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Transmedia Choreography: Integrating Multimodal Video Annotation in the Creative Process of a Social Robotics Performance Piece

Abstract

In this article I explore my current choreographic work with human and flying robotic performers. I adopt a number of existing conceptual lenses for the analysis of my choreographic approach, including 'interdisciplinary choreography', 'post-choreography', 'processing choreography', 'generative techniques' and 'metacreation'. Following a brief discussion of choreographic practices in digital (live) performance environments, I propose two new terms: 'transmedia choreography' and 'transmedia score'. Examples of multimodal video annotation in the creative process of our recent social robotics performance piece *I-Care-Us* will serve to discuss novel approaches in the production process of current transmedial performance works.

Transmedia choreography

How do you describe and situate choreographic work with human and flying robotic performers? Conventional notions of choreography inevitably will not suffice to discuss recent choreographic practices in interactive mixed reality environments, as these conceptual frameworks have been developed in different historical and technological contexts. For example, problems in choreographic analysis arise when interactive system design comes into play, posing questions such as: how do you choreograph an interaction between a human performer and a semi-autonomous agent, for instance, a flying robot programmed to make decisions, which may not be repeatable? Is the motion design of the robot's behaviors choreography, or something different? What kind of notation or documentation could support such choreographic practices? Building on existing novel conceptual frameworks that re-evaluate the term choreography in the context of digital (live) performance, I will propose two new terms and exemplify their utilization with reference to the work of several well-known practitioners in the field as well as illustrating my own choreographic approach.

Sophia Lycouris suggests that 'the impact of *interdisciplinary practice* in contemporary choreography' has contributed to the 'emergence of an expanded definition of choreography' (2009a: 347). This led her to propose the term 'interdisciplinary choreography' (2009a: 348). In her artistic work as well as her research activities she has been exploring the idea of a 'compositional meta-system on the basis of which the choreographic edifice work' (2009a: 350). Lycouris came to the conclusion that it is possible to develop appropriate 'compositional meta-systems in order to support the creation of new choreographic work (and work incorporating new technologies in particular) in which the relationships between all heterogeneous components of the work can be defined in a coherent manner' (2009a: 359). In another recently published article Lycouris writes in depth about the artistic concepts that led to developing interdisciplinary choreographic techniques for her project *E-Motions in Urban Networks*, a single screen animation film/installation project discreetly integrated in the urban space of Chelmsford, UK. Here choreography is seen as 'a set of techniques used to design dynamic changes in a given environment, be that physical, virtual, hybrid or conceptual' (Lycouris, 2009b: 143). On the other hand, Lycouris' choreographic methodologies are developed drawing on appropriate extra-disciplinary 'vocabularies', for example, ideas of space in contemporary architectural discourse such as Hillier's 'Space Syntax', or Eisenman's fluid environments

(Lycouris, 2009a: 359 and 2009b: 148). Lycouris' choice of terms clearly situates her artistic research and practice in the field of contemporary choreography. She adopts an integrative approach regarding the transfer and influence of concepts and techniques from other artistic and scientific fields, which is conducive to a compositional meta-system supporting choreographic work in interdisciplinary and hybrid settings.

Johannes Birringer, a well-known writer, researcher, choreographer and media artist, has adopted an interesting discursive strategy to discuss contemporary choreographic practice within the context of digital performance. The title of his article *After Choreography* (Birringer, 2008a) indicates that sufficiently radical changes have occurred to suggest the term 'post-choreography' to differentiate current artistic practice from conventional conceptions of choreography. He argues that:

> Although the notion of choreography has not disappeared in the context of contemporary twenty-first century digital performance and virtual art, it has undergone a re-evaluation in terms of how bodily movement produces data or how a performer or "immersant" engages with an interface environment that is programmable and networked, and thus open to unpredictable and emergent states. These states evolve from the system behaviour as a whole, from the digital body-environment interaction (Birringer, 2008a: 118).

