Interactivity in Contemporary Dance and Music

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1   Motivation

As far as I remember, "high" art forms and experimental approaches to artistic expressivity have always attracted me. Contemporary dance[1], which emerged in the second half of the 20th century, has not been an exception to my curiosity. I was lucky to study my undergraduate at Middle East Technical University, which has the oldest and one of the most respected contemporary dance companies in Turkey: METU Contemporary Dance Society. On top of it, I have happily been getting exposed to so many different approaches for musical expressivity in my masters study in Georgia Tech Center for Music Technology.

In my first year in Georgia Tech, I started wondering about the relationship between music and contemporary dance from a rather technical point of view. As a result, I wanted to implement a system that overlaps the bodily gestures of a single dancer and the musical composition. The gestures and the composition does not necessarily create each other from scratch. The system wouldn't limit the dancers movement as it would defeat the philosophy of freedom in contemporary dance. Similarly, movements of the dancer would not synthesize the music but rather alter the nuances in the music such as changes in playback speed, loudness, reverb, filtering, grain intensity (if granular synthesis is used) and so on...

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[1]In this paper, the term "contemporary dance" is used as the genre of dance, which is the continuation of modern, and postmodern dance rather than implying all dances present today. Typically, a dancer will introduce herself/himself simply as a "contemporary dancer", if she/he dances in this particular genre; whereas others will specifically name their style (tango, hip-hop etc...).

I started thinking about the system and I opened the idea to a friend of mine who is an amateur dancer in METU Contemporary Dance Society and asked if she would be interested in collaboration. I got a very discouraging response: She basically stated it is not how contemporary dancers work as the dance comes the first and the music should not control the dance anyhow.

The response made me wonder: Why would a dancer, dancing in a style which has taken out previous rules for liberation of dance, not be hesitant to set new rules? What would be the reason that restricts a dancer's mind to explore a choreography that would also directly manipulate the sound in any way the mind can imagine? Is it the fear that the music will take over the dance and strip it out of its emotions and stories? Is it the general attitude of the contemporary dance community or is there a chance that we are facing an artistic "paradigm shift" inside the community itself?

Afterwards I have let my ideas of a practical system stay dormant in my mind, because regardless of who was right or whether we understood each other's point, her statement made me realize I was putting the tools and methods over the artistic ideas and I should first think about the conceptual ideas before thinking of the technical ones.

This paper is a journey of mine to find answers to these questions. After an introduction to the evolution of modern dance in the 20th century and I will explain the interactive ideas inside contemporary dance. I will then dive into examples of interactivity in contemporary dance and music, and based on the examples I will show differences, powers and difficulties underlying in interactive performances with respect to non-interactive counterparts.

While giving the examples of interactive contemporary dance and music, I will indeed talk about technical realizations; however, since I'm more interested in artistic ideas behind interactivity (and I want to suppress my engineering instincts), I will not try to define, categorize or thoroughly investigate the systems explicitly. Readers who want to learn more about technical details in various implementations are encouraged to refer to the papers cited in section 4 and [1, 2].

2 Introduction

"Dance, is the movement of the body in a rhythmic way, usually to music and within a given space, for the purpose of expressing an idea or emotion, releasing energy, or simply taking delight in the movement itself". It is an essential part of nearly all cultures from prehistoric times to the modern era. [3]

Emerging in the start of 20th century, modern dance defied the dictated movements, artificial gestures and standardized costumes of classical ballet. The style is inspired from expressionism: Isadora Duncan, the most important figure of early modern dance, used feelings, instincts and inner conflicts as her inspiration. The movements were fluid and inspired from nature. [4]

In the 1940s, it was the expressionism's turn: with Merce Cunningham as the main figure, dancers reacted against the dependance of narrative and emotional expression. Cunningham, wanted to relate the dance to itself and separated dance from music and design. He worked with John Cage and used *chance operations*.[5] His dance consisted of complex movements. Believing anything can be turned into dance, everyday movements like walking, sitting were integrated virtuosically to the choreographies. [6]

Later, postmodern dance claimed that any movement is a dance and everybody can be a dancer. They took out Cunningham's complex dance technique and simplified the movements. They carried on not using any narrative and they disregarded any spectacle such as lighting, costume and stage. [7]

Today, modern dances continue their legacy with contemporary dance. Contemporary dance has taken narrative and emotional expressions back inside the performance while retaining a simpler choreography and everyday movements. [8] In this sense contemporary dance is more of a philosophical idea than choreographic.

