

WHOLODANCE

Whole-Body Interaction Learning for Dance Education

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Table of Contents

Executive summary	5
Introduction	6
Objectives	7
Methodology	8
Tools	10
Movement repository and data curation tools	11
<i>WhoLoDancE movement library and annotator</i>	11
<i>Segmentation tool</i>	11
<i>Movement quality annotation by comparison tool</i>	12
Data- and model-driven applications for movement analysis and creation	13
<i>Similarity engine</i>	13
<i>Movement sketching tool</i>	13
<i>Real-time mobile movement search application</i>	13
<i>Blending engine</i>	14
Multimodal interactive systems for self-experimentation	15
<i>Choreomorphy</i>	15
<i>Low-end VR platform</i>	15
<i>Sonification tool</i>	16
Avatars	17
Targeted users	19
Evaluation and dissemination events	20
MOCO 2017 – 4th International Conference on Movement Computing (London, UK)	20
WhoLoDancE-Metabody Toulouse 2017: a meeting at the crossroad of art, science and dance (Toulouse, France)	21
WhoLoDancE Seminar (Madrid, Spain)	21
Digital Echoes Symposium 2018 (Coventry, UK)	23
MOCO 2018 - 5th International Conference on Movement and Computing (Genova, Italy)	24
EUSIPCO 2018 – 26th European Signal Processing Conference (Rome, Italy)	24
WhoLoDancE Experience – Lab & Performance @ Romaeuropa Festival (Rome, Italy)	25
Festival della Scienza (Genoa, Italy)	26
Student evaluation events	27
27 March 2018 - Wolverhampton University (Wolverhampton, UK)	27
8 May 2018 - Coventry University (Coventry, UK)	28
Artist and researcher evaluation events	29
3 October 2018 - Coventry University (Coventry, UK)	29
14 November 2018 - Birmingham Dance Network (Birmingham, UK)	30
Dance artists and companies	31
Annalouise Paul (Melbourne, Australia)	31

Web-based evaluation of final prototypes of tools	32
Results	33
Student experience	33
Results from the web-based tool evaluation	34
Dance partner’s experience	39
Public testimonies	40
Discussion	42
Conclusion	44
Appendix	45
WhoLoDancE consent form	45
WhoLoDancE consent form and disclaimer	46
WhoLoDancE participant information sheet.....	47

Executive summary

WhoLoDancE developed a variety of applications with different technical needs and performances. To provide users with a unique solution leveraging all available functionalities, the Consortium implemented a three-layered comprehensive framework, including low-end, web-based applications as well as high-end, interactive applications taking the Unity 3D™ game engine as its core base, to cover all current application scenarios and possibly expand them in the future.

With the project termination approaching, the WhoLoDancE Consortium deemed necessary to develop a unified solution where to integrate all digital resources under implementation, to ultimately provide final users with a comprehensive resource where to search for dance sequences, segment and annotate movements, assemble new choreographies, perform avatar-based analysis of users' movements: the *WhoLoDancE Framework*. This resource is designed to serve all envisaged learning scenarios and dance practices, as well as be further expandable to additional scenarios in the future, by covering different state-of-the-art technologies, easily expandable and re-usable in different contexts. This deliverable covers the final evaluative work of the Consortium carried out in several European metropolises throughout the last two years. What follows is an outline of the several tools developed, the events where they were disseminated and evaluated, and a discussion of the findings and a conclusion.

In summary, we found that the tools were extremely useful to our key stakeholders and that the WhoLoDancE Framework opened up thinking for researchers, artists from other disciplines and areas of study, as well as pushed choreographic and educational scenarios further. The Consortium set out to explore proof of concepts for specific tools and ideas and ended up producing more tools and platforms than was intended. Dance studies, machine learning, digital technologists and those interested in cultural heritage preservation and in interdisciplinary studies, were drawn to the work and keen to follow the future of the WhoLoDancE tools.

Introduction

The aim for the WhoLoDancE project is to provide the dance community with tools that can advance the field of dance whilst genuinely supporting the opportunities for dance artists, teachers and learners to expand their methods, across a wide range of dance genres and working practices. A critical point here to make is that we are not suggesting that the technology should or could replace the teacher, as that teacher-student relationship is widely regarded as sacrosanct, as our interviews and surveys confirm this is the case. However, what we are suggesting is that digital technology can be a productive way of questioning traditional methods and provides a new kind of technology for dance learning, supplementing or providing alternatives to tools such as the 'mirror', which is frequently part of the studio or devising process for dancers. Our hypothesis rests on the idea that the digital technology we are developing within WhoLoDancE has the potential to further develop the dancers' understanding of their practice and deepen their understanding of movement analysis and movement qualities, whilst pushing their creative boundaries.

The WhoLoDancE project is exploring ways in which the virtual environment can augment and extend the *live* space of dance learning. The project team has created new kinds of immersive experiences whereby the dancer can learn independently with a virtual teacher, by being able to dance with a dance expert or even the learner's own projected image, rendered to generate new kinds of kinaesthetic connections. Dancers may find themselves dancing closely with their own avatar, discovering more about the spatial or dynamic properties of their dance, the subtleties of their movement qualities, their relationship with the digital *other* or the complexity of the movement system itself. The project is developed with a variety of potential users in mind although our primary user community has been pre-professional dancers, experienced amateurs and their teachers.

Emerging at a time of economic, social and political crisis, the project aspires to lead the way in a new form of promoting creative processes, enabling the abilities of participating collectives to surface. Further, the project aims to foster the appearance of new interpretations of reality, researching new and novel initiatives, not to reject the present, but as a legitimate artistic and creative aspiration to serve as an outlet for new perspectives, and new ways of acting and of being in a globalised world, using dance and technology as the impetus for exploration.

Objectives

The educational objective of the WhoLoDancE project, as listed on our project website¹, is to “disrupt the conventional mode of communication in teaching” through the use of technology. It is intended that this enhances the learning experience of the student, encouraging autonomy through reflection and encouraging both teacher and student to work interactively with the technology in order to construct new knowledge concerning technical, physical and creative processes. Fundamental to achieving this objective is the creation of an immersive environment, to emphasise the process of ‘doing’ as an educational learning method, fostering physical understanding through practical engagement and virtual experience.

The WhoLoDancE project team has been exploring different ways to advance from the use of video within the studio to using both high-end and low-end motion capture devices. These include devices whereby sensors are attached to the body to collect basic motion data, for example, wearable sensors such as Notches². The project has also collected a considerable bank of data using higher end motion capture equipment (using a dedicated motion capture studio that requires the dancer to wear a suit with markers) to produce a range of avatars of the dancer, which are then viewed through using a VR headset, such as the Microsoft HoloLens³, as one example⁴.

Technologies for motion capturing have evolved very rapidly in the past few decades. In addition to professional motion capturing systems, today we can count on commercially available low-cost devices that allow us to gather motion information in everyday environments and all sorts of sensing devices that allow us to complement this information with other multi-modal signals coming from sounds, muscle contraction, breathing, accelerometers, gyroscopes, etc.

When the goal of this multi-modal analysis is to make sense of dance movements, we are suddenly faced with additional layers of information to extract and analyse at all levels of abstraction. Similarly, dance offers a structured language for describing, planning and designing the emotional trajectories that can be elicited and evoked by dance movements, to make sense of which we need to resort to advanced signal processing solutions, from low-level trajectory analysis, to high-level movement quality assessment based on machine learning. The WhoLoDancE project approaches exactly such problems from all points of view.

¹ WhoLoDancE website: <http://www.wholodance.eu/innovate-the-teaching-of-dance/>

² See <https://wearnotch.com/>

³ See <https://www.microsoft.com/en-us/hololens>

⁴ For videos of these sessions, see here: <http://www.wholodance.eu/Videos/>

Methodology

The WhoLoDancE Consortium has showcased the developed technologies in the form of performative dance demonstrations/workshops. This was the first phase of the evaluation. The main focus of the workshops was to bring together experts of dance movement analysis coming from both sides of the spectrum: scientists who focus on movement analysis and quality assessment, as well as dancers, who help scientists make sense of descriptors that are often hard to pinpoint and formalize. Our workshops have presented the latest scientific and technical results. As the tools have developed, each of which offers a different way for dance learners to consider questions about where movement initiates, how movement propagates, how movement 'habits' generate or limit dance, and wider concepts that are fundamental to dance, such as corporeality and perception, the project team has given attention to how the tools could be applied in practice.