Paraphrasing the title of this important article, one could ask: what existed before post-choreography? According to Birringer, the 'conventional organization and articulation of dance as choreographic practice relied on a coding that fixes the steps and sequences of movement (located in real space and, more often than not, within patterns/rhythms of music) and makes them repeatable' (Birringer, 2008a: 118). Conversely, authors such as Friederike Lampert perceive choreography as a fluid continuum. Entirely planned and closed choreographies represent one pole, and entirely unstructured and unplanned improvisation the other end of the spectrum, which comprises ten distinct degrees (2007: 187).This approach allows Lampert to describe a large variety of contemporary choreographic processes. By contrast, Birringer's suggestion aims for a re-assessment of the complex relations between the 'performers' behavior' and the virtual ecologies they inhabit. Elsewhere Birringer states:

> In an indirect interface, the performers (or participants) are challenged to re-organize their motional, affective, perceptive, and proprioceptive behavior in the environment. The desired aesthetic aim would be to anticipate direct dance transformations or acting transformations in real-time. In other words, the more complex the technologies behind the interface become, the more attention, creativity, and originality need to be applied to transformative techniques and synaesthetic processes (Birringer, 2008b: 154).

Many choreographers in the field of digital performance share the view that there is a need for the development of adequate performance techniques for work with (interactive) technologies in live performance situations. American choreographer Kenneth King has suggested the term 'processing choreography', which describes the performance of dance works that make it possible for us to see 'the dancer's awareness, intelligence and spontaneity allowed to function on stage' (King, 2003: 8). In his essay *Transmedia* (1984) he writes:

> I like the idea of a technic rather than a technique, because there are larger, organic, holistic connections in the moving body, and another energy source. I mean, with whom or where can one train to move synergetically? (King, 2003: 6).

King's idea of 'moving synergetically' reflects his approach of dance training as 'collective kinetic investigation and exchange'. He encourages his students 'to bring something else or other - an interest, a vocation, a system, even another art - to the dance, to discover a larger organic understanding of the moving body' (King, 2003: XV). King's *transmedial* approach to dance training and performance have been instrumental for my study of forms of 'synergetic training' for digital (live) performance situations (Jürgens, 2011) developed by well known practitioners in the field, such as Schiller and Lovell, Wechsler, Coniglio and Stoppiello, McGregor, Sermon and many others.

Birringer's perspective is very valuable to my attempt at identifying what might be the constituent elements of a 'transmedia choreography', beyond developing techniques of moving synergetically in a digital (live) performance environment. He writes:

> For many artists working with computational and interactive systems, models of *real-time* sequencing and intervention in image and sound projection have become vital, and these are often derived from mathematics, cybernetics, biology, neuroscience and AI rather than from a primarily notational understanding of "choreography" (the writing of dance) based on principles of organizing movement in space and time (Birringer, 2008a: 118).

In excluding postmodern and post-post-modern choreographic approaches from his definition of choreography, Birringer is able to detect and eloquently designate what I call 'transmedial choreographic techniques' in complex digital (live) performance ecologies.

According to Mitchell Whitelaw new media art practices have integrated Artificial Life (A-Life) and Artificial Intelligence research and computation techniques. Genetic algorithms for example imitate the way DNA functions, in that the 'genotype' (the code written by the programmer) causes the corresponding 'phenotype' (the graphic user interface and the media) to appear. Another example is agent-based systems, which may simulate interaction in an artificial environment, or exhibit the behavior of flocks. Cellular automata can account for yet another technique, denominating the affecting or being affected by 'cell neighbors' in a formal system (2006: 8-10). Whitelaw dubs these kinds of art practices as 'metacreation', a concept that allows him to integrate complex scientific research and techniques into new media art practice.