3 Interactive Contemporary Dance and Music

The word *interactive* is defined by Oxford Dictionaries as "influencing or having an effect on each other" [9]. In arts, it is a debatable how to define a work as interactive. One might accept a work as interactive only if the spectators are invited to contribute to the performance, while another might simply claim a music band is highly interactive because their stage shows makes "the crowd go wild".

In the dance case, there is indeed an interaction between any kind of dance and its music, as whether the music is played live or from a recorded medium dancers try to synchronize with the music. However, the level of interaction is fairly comparable: typically folk dances involve improvisation in dance and music, each changing the other one. The line between musicians and dancers is not sharp; dancers can sing or make rhythms with their body and a musician might join dancing while playing an instrument. The spectators are welcome to join and even in some cultures it might be regarded as an insults if you stand back, when you are asked to join. On the other hand, a lot of dance performances from tango competitions to classical ballet use recorded or strictly notated and rehearsed music during a dance performance and the performance is rated by how well they stick to the predetermined dance movements and music. The spectators are not supposed to affect the show. Except the intermissions, they can only appreciate the dance "silently", without making any gestures that might distract the performers and fellow spectators. It is not important if this "tradition" is necessary or not; but it separates the spectators and the performance from each other.

In this paper when I talk about interactive dance, I mean a direct, active and real-time connection and manipulation of different elements that forms the dance performance, such as the dancers, music, lighting, spectators, setting of the stage with each other. Thus, in an interactive dance and music performance, music can be synthesized or processed by the reactions of these elements and the music itself can be able alter them.

Interactive dance and music have attracted interest in both academia and dance companies.

Jam sessions in which dancers and musicians shape each others performance are widely accepted under contemporary dance. With the development and increased affordability of motion tracking, sensor technologies and algorithms, lots of dance performances have started integrating such technologies.[2] There have also been a lot of implementations using technology for interactivity in dance and music. [10, 11, 12, 13, 14, 15, 16, 17, 18] These advancements have been used to create artistic works by several dance companies such as the Troika Ranch, Ventura Dance Company, Palindrom and by academia such as interactive installations and performances by Todd Winkler, the Danish Institute of Electroacoustic Music's the Digital Dance Project, and Arizona State University's Motion[e].

4   Case Studies

In this section, three cases will be investigated, namely The Digital Dance Project, the Palindrome and the Troika Ranch, in detail. The main focus is their standings and experiences with interactivity in dance and music, which will bring some insight to the question I've asked in the first section.

4.1   The Digital Dance Project

Wayne Siegel is an American composer and professor in the Royal Academy of Music in Aarhus, who has been actively composing for nearly 40 years. In 90's he has explored possibilities of interactive computer music both technically and philosophically in The Danish Institute of Electroacoustic Music, DIEM.

The Digital Dance project was one of such explorations. [19] In this project, aesthetic consequences of an interactive dance/music system, new roles or the dancers, choreographer and composer in an interactive performance, and possibilities/drawbacks of practical implementations are explored.

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[2]A nice resource about dance and technology is "The Dance & Technology Zone Website". Online: `http://art.net/~dtz/`

The group has built a hardware interface called DIEM Digital Dance Interface. The interface can use up to 14 flex sensors that are connected to a wireless transmitter unit. Flex sensors measure the angles of the limb it has attached to. The sensors are placed in elastic sleeves, which are used for sports injuries and such. A stationary receiver converted sensor data received via wireless transmission into MIDI data. MIDI data is sent to a computer which controls synthesis parameters.