The C-DaRE team have worked closely with Athena, and carried out extensive discussions, surveys and interviews with our potential user communities to find out about current practice, needs and curiosities and any perceived barriers to changing practices in the domain of dance. Based on feedback and the team's own knowledge as experts in dance teaching and dance making, a number of learning scenarios have been developed to show the potential application of the tools. These examples are indicative of how the tools may be valuable to different user groups. For more information on the specific learning scenarios the Consortium has outlined, please consult *D7.1 - Usability and Learning Experience Evaluation*⁵.

We used qualitative research in this phase as the research aims to develop new approaches to dance learning and making. The method was chosen as we wanted to find out about how a new approach to dance annotation may improve understanding of the role and purpose of dance annotation and inquire into how it can be useful in the dance learning environment. We used observation as the method to observe the students using the tools and then interviewed the conservatoire students to gain a better understanding of their experience.

The second phase of the evaluation was conducted through the WhoLoDancE website, where a Reserved Area was set up, accessed by a password, for people to evaluate the web-based tools remotely and at their leisure during a limited time period. The method used was an online questionnaire. This allowed us to invite people, nationally and internationally, to use some of the web-based tools and conduct the evaluation in their own time.

It is the duty of all researchers to ensure that any research activity meets the highest ethical standards. The project team has submitted the documents for ethical review and clearance to Coventry University's research committee in line with its requirement that all subject related research obtain ethical approval before undertaking any research involving human participants (see *Appendices*). WhoLoDancE falls under Coventry University's requirement that ethical approval is required for any research, design studies, artistic studies, experiments, survey work, questionnaires, interviews, focus groups or case studies.

In addition to the project consent form and information sheet that each participant was asked to sign to engage in the evaluation sessions, the COVUNI team also developed a consent and disclaimer

⁵ http://www.wholodance.eu/wp-content/uploads/2017/06/D7.1-Usability-and-Learning-Experience-Evaluation_final.pdf

form. This set of forms asked the participants to agree to keep the tools confidential and to also remind the user that the tools are prototypes and that the project assumes no responsibility for any damage to devices while using the tools. As it was important to ensure the tools were tested on a number of devices and run on different software systems, such an approach was deemed necessary. These forms can be found in the appendices.

Tools

The Consortium was ambitious throughout the project and developed a series of tools that were not promised in the initial *Description of Work*. As the team worked in an interdisciplinary fashion and always actively engaged with its key stakeholders, there were gaps in the various sectors that the partners felt they could address, providing a number of new tools and/or extension of tools.

The WhoLoDancE Consortium developed a series of tools which could be divided into three categories: i) the *Movement repository and data curation tools* ii) the *Data- and model-driven applications for movement analysis and creation*, and iii) the *Multimodal interactive systems for self-experimentation*.

The *Movement repository and data curation tools* include:

- the *Movement library* and the *Annotator*
- the *Segmentation tool*,
- *Movement quality annotation by comparison tool*

The *Data- and model-driven applications for movement analysis and creation* include:

- *Similarity tool*
- *Movement sketching tool*
- *Real-time mobile movement search application*
- *Blending engine*

The *Multimodal interactive systems for self-experimentation* include:

- *Choreomorphy*
- *Low-end VR platform*
- *Sonification tool*

The demonstrations/workshops involved all of the above tools being shown. The remote evaluation only used the *Movement repository and data curation tools*.

Avatars were also always developed and considered throughout the life of the project. Each tool considered and developed an appropriate avatar which supported the end goal of the project.

Movement repository and data curation tools

WhoLoDance movement library and annotator

The *WhoLoDance movement library* (WML) constitutes the web-based system to access and navigate the dance motion repository of synchronized multimodal recordings (MoCap and video) created during motion capture recording sessions, as segmented and annotated by Consortium dance experts. It consists of a web-based interface, data, metadata – including *title, genre, annotations, performer, dance company* and *date of recording* -, annotation management back-end as well as a user-management system. The system allows the user to browse recordings or search for specific ones by metadata- and annotation-related keywords, as well as to create personal playlists. For each recording, the user can visualise the video of the performance beside the corresponding MoCap-derived 3D avatar and interact with it, e.g., by rotating the avatar to observe the movement from different perspectives. A timeline shows the sequence progressing and evolution of associated actions (e.g., step, arm/leg gesture, change of support), movement principle states (e.g., in focus, symmetrical/asymmetrical, in balance) and movement qualities (e.g., heavy, fluid, sudden). The *Annotation tool*, embedded into the WML, enables manual annotation of performances with free text and controlled vocabularies based on the conceptual framework of WhoLoDance, through a tabular and a timeline view.

Segmentation tool

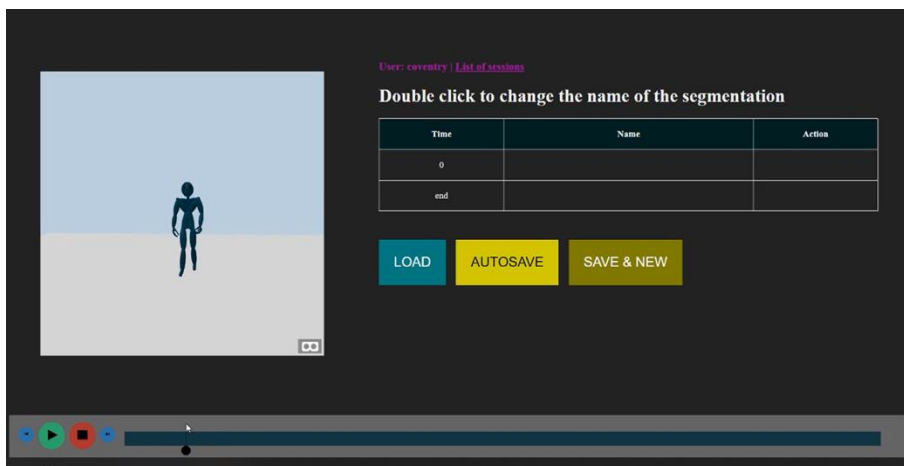


Figure 1. Screenshot from segmentation tool

The segmentation tool is the web-based application which allows manual segmentation of motion MoCap sequences into simpler movement segments. The tool includes three interconnected modules: a 3D scene where the user can rotate the scene, zoom in/out and switch to/from full-screen view, with the avatar changing colour at the beginning of a new segment; a player to follow the execution or jump to specific frames of interest, showing segments as coloured progress bars; a table to show the annotated segments, with labels and commands to add or modify annotations.

Movement quality annotation by comparison tool

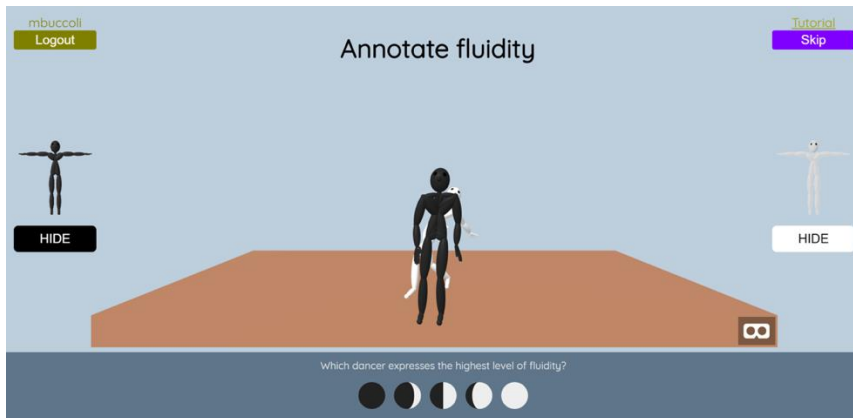


Figure 2. Screenshot from MQ annotation by comparison tool showing the black and white avatars

The movement quality annotation by comparison (MQA) tool is meant to make the annotation procedure sensibly lighter and easier, allowing experts from the dance community to contribute with little or no training. With this tool, we aim to collect a high amount of annotations from a large community, to be used for the training of algorithms able to automatically describe dance performances. Given a movement quality, say *fluidity*, the tool displays a 3D representation of two short dance movements represented by a black and a white avatar, in a loop, and asks the user to make a comparison between them and select which one is expressing a higher level of fluidity. Users can choose between five levels, or even skip the comparison if they decide the comparison is not meaningful or they do not feel confident enough to make a decision.