I have recently proposed a *Methodology for Bi-Directional Transfer between Contemporary Dance and New Media Technologies* (Jürgens, 2011). In this Ph.D. dissertation I link Whitelaw's 'metacreation' to Phillip Galanter's discussion of (complex) generative art, in particular to his well-known definition of generative art, which he describes as

> any art practice where the artist uses a system, such as a set of natural language rules [....] or other procedural invention, which is set into motion with some degree of autonomy contributing to or resulting in a completed work of art (Galanter, 2003).

The third chapter of this thesis is dedicated to the discussion of existing correspondences of generative techniques in contemporary choreography and in new media art, as well as to designing new techniques through the transfer of concepts, principles and methods from one area to another.[1]

I propose that within 'transmedia choreography', complex metacreational and generative techniques in new media art and in contemporary choreography can be organized in a compositional meta-system, such as suggested by Lycouris above (2009a: 350). This in turn may serve as a base for the synergetic training and performance in digital (live) performance situations. Additionally, beyond work with human performers, the term 'transmedia choreography' equally accommodates the transfer and application of choreographic principles and techniques to other scientific and artistic fields, as can be seen for example in Unander-Scharin's choreography for an industrial robot in *The Lamentations of Orpheus* (2009: 179-183).

Documenting transmedia choreography

Intrinsically linked to our discussion so far is the following question: What kind of score or document could eventually preserve indispensable information for documentation and re-staging purposes of highly complex transmedia choreographies? Which elements would such a 'transmedia score' contain?

Choreographer Carol Brown and her collaborators Anne Niemitz, Margie Medlin and Russell Scoones have very recently published a *Score for collaborative production process of REVOLVE* (2013: 40-43), an art-science collaboration based on research into brain patterns, sleep-wake cycles and the sonic thresholds of binaural beats. This chronobiological data is made available for synaesthetic performance through multi-sensory technology. Co-authored, the score is comprised of seven elements (time, dramaturgy, choreography, stereo sound, interactive system/quadrophonic sound, light and video), which are vertically organized in seven respective tracks, resembling a conventional musical score. An additional unnamed track provides a stage photograph from each section of the work. Mainly text-based, the two-page score provides essential information about the interrelations between the different threads, yet not much detail about the specific artistic elements of the work.

A transmedia score such as the example above can be described as a 'meta-score', a document containing essential information regarding the organization, coordination and synchronization of diverse elements of a work. Evidently, each collaborating artist will equally develop an individual score or other method (e.g. source code, software documents) to organize data, events and cues in their particular field. If created in digital media, transmedia scores can include individual scores, or provide metadata such as links to the documents, short descriptors of the contents, and different kind of annotations.

However, the concept of a 'transmedia score' may also be applied to existing working methodologies within the different artistic areas. In the field of contemporary choreography for example, video recordings of rehearsals and performances have become the prevalent method of developing and documenting new productions. However, these video recordings frequently are incomplete without some sort of 'choreographer's notebook' containing additional information, such as research notes, stage and light design ideas,

drawings of projected images, choreographic material in idiosyncratic symbols, and so forth. Relevant information for the documentation of the work and re-staging of the performance (recorded music, source code of digital media events, cue sheets and the like) is often stored across different media and even physical devices (computers, hard drives, CD-ROMs or DVDs, notebooks, and so forth). Fortunately, recently developed multimodal video annotation techniques now allow for different kinds of data (video, text, graphics, drawings et cetera) to be combined in a single document, which may also be regarded as a 'transmedia score'. In the following section of this paper I will introduce a novel video annotator for the creative process in the performing arts, the TKB Creation Tool software prototype.