The interface has been used to form several performances. One of the most notables ones is *Sisters* choreographed by by Marie Brolin-Tani.[3] The choreography and the music of the performance has effected each other during the realization process and during the rehearsals, they have been developed jointly. In [20], Siegel explains the choreography, music and the technical system. He states clearly that music had no notion to surpass or even be of equal importance with the dance and explains *"the composers task was to create software that would produce sounds to accompany the choreography."*

4.2 Palindrome Dance Company

Palindrome Dance Company[4] is one of the oldest and well-respected dance companies in the contemporary dance scenery. Robert Wechsler, the founder and artistic director of Plaindrome, has started experimenting with interactivity in 1974 by using electronic sound making "boxes" responding to lighting conditions changed due to his movements during dance. [21] The group has got its name in 1982 in New York and moved to Germany in 1988. The works by Palindrome are based on interactions between dancers, technology and sometimes audience.

In 1995, the company has started using computers with the assistance of computer engineer Frieder Weiß, who had then co-directed with the group until 2006. Frieder Weiß has been actively developing Eyecon, a *"video-based motion sensing system which allows performers to generate or control music and projected images through their movements and gestures in space"*. [15]

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[3]The performance is available online: http://vimeo.com/13756682

[4]The company's works and ideas are well documented and are easily accessible online at www.palindrome.de. Readers should read the statements, manifestos and publications and watch the performances if they really want to grasp the artistic work of the company and its evolution throughout the years.

Palindrome also uses body-worn electrodes such as EEGs in their performance.

Over years, Palindrome has gathered an outstanding knowledge and experience in interactive dance and music. Yet, the group's main focus has always been artistic pursuit; the technology has only been used as a tool to realize it. [22] Even when explaining the physical set-ups and software, Robert Wechler clearly emphasizes what kind of technology used is much less significant than how it is used and the technology should not suppress the reason. Although having worked with Frieder Weiß for 10 years and most of the technical works with computers are attributed to his contributions, he (while acknowledging his colleagues works) further suggests artists not to work with engineers because his and other's experience show that results will have "lower tech but higher art". [21]

Being one of the pioneers in integrating technology to dance, Palindrome has faced many apprehensions along with praise. In [23], Wechsler has pointed the concerns of dancers and choreographers alike:

> *Resistance to the use of computers in the dance world is deep-rooted and, being a dancer, not hard for me to understand. In contrast to some professions, computers are not making our lives any easier. For one thing, in its present state of development, work such as ours requires an inordinate amount of patience, something dancers are not generally blessed with. Moreover, to many they represent a denial of, or at least a distraction from, that which is most essential to dance: the expression of the sensual and "primitive" aspects of human life. For these reasons the role of crusader does not sit well with me. In our performances we seek to draw attention to this and other dilemmas surrounding the increasing computerization of our world, even as we succumb to the irresistible attraction of new possibilities.*

In the same paper, he also acknowledges, with some exceptions, technology has neither made a huge impact on how performances are prepared nor it made the works better. He explains a group does not need technology to interact as it is inherently inside dancing. Nonetheless, he shows technology is useful to form interactivity by giving examples from the works in Palindrome and expresses technology can be used to reverse dancing in synch with music to making music in synch with dance.

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4.3 Troika Ranch

Troika Ranch has been founded by Mark Coniglio and Dawn Stoppiello in 1994. The word "troika", a type of carriage drawn by three horses used in Russia, symbolizes dance/theater and music while "ranch" symbolizes the interactivity between these three disciplines. The artists' mission in producing live performances, interactive installations, and digital films is to create artwork that best reflects and engages contemporary society. The Troika Ranch mainly uses their own image processing application called Isadora® [24], developed by Mark Coniglio.