Data- and model-driven applications for movement analysis and creation

Similarity engine

The similarity engine can measure the similarity between dance performances modelled using *movement features*, i.e., numerical descriptors of the evolution of movement properties and qualities over time. Once a recording of interest (*query*) is identified in the library, it allows to search for similar motion sequences in relation to a range of user-defined criteria. In the derived similarity search web-based application, the user should first (1) *select a 5s excerpt* from the query segment and (2) *specify (a) the features* to take in consideration and, for each one, (b) *a 0 to 1 value* representing its relevance in the estimation of global similarity. The algorithm then assigns to each recording in the database a value indicating its similarity to the query and builds a global ranking, returning a list of recordings sorted according to their similarity value. The user can watch the query and the output segments simultaneously to visualise the comparison.

Movement sketching tool

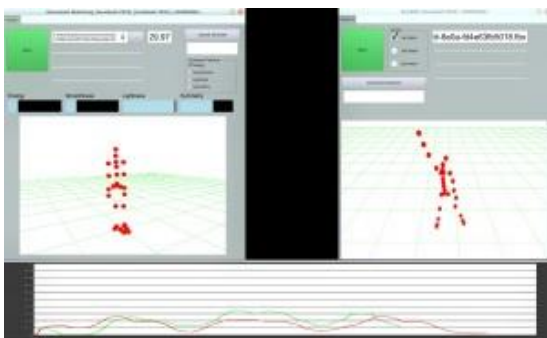


Figure 3. Screenshot from the Movement sketching tool

The tool allows the user to record one's movement through low-cost sensors (e.g., xOSC, Notch), analyse it in relation to a selection of expressive movement qualities of choice and search for similar movements through the similarity engine. In this way, the tool compares the user's movements with those of professional dancers stored in the library and makes query results available in standard or VR-based visualisations, or also audible through sonification.

Real-time mobile movement search application



Figure 4. Photo of the mobile search application being used on a mobile phone in Genoa, Italy

The application allows the user to record movements and perform similarity search within the movement library through any mobile device, such as a smartphone or tablet. In the minimal configuration, the user

points the mobile or tablet camera towards a moving person, and the movements are used as query for similarity search, returning a stream of images corresponding to similar movements in the repository. In a more extensive setup, the search results can be projected onto a wall using a beamer, to visualise search results in real time.

Blending engine



Figure 5. Screenshot from the Blending engine

The Blending engine is an interactive tool for composition and blending of MoCap data available in the movement library to create motion sequences. Sequences can be assembled in a *linear setup*, i.e., blending movements consecutively in time to form a longer, seamless sequence, or *in parallel*, i.e., superposing parts of movements to form new movements, e.g., with the leg movement of one sequence and the upper body part of another. Users can assemble choreographies or blend sequences and save those as new FBX files. These files can be read and displayed inside the Unity engine using any of the created avatars (*Choreomorphy*).

Multimodal interactive systems for self-experimentation

Choreomorphy



Figure 6. Screenshot showing the use of the Choreomorphy tool with a dancer in the shadow

Choreomorphy is a Unity-based interactive application that supports reflective dance improvisation through the use of MoCap technologies. The design idea is that different avatars and visualisations of movement highlight different aspects and eventually trigger different qualities and patterns of moving, which is meaningful from both a pedagogic as well as creative and aesthetic perspective. By wearing an inertial motion capture suit, the user can visualise his/her movements in real time in the form of a 3D avatar with related customisable motion effects, allowing to focus on specific aspects of the movement such as traces, or volumetric space. The tool allows to change and customise the visualization by switching among different avatars and settings in real time, facilitating self-reflection and experimentation. The application also allows to load pre-recorded MoCap data and watch them in a variety of avatars, environments and effects or even in augmented reality through the HoloLens.

Low-end VR platform



Figure 7. Photo showing the VR headset and mobile phone used (left)

Figure 8. Photo showing the avatar of the Notches on a tablet (right)

This web-based visualisation layer is designed to watch MoCap recordings as an immersive VR experience on a common smartphone and can be placed on top of other applications. The platform supports tracking of head orientation and includes a standard avatar to watch MoCap recordings, a system to watch videos on virtual walls and customizable 3D environments.

Sonification tool



Figure 9. Image of the sonification tool in action with two dancers

The tool is designed for sonification of movement qualities in real time. Multimodal feedbacks are fundamental to highlight details or different aspects of a dancer's movement in a variety of contexts, such as rehearsal, performance or choreographic production. While a visualization may offer more information, a dancer cannot focus on a screen while performing: in this case, sonification enables to have a real-time, responsive feedback on the movement without causing distraction. The sonification tool relies on a movement quality library: while different sensors (e.g., Kinect V2, XOSC IMU, MYO, etc.) capture dancer's movements and positions on stage, several EyesWeb-based analysis modules analyse them and stream the extracted qualities to a sonification environment (e.g., supercollider, Max) that maps movement qualities with various elements of sonification.

Avatars

Throughout the development of the project the technology partners have been working closely with the dance partners as they created or refined the avatars that would be central to the project. The avatars created by MOTeK during year one and two of the project, please see *D2.5 - 3D Avatar Scenes*⁶ and *D2.6 - Motion Capture sequences and skeleton avatar*⁷ were carefully considered and shared with key stakeholders. The avatars created within the Choreomorphy tools were also tested by Athena. More information can be found in Deliverable D7.2 Evaluation of the personalised experience⁸.

The creation of dancing avatars and other visualisations were fundamental to the WhoLoDancE project and were integral in supporting the learning, teaching and creative environment. Each avatar was designed to exhibit different principles of movement in dance. The movement principles that were defined at the start of the project served as the primary guideline for the types of avatars created.

Most of the tools in the WhoLoDancE project have been developed for traditional devices, such as computers or mobile phones, on flat screen, but with the intention to bring them eventually to an immersive environment. To turn now to our work specifically with VR technologies, we designed a framework for immersive visualisations of dance performances using low-end head mounted devices, and we developed a *web-based tool* as a prototype for visualising recordings from the *Movement Library* or performances created with the *Blending engine*. During one of the recording sessions, we experimented with the use of Microsoft HoloLens to watch a recording session as a projection in the physical space (Mixed Reality). Doing this, artists had perspectives of their own body that they may not have experienced before, re-watching their own recorded movements through a different virtual body (an *avatar*), from every angle.

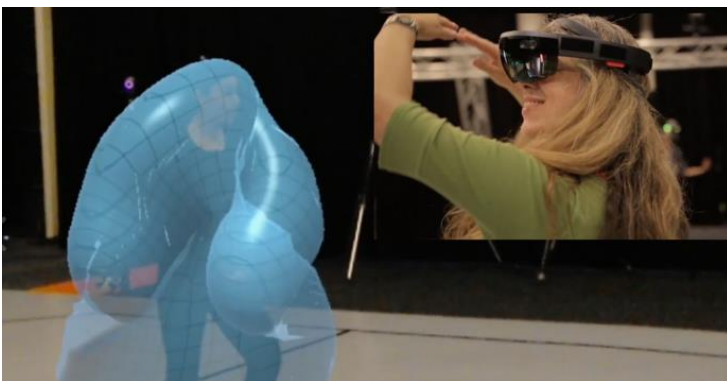


Figure 10. Screenshot from WhoLoDancE filmⁱ which shows Sarah Whatley wearing the Microsoft HoloLens and dancing flamenco with Rosamaria Cisneros

⁶ D2.5: <http://www.wholodance.eu/wp-content/uploads/2016/11/D2.5-3D-avatar-scenes.pdf>

⁷ D2.6: http://www.wholodance.eu/wp-content/uploads/2016/11/D2.6_Motion-capture-sequences-and-skeleton-avatar.pdf

⁸ D7.2: <http://www.wholodance.eu/deliverables/>

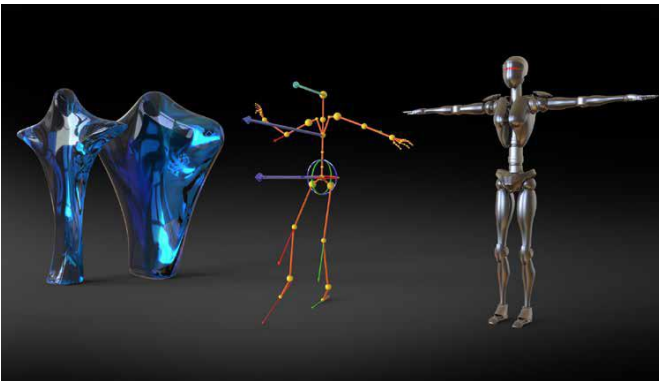


Figure 11. Visualization of avatars developed in WhoLoDance



Figure 12. An example of complex multi-sequence blending

Targeted users

Targeted users were identified early on in the project and it was agreed that i) dance students-learners both intermediate or advanced ii) dance artists- both practitioners and professionals iii) dance educators and teachers iv) choreographers would be our key stakeholders. However, it was also noted that people interested in machine learning, cultural heritage and information technology and portable technology would also find the WhoLoDancE tools of interest. For this reason, several of our events invited a variety of individuals. This will be further explained in the details of the testing/evaluation/dissemination events organised throughout the life of the project.