A Transmedia Knowledge Base for Contemporary Dance

Recently, the Transmedia Knowledge Base for Contemporary Dance Research Project (TKB, 2010-2013) has come to a close.[2] Coordinated by linguist Carla Fernandes (Universidade Nova de Lisboa, FCSH, Portugal), the TKB-project aimed at the design and construction of an open-ended multimodal knowledge base to document, annotate and support the creation of contemporary dance pieces. Fernandes designed the TKB research project following her post-doctoral cognitive-semiotic analysis of Portuguese choreographer's piece *SetUP (2005)*. Several national and international collaborations with artistic and scientific research partners and consultants have been established during the course of the project, including with: Universidade Nova de Lisboa (Faculty of Science and Technology/IMG - Department of Computer Science, with Nuno Correia); Universidade do Porto (CLUP - Linguistics Centre, with Isabel Rodrigues); Espaço do Tempo (Choreographic Centre directed by Rui Horta); Amsterdamse Hogeschool voor de Kunsten - AHK (with Berta Bermúdez); Coventry University (with Sarah Whatley, Director of Siobhan Davies Archive) and Scott deLahunta (Director of 'Motion bank' at the Forsythe Foundation). Fernandes describes the research project as follows:

> The global purpose of TKB is to extend the scope and application of the "documentation" concept to contemporary dance in different ways. It aims at developing a strong link between the recent dance-research community and the well-established communities in cognitive linguistics (since Lakoff and Johnson 1980) and computer science, by taking a closer look at the cognitive process of "choreographic thinking" (Stevens and McKechnie 2005) and therefore contribute to the domains of multimodal corpora (Kipp 2008), terminological ontologies, cognition and verbal–non-verbal relations (Fernandes and Jürgens, 2013: 116-117).

The TKB knowledge base is comprised of three complementary elements, (1) a case study of three contemporary dance pieces by Portuguese choreographer Rui Horta, for which the video annotation software ELAN was used; (2) the 'Creation Tool', a novel real-time video annotation software prototype serving as a digital notebook for choreographers during their creative processes; and (3) the conception, design and implementation of the first web-based collaborative archive for contemporary dance in Portugal.

Personally, I was invited as a choreographer in the field of digital performance/transmedia choreography to develop design specifications and conduct utility tests with the custom-built video annotator to be programmed by a team of young researchers at the

Universidade Nova de Lisboa under the supervision of Nuno Correia. The resulting software prototype called 'Creation Tool' has just been presented to the public in May 2013.[3] My interest in collaborating on the software development was the rare opportunity to ask for specific annotation modes and features that could be useful in working with immersive interactive systems on stage.

Subsequent to the implementation of the design specifications I have tested the Creation Tool during hands-on workshops as a tool for the rehearsal process, namely (1) as a digital notebook for collaboration with a programmer using interactive particle systems, and (2) as a tool to retrieve information of an existing digital performance piece, to annotate a particular scene by a different dancer, who would learn and perform the section (Fernandes and Jürgens, 2013: 124-128).

Although conceived of as a (real-time) multimodal video annotator for tablet computers, from my viewpoint as a transmedia choreographer and theatre interaction designer, I find the Creation Tool to be most useful as a trans-disciplinary communication tool, both in real-time and offline utilization modes. In other words, members of the artistic team in a typical digital live performance setting can annotate rehearsal videos on the fly, or analyze the footage at home, by choosing from the Creation Tool's annotation modalities: drawing, markers, icons, text, audio comments, and two video streams with the possibility to overlay the images. Subsequently everyone's annotations can be retrieved to communicate observations to other artistic team members, to discuss rehearsal outcomes, or to develop specific details. Moreover, annotations can be used to prepare for future rehearsals, thus optimizing the coordination and planning of the creative process and production. Towards such integration of multimodal video annotation in the creative process I have recently presented a (mutually inclusive) *seven-phase model of the development cycle* of a digital (live) performance work, which also distinguishes *collaborative working hours* (e.g. rehearsal time) from *individual working hours*, or time spent individually working on the project away from the studio (Fernandes and Jürgens, 2013: 129-130).