The company identifies its main driving for as interactivity between anything involved in the performance, from dancers, to audiovisuals and audience. Recorded media allows one work to be duplicated very easily and in complete precision however due to this property it especially prevents the performance to be manipulated. Mark Coniglio gives an example of this disadvantage of dancing with "taped" music, rather than an interactive dance and music system as:

> *I often witness the tension between recorded media and live performance when I attend performances in one of New York Citys small, alternative modern dance venues. It is almost a given in these situations that the dancers will perform to music pre-recorded on a compact disc. On any given night, these performers have the potential to give the performance of a lifetime, given the right combination of skill, an understanding of their instrument (i.e. their body) in relation to the material that they are to perform, and an awareness of the nebulous (but, as any performer will acknowledge, real) feedback loop between performer and audience. But, when the performers attempt to nuance a gesture or phrase in response to the aforementioned relationships, an unrelenting and unaware companionthe digitally recorded music with which they performthwarts them. In this situation, they cannot hold a spectacular balance because if they did, the music would race on ahead of them and a subsequent phrase of the dance would suffer as they attempt to catch up. [25]*

5 Comparison of Interactive and Non-Interactive Content

As interactive and non-interactive performances aim (and bring) conceptually different outcomes, it is not correct to talk like one is better than the other but we can simply put out the cases where one is more advantageous over or different than the other.

- Interactivity between dance and music blurs the lines between the dancers, the choreographer and the composer. It extends the role of the dancers to the composer as their conscious movements are now the part of compositional process and to the choreographer as their conscious movements are now the part of choreographic process.

- Interactivity between dance and music allows the artists to pursue new way to show expressivity.

- Allows dancers to stretch the music according to their movements so they are actually relieved of strict timing limitations. Dancers may gain more comfort and saliency than dancing to "taped" music.

- Each performance of the piece will be more different than each other and thus each performance is now highly reproducible.

- "Interactive dance places quite different demands on the dancers than than the demands placed on the instrumentalist simply because dance is a primarily visual medium. If a dancer performing for interactive dance is forced to make an awkward gesture foreign to the performance, it will detract from visual focus and disturb the visual expression." [20] It is a main challenge, as it pushes the creativity and potentials of everybody involved in the project from choreographers, composers to dancers and technical assistants.

- In an interactive performance, the dancers not only need to concentrate their bodily movements but they may also need to think of the consequences mapped to music. This leads to another level to complexity to the act. This increase in complexity, even though it does not necessarily contradict the philosophical idea between contemporary dance that everybody can dance (since a

choreography just may not be suitable for non-experienced dancers), it makes things harder for a regular human-being. Even professional dancers, who are not traditionally trained for such interaction, so it may be hard for a dancer to accept and dance in an interactive medium.

- Mapping dance to music and music to dance (and graphics etc.) is a dual sonification/visualization task. Thus the mappings needs to be carefully addressed to avoid common sonification [26] and visualization [27, 28, 29] problems without forgetting dance is the main story-teller and music is the accompaniment. Still, the sonification/visualization issues can not be deemed as a disadvantage of interactive works over non-interactive because an artistic work relies mainly on the creativity of the contributors not the methods. Methods are just the way to achieve such art...

- The success of an interactive work is typically more dependent of the technology and a performance can be considered successful or not due to the robustness of the interactive system. The system has to be easily controllable/maintainable before and during the performance. The collaborators should also understand the limitations of their system and choreograph, compose, dance accordingly. They should never forget that technology does not take away their responsibilities, technology's sole role is to try to achieve an interactive medium.

6 Conclusion

From the start of 20th century, modern dance forms have revolutionized the idea of dance in both choreography and philosophy, and with the emergence of easy-to-use, cheap and powerful technologies like computers, high-quality sound recording and playback devices, projectors, sensor-based systems (such as cameras, motion tracking technologies and accelerometers) in the end of 20th century, a lot of artists involved in contemporary dance community have been experimenting new methods and ideas in dance and have integrated technology to their performances to some extend.

Nowadays, most of the technologies such as sound playback, graphics design/projection and

lighting, and their usage during a contemporary dance performance can be considered as "familiar" as they are typically finalized before the performance and presented in predetermined time and ways. Although contemporary dance is the frontier in finding new approaches in expressivity, there has been a skepticism in the community about interactivity of elements in the performance. Nevertheless, there are a handful successful works using interactivity in contemporary dance and music.

There is no doubt that inserting interactivity in contemporary dance opens the doors to explore new ways of expressivity. An interactive system compliments improvisations and nuances, so the remakes of the original performance need not be the same as a "taped" dance performance; thus the reproducibility of artistic work is boosted.