WhoLoDancE set out to work with professional dancers interested in the intersections of dance and technology, dance learners, and technologists keen to deepen the discourse on mediated performances. While many of the evaluation events were organized by COVUNI, the entire Consortium was involved in coordinating and arranging events that were used evaluation opportunities.

For the formative evaluation for the WEP at ATHENA, seven participants were approached one by one, observed during and interviewed after completing a number of tasks suggested by the evaluator. Three of them would be characterized as UX experts, while the other four were potential users with dance experience, in different dance genres and level from intermediate to professional dance teacher.

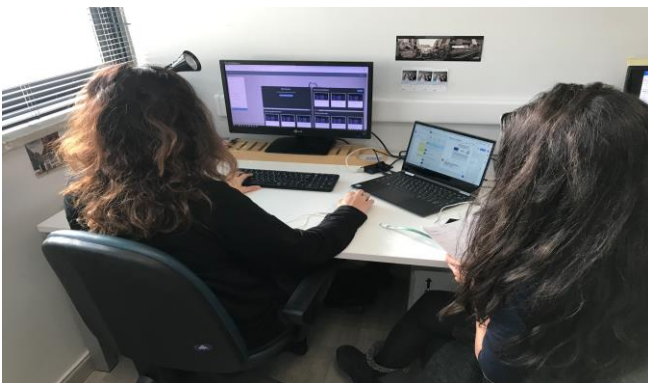


Figure 13. Users at ATHENA using the WEP (Athens, Greece)

Evaluation and dissemination events

The Consortium was strategic with its planning of its evaluation events and dissemination activities and actively tried to combine the two. The project used the last two years of its development phase to simultaneously develop the tools and to carefully share those prototypes with its key stakeholders. WhoLoDancE was part of several international festivals, conferences, seminars and symposiums which afforded the Consortium an opportunity to carefully curate lecture-demonstrations and participatory workshops where participants could engage with the tools and discuss the work with the developers and the dance partners. What follows are descriptive texts of the several dissemination and evaluation events curated by the Consortium. For each event, different partners led but all were involved in the planning of the sessions, and COVUNI attended, offering both the flamenco dance expertise in addition to leading on the evaluative work.

MOCO 2017 – 4th International Conference on Movement Computing (London, UK)

The fourth International Symposium on Movement and Computing (MOCO'17) was held in London, UK. MOCO'17 was organized by Goldsmiths, University of London, one of the UK's leading universities for the arts, and held in the Professor Stuart Hall. The Department of Computing has a strong tradition of interdisciplinary work that takes seriously the notion of technology as a creative discipline. The WhoLoDancE team curated a workshop which referenced the challenge of representing embodied movement knowledge within computational models, yet it also celebrated the inherent expression available within movement as a language. While human movement itself focuses on bodily experience, developing computational models for movement requires abstraction and representation of lived embodied cognition. Selecting appropriate models between movement and its rich personal and cultural meanings remains a challenge in movement interaction research. The WhoLoDancE workshop aimed to address these themes and engage in conversations with the participants.



Figure 14. MOCO Performance and example and dance and technology meeting on stage

The WhoLoDancE team met over 100 MOCO participants, all of which demoed the tools, spoke to the developers and/or engaged with the dance partners allowing for in-depth conversations of the project's tools.

WhoLoDancE-Metabody Toulouse 2017: a meeting at the crossroad of art, science and dance (Toulouse, France)

WhoLoDancE-Metabody Toulouse 2017 was a transcultural event which took place in Toulouse, France, on December 18-19 at *Centre Culturel Bellegarde* and was organised by our partner K. Danse within the Metabody initiative. *Metabody Toulouse* is a collaborative platform for experimentation, critical thinking and presentation of artistic works, which proposes transdisciplinary exchanges between artists, scientists, programmers, inventors, researchers, philosophers.

For the 2017 edition, *Metabody Toulouse* presented various works articulated around dance and relevant scientific research carried on by local, national and international partners within the Radical Choreographic Object (RCO) and the WhoLoDancE projects. RCO is an interactive participatory dance performance, with variable scales, which unfolds according to the physical behaviour of audience participation and their reactions instructed via their smartphones. For WhoLoDancE, representatives of Motek (The Netherlands), InfoMus and Politecnico di Milano (Italy), Peachnote (Germany), Athena RC (Greece), University of Coventry (UK), contributed to the presentation of technological prototypes dedicated to the annotation and fine analysis of kinaesthetic and qualitative aspects of movement in dance, the use of a similarity search software in order to identify similar patterns of movement, the blending of choreographic sequences taken from a large repertory of 3D high quality motion capture movements, including ballet, contemporary dance, flamenco and traditional Greek dances.

WhoLoDancE Seminar (Madrid, Spain)

The *International Living Arts Centre Naves Matadero* fosters innovative projects that enables them to transform the relationship with artistic expression, rethinking the process, strategies and creative impact. It works as part of a network with national and international agents and institutions, uniting artists, collectives, curators, independent cultural agents, etc. Curiosity for theatre, dance, new circus, music, the visual arts, performance and unidentified hybrid forms allow *Naves Matadero – International Living Arts Centre* based in the centre of Madrid, to be an expanding space which, from its most immediate environment, makes contact with the city and becomes an exceptional centre with the wherewithal to tackle projects at the national and international level.



Figure 15. Image from Naves Matadero (Madrid, Spain)

On April 17-18, 2018 the *International Living Arts Centre Naves Matadero* hosted a two-day seminar dedicated to the WhoLoDancE project, with the support of our partner Stocos Institute. The seminar was directed to professionals in the dance field, dancers at the conservatoire as well as anyone interested in getting in contact with the WhoLoDancE project and those that wanted to engage with the prototype tools developed by our Consortium. Day one of the event saw a mix of 14-25-year-old dance students studying at the *Conversatorio Profesional de Danza Fortea* and also informatics at *Universidad Carlos III* in Madrid.



Figure 16. Image of Choreomorphy tool being used by a dancer (Madrid, Spain)



Figure 17. Image of dancer in motion capture suit and using Choreomorphy tool (Madrid, Spain)



Figure 18. Image of participants looking at the avatar on screen of the Choreomorphy tool (Madrid, Spain)

Visitors were able to experiment with the Choreomorphy tool, dressing up in motion capture devices and dancing while visualising themselves through different avatars. The sonification tool, which allows to track and visualise one's movements and change the background music according to the dancer's position, all by wearing a sensor-equipped bracelet.



Figure 19. Image of Amalia Markatzi, Wholodance partner, delivering Greek dance to participants

The, WhoLoDancE tech team, in collaboration with all of the dance partners guided the audience trying their hands on the project interface tools, such as the blending engine, and created dance sequences from simple movements. The similarity search tool was coupled with the flamenco dance expert to execute queries in search of dance movements, and a simple exploration of the movement library, its collection and features was also carried out. The audience was also invited to participate in the dance seminar held by the Greek partner Amalia Markatzi, from our partner Lykeion Ton Hellenidon, on traditional Greek folk dances. Her work consisted of introducing the history and features of the longstanding art form and she invited the audience to part of the live dance performance.

Digital Echoes Symposium 2018 (Coventry, UK)

Digital Echoes 2018 is an annual symposium which looks at the current trends within the dance and digital technology field. It examines closely the intersections of interdisciplinary work and brings leading thinkers, artists, dancers, performers, academics and technologists together. The WhoLoDancE project was featured in the 2017 and 2018 symposium in a number of ways. Katerina El Raheb (ATHENA) from the Consortium presented at the 2017 Symposium and in the 2018 event, the COVUNI members disseminated the project and its goals, highlighting the progress being made. The project's materials were disseminated and the DES2018 participants were invited to see the tools and discuss its progress. The COVUNI team spoke with several of the participants and engaged in meaningful and useful conversations. This information was then taken back to the Consortium and shared within the appropriate contexts.