As simple as this distinction might seem, its implications for annotation methodologies are far-reaching. To start with, the choreographer (or for that matter any artistic director) who decides to use the Creation Tool as a digital notebook to support the creative process will have to decide who is going to annotate what kind of video content during which time periods. Traditionally, choreographers have been working with rehearsal or production assistants, whose responsibility (among other tasks) it is to take notes. This vital information can be communicated to dancers and other collaborators at any time during collaborative working hours. Considering individual working hours away from the studio as valuable time for the creative process raises the question as to how vital information from these periods is preserved and communicated. Most probably an *assistant-based approach* will suffice for traditional organization of rehearsals notes -- although it may be asked how the collaborator's observations (programmers, sound designers, light- and set-designers etc.) might be integrated most efficiently.

On the contrary, a *specialist-based approach* can offer a number of advantages: individual working hours can be seamlessly integrated as each collaborator takes their own notes and publishes them to a shared platform; complex sections of the piece can be easily identified as the different specialists annotate their observations on different tracks connected to the same video footage; and finally, the need for discussion between

collaborators also becomes more obvious as a consequence of the respective annotations.

Along this line of inquiry we are currently working on a case study investigating whether the Creation Tool (and the use we are able to make of it) can support efficient communication between the sound designer (Simão Costa) and the choreographer (myself). This modality is relevant to the type of communication occurring during individual working hours away from the studio with particular regard for a selected scene within our new production entitled *I-CARE-US*.

(embed video trailer here) https://vimeo.com/66671254

Figure 1: Video trailer of the digital performance piece *I-CARE-US* (premiere 2014, Lisbon, Portugal) by Fernando Nabais and Stephan Jürgens. Light design: Miguel Cruz; sound design: Simão Costa; dancers: Miguel Santos, Pedro Ramos, Marina Nabais and Diana Bastos Niepce; programming of the AR.Drone Performance App: Sandro Fioravanti.

Multimodal video annotation in the creative process of the social robotics[4] performance piece *I-Care-Us*

I-Care-Us by Fernando Nabais and Stephan Jürgens is a digital live performance for flying robot and human performers to be premiered in 2014.[5] The flying robot performers are re-programmed Parrot *AR.Drone 2* quadrotors (helicopters with four helices), which engage in an inter-species dialogue by means of custom-developed software solutions and alternative shell design. We have developed a stand-alone application, written by our programmer Sandro Fioravanti in the scientific programing environment LabView, which allows us to use sensorial data and video streams to elaborate the interaction design for the performance. Unlike the popular mobile device applications, our software is not limited to flight control functionality, simple image streaming and recording tools or flight animations. Instead, the focus here is the design of (social) interaction skills, thus enabling the flying robot to display (semi-) autonomous behaviors in its performance environment.