It also grants new roles to the elements of a dance performance: Similar to Keislar's interpretation of the roles in music with abstractions [30], an interactive medium becomes an abstraction of an instrument and dancers become an abstraction of instrumentalists (yet, it's far from being the dancers role). The choreographer and the composer becomes the meta- of each other and if technical assistants work with their own initiative to map events between composer and choreographer, they also become creative meta-choreographer/composer of the performance. The contributions of each collaborator are not drawn by red lines anymore; rather the role of each person and even technology overlaps with each other. Consequently, each element benefits from an increased freedom in expressions and they have to carry more responsibilities on their backs in the same time.

It should be noted that the aim of comparison is not to praise interactivity in dance to non-interactive approaches. First of all, it is an artistic choice to add interactivity to your performance. The decision is pretty similar to composing for fixed media, playing notated and rehearsed music versus playing free-jazz or making jam-sessions. In both cases, I don't believe anybody can claim one is better than the other; we can at most state our personal tastes. What is more, it shouldn't be forgotten that even when an interactive system or methodology is taken out of the stage and the spectators are only allowed to show their appreciation by clapping and cheering in the end of the

performance, appreciation of the performance itself is still an (and probably the most important) interaction between the artists and the crowds.

One thing artists should not confuse is why they are doing and how they are doing the interactive performance. All elements used in a performance such as lightings, clothes, sensors, computers, loudspeakers arrays, even humans are merely tools to express art. Relying on technical assistance too much and getting carried away by what technology offers might cloud the idea or the story that pushed the artists's to form a work. They also have to be careful that the dance should be the focus of the project and everything else should be used to support it. If it is not the case for some elements in performance; then they shouldn't be there from the first place. (or maybe the final work is not totally in the scope of contemporary dance)

The only thing I couldn't find an answer to is the possible future of contemporary dance and interactivity in this dance style. Looking at the trends in contemporary dance, it is pretty evident that the way it has followed has been very unpredictable. On top of that today's world is the "fastest" humanity has ever lived in and it's getting faster and faster. Everyday, new technologies emerge and get exploited immediately [31], and we face new social and political phenomenon that we could have only imagined [32]. We just have to wait and see how contemporary dance will undertake and blend these changes with the art, and I believe we are lucky to be clueless...

7   Acknowledgements

References

[1] A. Mulder, "Human movement tracking technology," tech. rep., Simon Fraser University, 1994.

[2] R. Wechsler, "Motion Tracking – a practical guide for performing artists." Online: http://www.palindrome.de/content/files/book%2016.doc, 2008.

[3] B. O. Encyclopedia, "Dance," 2010. [Online; accessed 12/1/2010].

[4] I. Duncan, *The art of the dance*. Theatre Arts Books, 1970.

[5] J. Cage, "An autobiographical statement," *Southwest Review*, vol. 76, no. 1, p. 59, 1991.

[6] R. Copeland, *Merce Cunningham: the modernizing of modern dance*. Theatre Arts Books, 2004.

[7] N. Carroll, "Post-modern dance and expression," *Philosophical Essays on Dance*, pp. 95–104, 1981.

[8] S. Banes, *Terpsichore in sneakers: post-modern dance*. Wesleyan Univ Pr, 1987.

[9] O. Dictionaries, "interactive," April 2010.

[10] A. Camurri, "Interactive dance/music systems," in *Proceedings of International Music conference (ICMC'95)*, pp. 245–252, 1995.

[11] T. Winkler, "Creating interactive dance with the very nervous system," in *Proceedings of Connecticut College Symposium on Arts and Technology*, 1997.

[12] A. Camurri, S. Hashimoto, M. Ricchetti, A. Ricci, K. Suzuki, R. Trocca, and G. Volpe, "Eyesweb: Toward gesture and affect recognition in interactive dance and music systems," *Computer Music Journal*, vol. 24, no. 1, pp. 57–69, 2000.