Figure 20. Digital Echoes Symposium Dancer photo credit: Rosamaria Cisneros

MOCO 2018 - 5th International Conference on Movement and Computing (Genova, Italy)

Following on from previous successes of past editions, the 5th International Conference on Movement and Computing (MOCO'18) was hosted in Genova, Italy on June 28-30 2018 and was co-organised by University of Genova, Paris 8 University, MINES ParisTech and IRCAM.



Figure 21. Image of Michele Buccoli, Politecnico Milano, illustrating the Segmentation tool

The WhoLoDancE Consortium curated a workshop where the tools were not only demoed for participants, but conference attendees were allowed to engage with the Consortium.

EUSIPCO 2018 – 26th European Signal Processing Conference (Rome, Italy)

The 26th European Signal Processing Conference (EUSIPCO 2018) took place from the 3rd to the 7th of September 2018 in Rome, Italy. Organised by *Roma Tre* University, EUSIPCO 2018 was held at *Centro Congressi di Confindustria – Auditorium della Tecnica*. The flagship conference of the European Association for Signal Processing (EURASIP) addresses the latest developments in research and technology for signal processing and its applications. It featured world-class speakers, oral and poster sessions, keynotes and plenaries, exhibitions, demonstrations, tutorials, demo and ongoing work sessions and satellite workshops, and attracts many leading researchers and industry figures from all over the world.

Among these, the conference welcomed the “*WhoLoDancE: body motion analysis with applications to dance education and beyond*” Satellite Workshop. The main focus of the workshop was to bring together experts of dance movement analysis coming from both sides of the spectrum: scientists who focus on movement analysis and quality assessment, as well as dancers, who help scientists make sense of descriptors that are often hard to pinpoint and formalize. The workshop presented the latest scientific and technical results achieved by the WhoLoDancE Consortium and showcased the developed technologies in the form of live demonstrations and dance improvisation performances, as well as giving the public the opportunity to engage first-hand with virtual reality and multimodal interactive experiences.

WhoLoDancE Experience – Lab & Performance @ Romaeuropa Festival (Rome, Italy)

Initiated in 1986 and accompanied by growing success, the Romaeuropa Festival is now at its 33rd edition, and is renowned as the most important Italian festival and, according to the Wall Street Journal, one of the top four in Europe for the promotion and diffusion of contemporary arts, theatre, dance and music. Composite as its public, the festival knocks down conventional barriers between “high” and “mass” culture, in the name of exchange, union and intertwine of culture and expressive codes. Each year Europe, America, Oceania, Asia, Africa meet in the Italian capital in a spectacular wave of dance, theatre, music, cinema, meetings with artists, visual arts and technological challenges. Sounds and artistic expressions of five continents build an intense, aesthetic experience stretched over two months of performances into an articulated geography of spaces.

The festival hosted a WhoLoDancE-dedicated event, entitled “WHOLODANCE EXPERIENCE – LAB & Performance @ Romaeuropa Festival” on the 7th of October 2018. The Consortium focused on sharing the project tools and their potential applications in choreography and dance teaching environments. The interactive laboratory including web-based demos, live dance demonstrations with multimodal tools and hands-on sessions allowed a meeting between the public and the Consortium to discuss achievements, open challenges and potential applications of the WhoLoDancE approach. The dance partners also invited participants to dance and use the tools.



Figure 22. Image of Massimiliano Zanoni (Polimi) showing the functioning of the Blending engine with the support of Rosamaria Cisneros (Covuni) and Muriel Romero (Stocos)

The event was held at the cultural centre *MACRO Testaccio – La Pelanda*, a former slaughterhouse which has now become a living space for events and temporary exhibitions.

Festival della Scienza (Genoa, Italy)

The *Festival della Scienza* of Genova is the leading science festival in Italy and one of the biggest in Europe, accounting for about 200,000 visitors, 300 events and 350 speakers each year. The annual 11-day event, spread across the beautiful historical centre of Genova in about 50 different locations, represents a fixed point of reference for science dissemination where researchers, science enthusiasts, schools and families gather to explore and investigate science crossing over traditional subject boundaries, through exhibitions, interactive laboratories, meetings, workshops, shows and conferences ranging from mathematics, natural and human sciences.



Figure 23. Image of participants doing Greek folk dance

The 2018 edition, entitled “*Change*”, took place from 25 October to 4 November 2018. Among others, the festival hosted a one-day event dedicated to WhoLoDancE, namely the “*WhoLoDancE Performative Workshop*” (27 October, 18:00 – 19:30, Casa Paganini-InfoMus). The event was aimed at offering an «experiential journey» where to discover four different dance genres and participate directly in the various ways innovative digital technologies developed WhoLoDancE are integrated into new pedagogical processes for teaching, learning and creating dance movements. These included motion capture, algorithmic treatment of data, annotation of movement qualities, segmentation, similarity search, movement blending, virtual reality, movement sonification and sketching.

Student evaluation events

In March 2018, the whole suite of tools was shared with dance students in conservatoire training in Madrid, Spain. In March and April 2018, the *Annotation tool* was shared with students from two different universities in the UK. The conservatoire students experienced seeing the tools being demonstrated and using the tools over a two-hour session, we then interviewed nine students to ask them about their experience immediately after this session. The UK students were shown the Annotation tool and then used it. There were seven UK students in total. The *Annotation tool* uses pre-recorded video sequences aligned next to an avatar of the same sequence motion captured, drawn from four different dance genres: contemporary dance, ballet, flamenco and Greek folk dance. The user can annotate the sequences, on a timeline, drawing from a set of movement principles, movement qualities and actions defined by the project team⁹. The tool is designed to support an in-depth analysis of dance movement, to identify style features, and to tune the user's perception by drawing attention to the complex interrelationships between the component parts of dance.

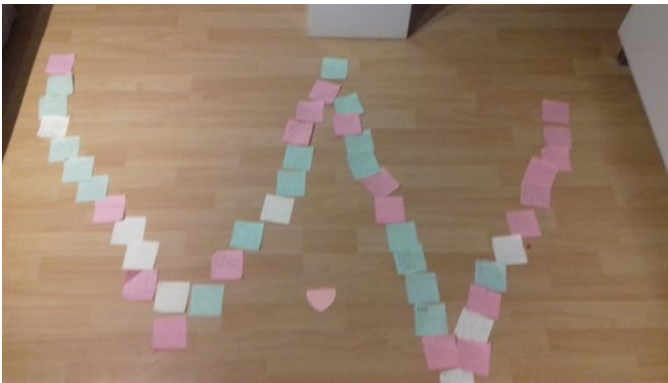


Figure 25. Image of comments collected on post-it notes

27 March 2018 - Wolverhampton University (Wolverhampton, UK)

On 27th March 2018, an evaluation event with dance students studying at Wolverhampton University¹⁰ welcomed 15 undergraduate dance students as well as dance Science tutors and dance educators from the university attend the event. We showed them the Annotation and dance segmentation tool and looked at the ways that these tools could be useful for their dance learning and practice. The tool was well received, and the participants acknowledged that indeed there was a need for such tools that could engage their way of seeing, discussing and learning dance.

⁹ The movement principles are Alignment, Disaligned, Co-ordination, Isometrical, Asymmetry, Symmetry, In Balance, Off Balance, In Focus, Out of Focus, Stillness; and the movement qualities are Direct, Fluid, Fragmented, Heavy, Indirect, Light, Rigid, Sudden and Sustained.

¹⁰ <http://courses.wlv.ac.uk/course.asp?code=DC001H31UVD>



Figure 26. Image of student looking at annotation tool with Karen Wood (Wolverhampton, UK)

8 May 2018 - Coventry University (Coventry, UK)

Student evaluation with second- and third-year dance students studying at Coventry University. Similar to the above-mentioned evaluation session, this workshop also worked closely with dance students studying choreography and dance performance. Similar findings were confirmed, and the tools were exciting and inspirational for the group of students and teachers.

