or efficiency of performing the tasks are measured and analyzed. It is assumed that differences in performance reflect diminished allocation of resources for the execution of one or both tasks and/or interference between the tasks due to overlapping demands on specific cognitive resources.

¹⁷ See Dubois, Kitsou. "Dance and Weightlessness: Dancers' Training and Adaptation Problems in Microgravity." Leonardo 27.1 (1994): 57-64.

¹⁸ McKechnie, Shirley. Telephone interviews, 6-7 Oct. 2006.

¹⁹ deLahunta, Scott. Willing Conversations: The Process of Being Between. Leonardo 39.5 (2006): 479-481.

²⁰ deLahunta interview.

²¹ McKechnie interviews.

²² McKechnie interviews.

²³ deLahunta e-mail.

²⁴ End of Award Report, Art and Science Research Fellowships. Online. 21 Feb. 2005 <www.choreocog.net/texts/mainrept.doc>.

²⁵ McKechnie interviews.

²⁶ deLahunta interview and e-mail.

²⁷ Habermas, Jürgen. Knowledge and Human Interests. Transl. Jeremy Shapiro. Boston: Beacon Press, 1971.

²⁸ Habermas, Jürgen. "Discourse ethics: Notes on philosophical justification." Lenhardt, Christian and Nicholsen, Sherry Weber, transl. Moral Consciousness and Communicative Action. Cambridge: MIT Press, 1990: 43-115.

²⁹ The third Australian project, which will run from 2005 to 2007, carries the 13-word title *Intention and Serendipity: Investigating Improvisation, Symbolism, and Memory in Creating Australian Contemporary Dance*.

³⁰ Peat, *op. cit.*

³¹ Bordwell, David. "A Case for Cognitivism." IRIS 9 (1989): 11-41.