[13] A. Camurri, B. Mazzarino, S. Menocci, E. Rocca, I. Vallone, and G. Volpe, "Expressive gesture and multimodal interactive systems," in *Proceedings AISB*, 2004.

[14] V. Dyaberi, H. Sundaram, J. James, and G. Qian, "Phrase structure detection in dance," in *Proceedings of the 12th annual ACM international conference on Multimedia*, pp. 332–335, ACM, 2004.

[15] R. Wechsler, F. Weiß, and P. Dowling, "EyeCon – a motion sensing tool for creating interactive dance, music and video projections," in *Proceedings of The Society for the Study of Artificial Intelligence and the Simulation of Behaviour (SSAISB)'s convention: Motion, Emotion and Cognition*, University of Leeds, England, 3 2004.

[16] G. Qian, F. Guo, T. Ingalls, L. Olson, J. James, and T. Rikakis, "A gesture-driven multimodal interactive dance system," in *Multimedia and Expo, 2004. ICME'04. 2004 IEEE International Conference on*, vol. 3, pp. 1579–1582, IEEE, 2005.

[17] Y. Wang, G. Qian, and T. Rikakis, "Robust pause detection using 3D motion capture data for interactive dance," in *Acoustics, Speech, and Signal Processing, 2005. Proceedings.(ICASSP'05). IEEE International Conference on*, vol. 2, IEEE, 2005.

[18] R. Aylward, S. Lovell, and J. Paradiso, "A compact, wireless, wearable sensor network for interactive dance ensembles," in *Wearable and Implantable Body Sensor Networks, 2006. BSN 2006. International Workshop on*, pp. 4–70, IEEE, 2006.

[19] W. Siegel and J. Jacobsen, "The Challenges of Interactive Dance: An Overview and Case Study," *Computer Music Journal*, vol. 22, no. 4, pp. 29–43, 1998.

[20] W. Siegel, "Dancing the Music: Interactive Dance And Music," in *The Oxford Handbook of Computer Music* (R. Dean, ed.), ch. 10, pp. 191–213, Oxford University Press, USA, 2009.

[21] M. Barrios-Solano, "Interview with Robert Wechsler." Online: http://www.palindrome.de/content/interview.htm, February 2008.

[22] R. Wechsler, "Artistic Considerations in the Use of Motion Tracking with Live Performers: a Practical Guide," in *Performance and Technology: Practices of Virtual Embodiment and Interactivity* (S. Broadhurst and J. Machon, eds.), Palgrave Macmillan, 2006.

[23] R. Wechsler, "O Body Swayed to Music (and Vice Versa): roles for the computer in dance," *Leonardo*, vol. 30, no. 5, pp. 385–389, 1997.

[24] M. Coniglio, "Isadora, software." `http://www.troikatronix.com/isadora.html`, 2002-2008.

[25] M. Coniglio, "The Importance of Being Interactive," *New visions in performance: the impact of digital technologies*, p. 5, 2004.

[26] P. Vickers and B. Hogg, "Sonification abstraite/sonification concrete: An'aesthetic perspective space'for classifying auditory displays in the ars musica domain," in *International Conference on Auditory Display (ICAD2006), London, UK*, Citeseer, 2006.

[27] V. Arvey, *Choreographic music; music for the dance*. EP Dutton & company, inc., 1941.

[28] P. Hodgins, *Relationships between score and choreography in twentieth-century dance: music, movement, and metaphor*. E. Mellen Press, 1992.

[29] E. Isaacson, "What you see is what you get: on visualizing music," in *Proceedings of the International Conference on Music Information Retrieval*, pp. 389–395, Citeseer, 2005.

[30] D. Keislar, "A Historical View of Computer Music Technology," in *The Oxford Handbook of Computer Music* (R. Dean, ed.), ch. 10, pp. 191–213, Oxford University Press, USA, 2009.

[31] J. Wortham, "With Kinect Controller, Hackers Take Liberties." New York Times, Online: http://www.nytimes.com/2010/11/22/technology/22hack.html, 11 2010.

[32] "Secret US Embassy Cables." Wikileaks, Online: http://213.251.145.96/cablegate.html, 11 2010.