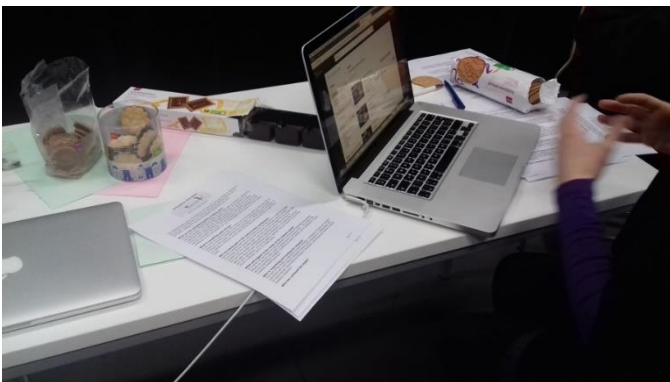


Figure 27. Photo of the evaluation event at COVUNI

Artist and researcher evaluation events

An important component of the evaluation was to ensure that we had artists and researchers use the tools and give feedback. Two events were planned which we promoted as ‘labs’ and organised as two or three hours long to enable the participants to have a substantial amount of time with the web-based platform and tools and the opportunity to continue to have access post-event for a limited time. This was important because having more time with the tools may create a deeper engagement and offer an opportunity for them to use in their work. The evaluation events catered to different artists from several backgrounds with varying degrees of experience.

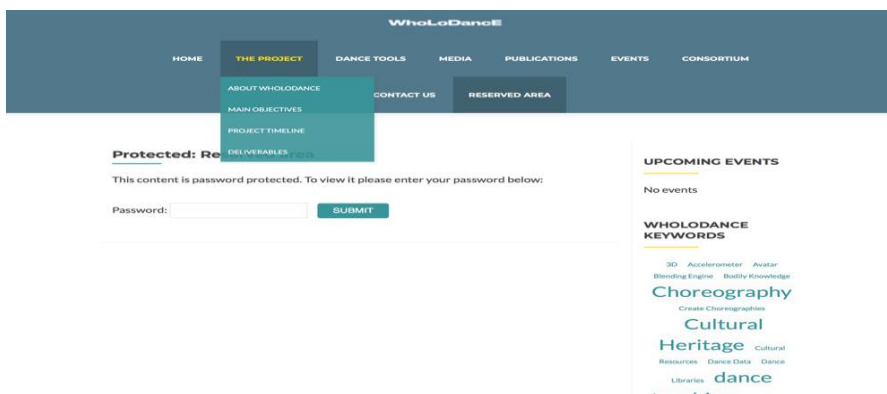


Figure 28. Screenshot of Reserved Area that artists were given access to, to evaluate the web-based tools

3 October 2018 - Coventry University (Coventry, UK)

This evaluation lab was held in the Performance Studio at Coventry University for three hours and primarily for staff and students to use the web-based prototype tools that have been developed in the project. The tools were available online (for a limited period) and people bought their own laptops and given passwords to enable them to access the Reserved Area on the website and thus the tools. Six people attended this event.



Figure 29. Image of evaluation lab at Coventry University (Coventry, UK)

14 November 2018 - Birmingham Dance Network (Birmingham, UK)

Birmingham Dance Network (BDN) creates opportunities for artists to easily connect, network and discover other artists, choreographers and teachers. They hold monthly social events and we were able to organise an evaluation session, attached to the social, with artists attending. 16 artists attended the social and 14 agreed to take part in the evaluation. The participants were told that they would be evaluating digital proof-of-concept tools developed by the WhoLoDancE project. They brought their own laptops and given access to the Reserved Area of the website to evaluate the tools.



Figure 30. Image of artists and BDN social and signing up for the remote evaluation (Birmingham, UK)

Dance artists and companies

Freelance dance artists and dance companies were also given the tools for an extended period of time. We also chose to ask the dance partners for their feedback as they were part of the project and shared the tools with their local and/or national communities and could provide a unique perspective. The dance partners brought dancers from their companies to demo the tools or to be part of the motion capture sessions. Their perspective of not being fully part of the Consortium yet demoing the tools and sharing them with key stakeholders, was valuable feedback and we decided, following all ethical protocol, to interview and allow them to feedback into the evaluative work. Their feedback will be in the results section, but it should be noted that the dance partners and their dancers or teachers were invited to feedback and offer their experience.

Annalouise Paul (Melbourne, Australia)

Annalouise Paul is a dance maker and performer whose choreographic works explore identity and transformation through the intersection of traditional and contemporary dances. She seeks to understand the connection between personal and cultural histories in shaping solo and ensemble works using her original dance methodologies. An independent artist for thirty years, she was trained in contemporary dance at Laban Centre for Dance and Movement, London and in flamenco dance in Madrid and Seville.



Figure 31. Annalouise Paul performing in Forge

Annalouise's original methods for creating hybridised choreography follow two key approaches she has innovated, Dance DNA and Hidden Rhythms. These are central to her practice and a result of dual training in flamenco and contemporary dance. Practice-led research has been ongoing through residencies and workshops in Australia, France, Singapore and India since 2013. Annalouise Paul creates dance narratives inspired by histories, bodies and an observation of cultures and peoples. She also works closely with digital technologies and somatic practices.

Annalouise was in residence at C-DaRE from 2nd to 6th July 2018. She tested the WhoLoDancE tools and worked with the Consortium's flamenco dance expert for the week. She also tested the tools remotely and shared the project and its tools with her local dance community in Australia.

Web-based evaluation of final prototypes of tools

For the web-based evaluation of the final prototypes 35 User Board members, 20 educators and choreographers in France and 20 dance artists and educators from the UK were invited to take part in web-based evaluation. Through the WhoLoDancE website, a Reserved Area was set up, accessed by a password, for people to evaluate the web-based tools remotely and at their leisure during a limited time period. Not all invitees responded to the invite and it seems the most successful recruitment happened when in person and not just over email.

The Reserved Area had five tools on the space, each with a description, tutorial video, a link to the tool and a link to the evaluation questionnaire. Coventry University led on providing the vocals for the several films that were made and also offered feedback on the videos. The team supported Lynkeus with the preparation of the scripts in addition to providing voiceovers and guidance with the actual film.

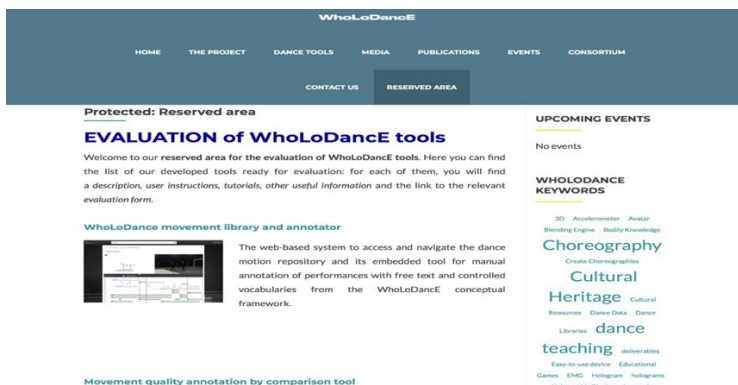


Figure 32. A screengrab of the Reserved Area once the password has been entered. The start of the list of tools can be seen

For the WEP, the participants signed the consent form and users were briefly introduced to the evaluation methodology, without being revealed, however, from the start, the objective of the platform.

The methodology of the formative evaluation consisted of a think-aloud protocol combined with observation of the user and followed by semi-structured interviews, after completing a number of tasks given by the evaluator-interviewer. The process was divided in two discrete parts, with two steps for each one of them. During the first part, users were urged to explore the tool and its functionalities, without any introduction or guidance, in order to detect if the purpose of the tool is clear. After that, a brief interview estimated at five minutes was conducted.

The second part included a task-based evaluation. Several tasks such as setting personal preferences, locating recommended courses, enrolling and quitting from a course, completing lessons and browsing were asked from the users. Finally, a ten minutes interview was the final step.

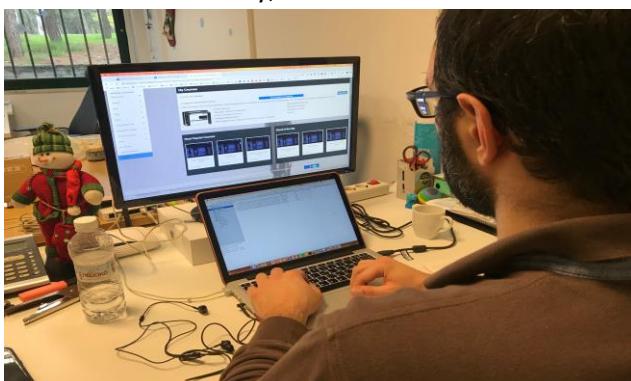


Figure 33. Participant using the WEP tool

Results

In this section, we will start with the feedback gathered from the students at the demonstration/workshop events. We will then move on to the feedback from the remote evaluations of the web-based tools and also offer direct comments from some of the dance partners as well as testimonies from the participants whom attended the public workshops.