Evidently, many individual working hours have been spent on developing the software for the AR.Drone 2, which is only the starting point in the media design (interactive video projection, interactive sound design, light design and scenic design) of the performance. To make effective use of the precious collaborative working hours during rehearsal periods, well-defined interaction strategies have to be prepared to allow for simultaneous software development, interactive media programming and the creation of choreographic material. Given these circumstances, multimodal video annotation seems to be a powerful tool to support the creative process, particularly during individual working hours. As we are advancing in the production of *I-Care-Us*, I have been integrating the TKB Creation Tool software prototype in terms of the ways in which communication between the specialist collaborators of the artistic team can be best supported.
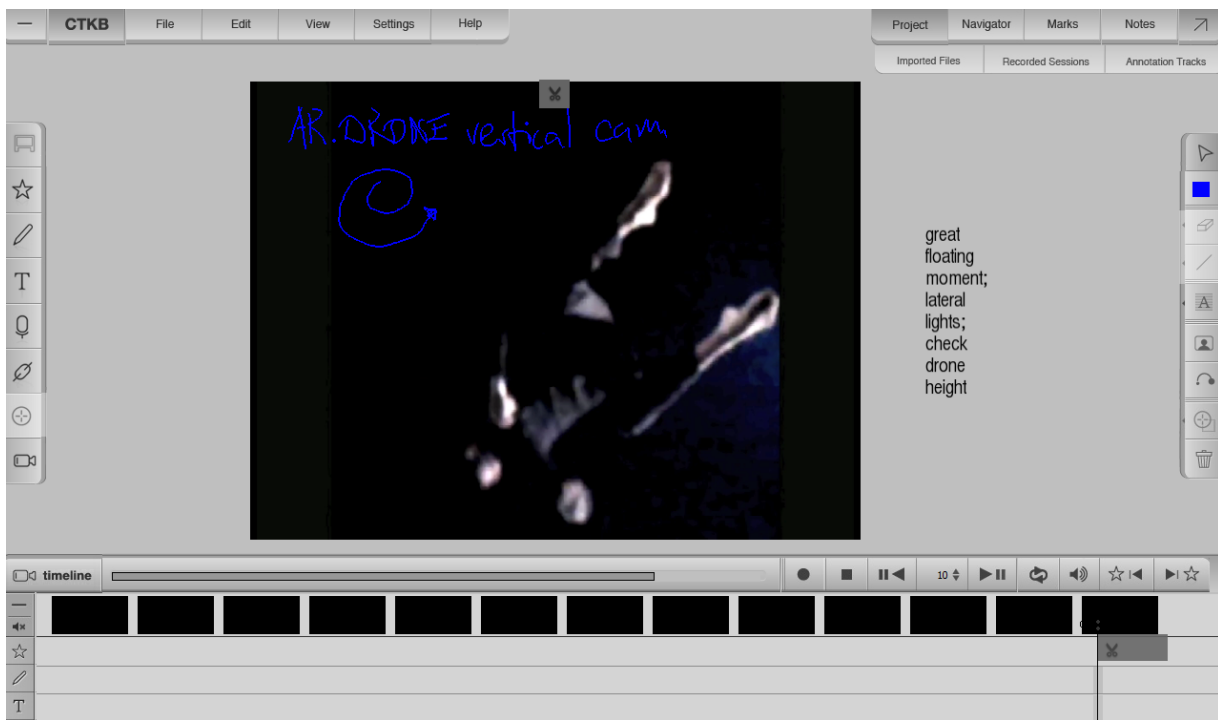
Figure 2: Multimodal video annotation with the Creation Tool: markers, text and ink tools

Figure two shows a screen print of the Creation Tool interface in the offline and single video stream mode. The image of the dancer filmed from above stems from the vertical on-board camera (pointing at the floor) of the AR.Drone 2. (another high resolution on-board camera films horizontally pointing in the flight direction). Three annotation modalities are used in this example: marker, text and ink. Markers can be customized according to the symbols the annotator wishes to use. In this example the scissors indicate a section of the AR.Drone rehearsal video, which was marked as captivating. This could be used for editing (if a pre-recorded video was going to be used in the performance), or analyzed in compliance with parameters for the use of live video projection, as with regard to kinetic information such as the flight path of the quadcopter, for example. The blue ink trace in figure two indicates an augmenting and spiraling motion, while the text annotation describes the effect on the viewer ('great floating moment'). Additionally, information about the light design is added and an auxiliary note serves as a reminder to check the height of the helicopter at this precise moment in order to be able to recreate the motion path.

Figure 3: Creation Tool hypermedia note feature (attached AR.Drone data sheet in this example)

Figure 3 displays an annotated frame of another rehearsal video, presenting the hypermedia attachment feature of the Creation Tool. The annexed AR.Drone data sheet contains recorded flight details, which we use to edit artistically compelling moments and store them in a database as 'behaviors' that can be used interactively. It goes without saying that different types of documents can be attached, as well as hyperlinks be set. In our example, technical details of the flight data were attached to look into the expressive potential of the flying robot at this particular point in time.

The novelty in this approach resides in the 'transmedial score' organization of discipline-specific information. For example, if one wanted to understand how exactly choreographic principles are encoded in semi-autonomous flight behaviors of the AR.Drone 2 in the example above, no conventional rehearsal video nor traditional choreographic score would provide the necessary information. Multimodal video annotation on the contrary serves as a transmedia container of essential information, such as the visual documentation of the flight, the recorded data sheet to synchronize video frames and motion data, choreographic notation and even the programmer's code.

In our AR.Drone performance application, recorded flight data from our rehearsals can be visualized as a 3D view of the motion path and exported as a video file, which in turn can be annotated in the Creation Tool.[6] Our sound designer Simão Costa has imported the flight data via the OSC protocol into the software Max/MSP to develop parameters for an interactive system. Whenever Simão wishes to share his ideas with the rest of the team, he can use a screen recording software (such as ScreenFlow) to document his experimentation, annotate relevant sections in the Creation Tool and synchronize his video annotations with the flight data, so that the choreographer can clearly perceive which motion path produces what kind of interactive sound. Inversely, choreographic

experimentation with piloted flights or semi-autonomous behaviors can be recorded, annotated and synchronized with the flight data to allow the sound designer to work on the sonorization of the movement. The above case study was designed with this workflow in mind and thus shows whether multimodal video annotation during individual working hours (utilizing the Creation Tool) can efficiently improve communication between collaborators.

Collaborative transmedia scores and multimodal video annotation

Successful communication via multimodal video annotation between collaborators from different artistic fields will evidently depend on methodology. Shaw and Lewis have presented a seminal article revealing methodological details of their collaboration, which was accompanied from the start by a continuous compilation of 'generative indexes for performance in the interstices of dance and computer science' (2006: 75). Their first step was to carefully examine existing lexicons of programming, contemporary dance, drawing, technology-based art and other writings and research. Based on this preparatory investigation they proceeded to discuss intersecting approaches and establish their own expandable and evolving lexicon, which significantly would often contain multiple conceptions of the same term used in different disciplines. Most frequently collaborators in such interdisciplinary projects do not spend much time and effort to clarify their conceptual positions and resulting application of terms, but work (probably less consciously than Shaw and Lewis) with multiple conceptions within the same project.

Collaborative video annotation, as proposed in our case study above, therefore benefits considerably from the simultaneous development of an 'evolving lexicon' or shared glossary of concepts and terms. Compiling and reviewing the elements of the vocabulary that collaborators build and share during the production process of a new work (and beyond) likewise is a crucial task in collaborative video annotation. In our concrete experience with the TKB Creation Tool, idiosyncrasies become clearly visible in each collaborator's annotation style, much in the same way that multiple conceptions of identical terms used in different disciplines become perceivable. Video annotation carried out collaboratively in fact hinges on the creation and expansion of a shared vocabulary of terms, markers, and graphic symbols to be used by the team.

In some cases, shared vocabulary may be entirely comprised of a distinct system of graphic symbols used to communicate conceptions and procedures, as for example in the sophisticated scores of French choreographer Myriam Gourfink and her collaborators.[7] Text-based (as in Brown's case), composed of custom-designed graphic symbols (as in Gourfink's example), or otherwise constituted, an 'evolving lexicon' emerging from the choreographer's creative process is a magnificent example of a shared extra-disciplinary vocabulary, describing a particular compositional meta-system. Carol Brown's (transmedia) score, for example, reveals as much about how different performative strands and events are synchronized and organized in her work, as it introduces us to the outline of a compositional meta-system and specific vocabulary co-developed with her collaborators.