Student experience

Overall, there was a positive response to the demonstration of the tools and an enthusiasm to use and play with the technology. Some commented on the need for portability and ease of access to the software, which includes cost consideration. Most of the students could see the potential for learning and complementing what the teacher offers in the dance studio. In addition, the potential for choreographic opportunity was noted by most. The students were also thinking about ‘what next’ in terms of the future for dance and what technology can contribute to the artform and their own practice.

More detail came from observing the students using the tools and in particular, the Annotation tool. This highlighted to the students the anatomical structure of the skeleton and the detail that can be seen in watching an avatar of the dancer from a clip in the movement library. This brought comments such as, ‘when learning rep[ertoire], I can see the joints move’ and ‘I can see the quality of the movement’. Some students commented on the usefulness of seeing this detail to complement what was learnt in the studio. Another student said about watching the avatar that they were, ‘noticing own habits and ways of moving’. They were getting real-time information about the way they move that they may not have received before, indicating that a new way of looking and experiencing may be taking place, whereby they were thinking about their own dancing from a new perspective.

One student commented on how it could make studying easier, ‘we can study better with the avatar – we can work in our own house etc. so it makes it easier to study. This can improve my dancing’. However, discussion also focused on portability and the kind of platform that they would like for accessing the tools. There were mixed views on whether they would prefer to have an app on their mobile phones with the software available or whether the change in screen size would mean losing detail. While portability and ease of access was an important consideration, they did not want to lose the detail of the skeleton that can be seen from the avatar representation on a larger screen. They could also see the creative potential of the tools especially for long distance collaborations, showing that these students were also thinking about life after their study years.

Results from the web-based tool evaluation

The results that follow are for the WML and annotation tool.

1. Was the tool user-friendly?

7 responses

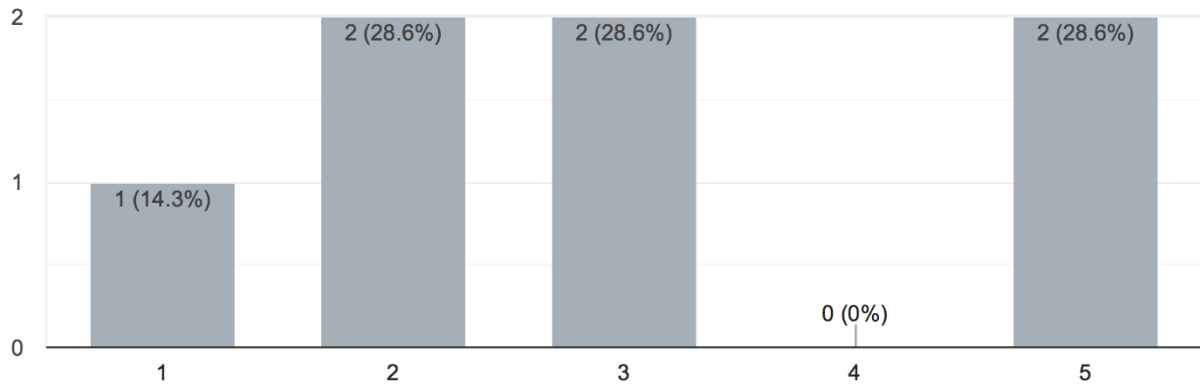


Figure 34. Image showing the results from question 1 from the online questionnaire for the WML and annotation tool. The X axis represents a Likert scale of 0-5, where 0 was 'Not Very' and 5 was 'Very Much'.