The limitation of Brown's score, however, are also the limitations of printed scores: even though the horizontal axis of the score provides a notion of progression in time and the vertical axis informs us about the layering of interrelated performance components, there is no third axis or dimension. On the contrary, video annotation allows the possibility of

adding layers of information 'on top off each other', superimposing them on the depth axis (see examples above). Some annotations remind us of familiar image editing software, through elements such as ink markers, graphic symbols and text commentaries. These kinds of annotation still resemble conventional printed scores that have been marked up. On the contrary, overlaid video streams and hyperlinked documents point to depth dimension in a different way. An example of this may be found in the work of Lansdale and her collaborators', where an intertextual analysis of performance texts is presented within the context of the *Decentering the Dancing Text* research project (2003).[8]

In figure three, we recognize a superimposed image of the flight data sheet on top of the timeline of the video annotation. Here, depth dimension is used to correlate mathematical data and visual information of the AR.Drone's behavior. In theory, another image could be superimposed next to the data sheet relating the particular flight behavior to an associated instant of the story of Icarus and Daedalus. The depth dimension here serves as a visual metaphor for the possibility to relate virtually any relevant information to the annotated instant. Multimodal video annotation may thus unleash the full potential of the transmedia score. The development of tools such as the TKB Creation Tool prototype allow sophisticated multidimensional connections across often disparate information blocks of complex digital (live) performance work and transmedia choreography.

Conclusion

In this article I have proposed the terms 'transmedia choreography' and 'transmedia score', building on existing novel conceptual frameworks that re-evaluate the term choreography in the context of digital (live) performance. Lycouris' term 'interdisciplinary choreography' can be said to encompass the choreographic practices described by the notions of 'processing choreography', 'generative techniques', 'metacreation' and arguably also 'post-choreography'. However, the designation 'transmedia choreography' from my point of view focuses more on the application of choreographic principles and techniques across the most diverse media. In my artistic practice this approach results for example in the motion design of the quadcopter's flight paths and expressive behaviors, as much as in the planning of the shots realized with the two onboard video cameras of the robot.

These choreographic interventions across the media and in different artistic fields are not perceived by anyone except the collaborators on the new work, nor are they documented in the way conventional choreography is usually documented. Subsequently I have discussed the term 'transmedia score' as a means to organize performative action, interaction design and media events in a single meta-document. Moreover, a (digital) transmedia score can preserve and illuminate the details of the choreographic involvement in the diverse artistic fields through conceptual (hyper-)links of documents. Finally, I have discussed the role of recent video annotation techniques in the context of the transmedia score, which in my perspective opens up exciting future possibilities for artistic practice and research.

1 For a more in-depth discussion please see my Ph.D. dissertation, which can be downloaded at: http://www.sjurgens.net/english/research/phd/

2 For more information see: http://tkb.fcsh.unl.pt/

3 At the international conference Multimodal Communication: Language, Performance and Digital Media, May 2-3, 2013, hosted by the CCB at Lisbon, Portugal. Videos from the conference presenting the TKB project are available here: http://dance-tech.tv/video-category/tkb-a-transmedia-knowledge-base-for-performing-arts-conference-2013/

4 The term 'social robotics' describes an area of study within the field of human-robot-interaction/robotics. Social robots are autonomous to a high extent and are able to communicate and interact with humans and embodied agents. See for example: http://scazlab.yale.edu/about-lab

5 For more information see: http://www.sjurgens.net/english/artistic-work/i-care-us/

6 For more information see: http://projectoicareus.wordpress.com/about/

7 See: http://www.myriam-gourfink.com/scores.html

8 This framework is comprised of five main categories: (1) the semantics of the work itself; (2) the description of the work; (3) the *meaning makers*' responses to the work; (4) cultural connections, and (5) theoretical connections (Lansdale et al., 2003). Landsdale et al. provide these categories and sub-divisions as a means to consider the most diverse materials in their intertextual analysis of a performance text.

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Biography

Stephan Jürgens holds a Ph.D. in Contemporary Choreography and New Media Technologies. His research interests concentrate on designing creative strategies for live performance involving interactive systems. He has been teaching movement research, interdisciplinary choreography and interactive system design in many different learning environments and institutions. Stephan collaborated on several international research projects, all of which investigated the use of recent technology in Contemporary Dance and Digital (Live) Performance. As a choreographer, Stephen has presented several works supported by the Portuguese Ministry of Culture.