2. Could you see yourself using this tool in your work and practice?

7 responses

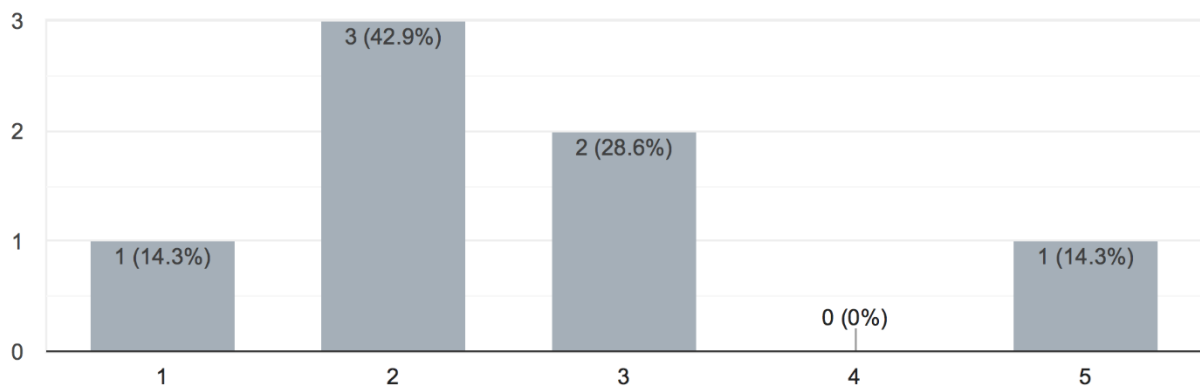


Figure 35. Image showing the results from question 2

3. Do you think this tool might affect your work experience?

7 responses

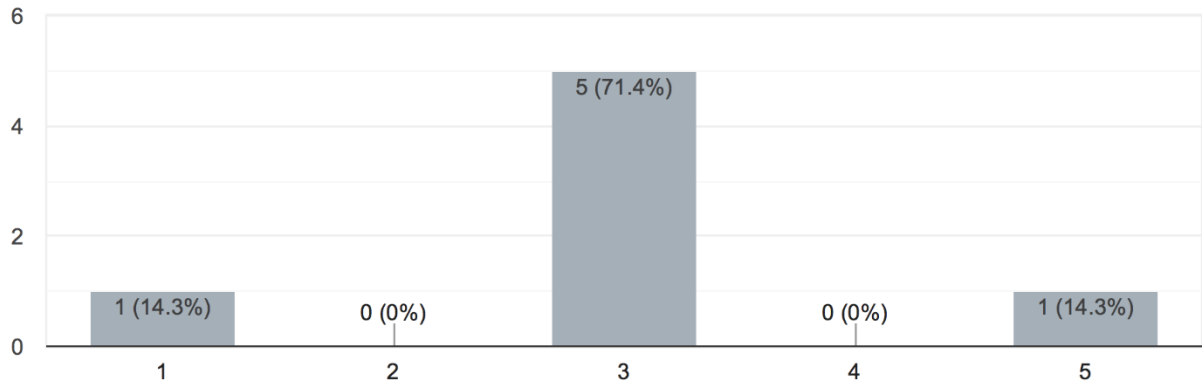


Figure 36. Image showing the results from question 3

4. Might this tool affect your dance learning experience?

7 responses

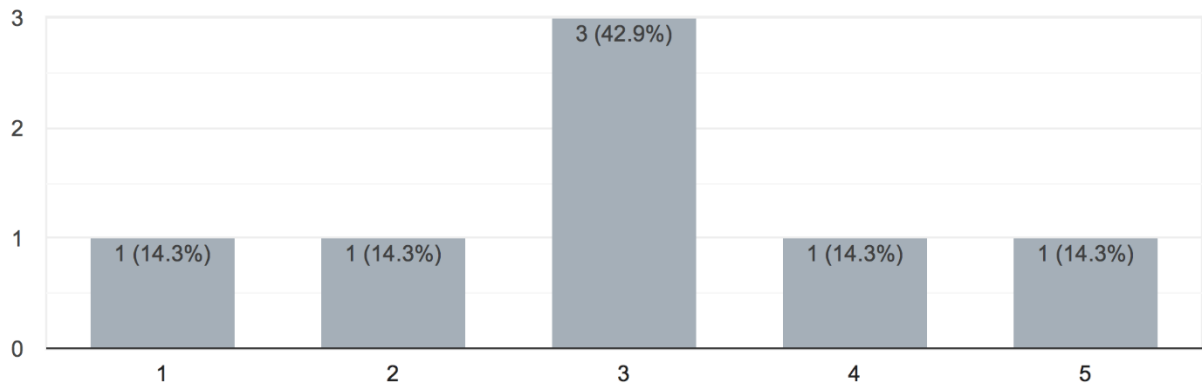


Figure 37. Image showing the results from question 4

5. Might this tool affect your creative experience?

7 responses

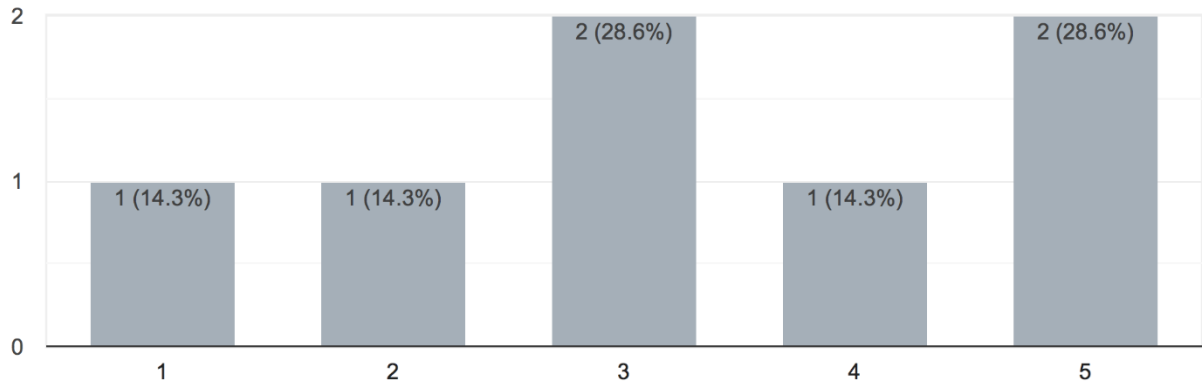


Figure 38. Image showing the results from question 5

6. Would you pay money for this tool? How much?

5 responses

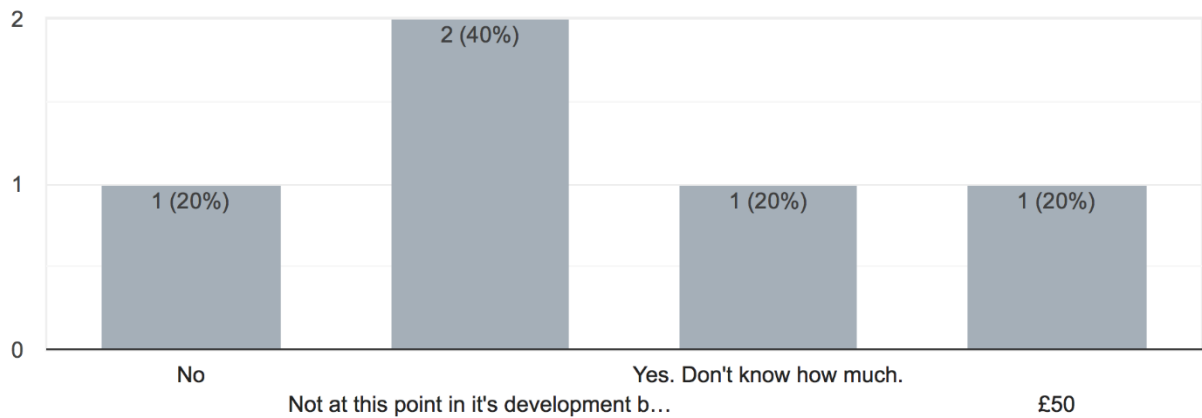


Figure 39. Image showing the results from question 6

7. Would you want this tool to be on a computer? Mobile? Ipad? (three options)

7 responses

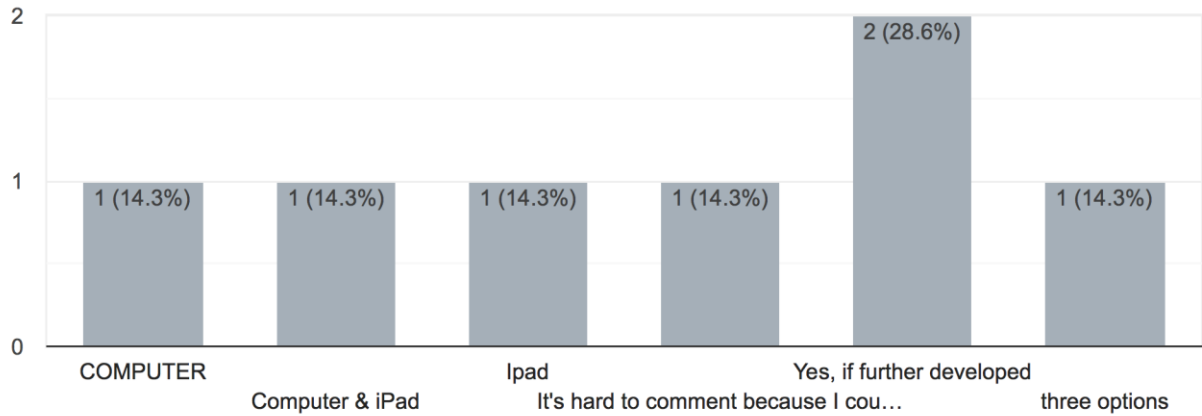


Figure 40. Image showing the results from question 7

8. How easy to enter/navigate/search etc. Feel of interface – ease of use etc.

7 responses

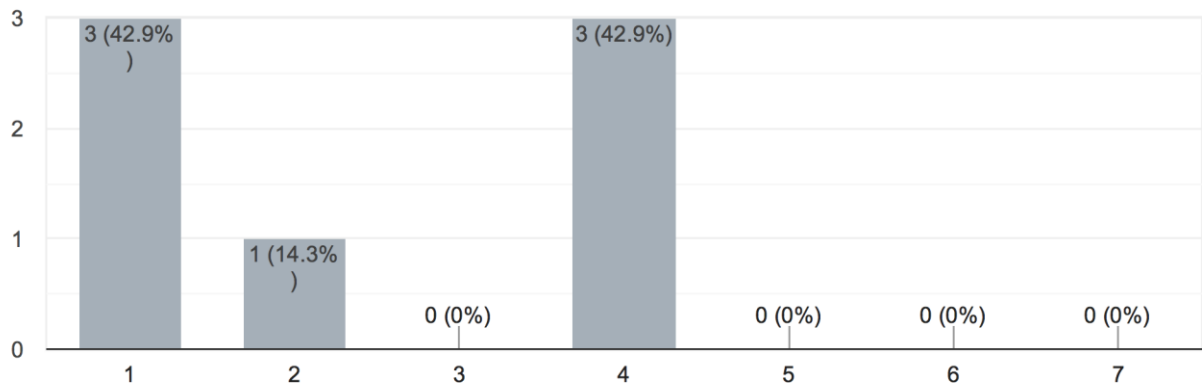


Figure 41. Image showing the results from question 8

9. How useful was the video tutorial?

7 responses

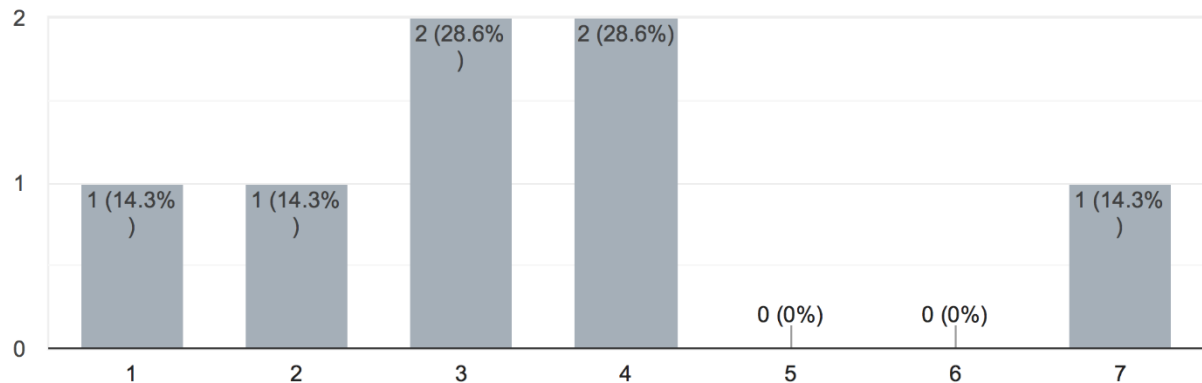


Figure 42. Image showing the results from question 9

10. Which functionality of the tool did you find most relevant to your practice?

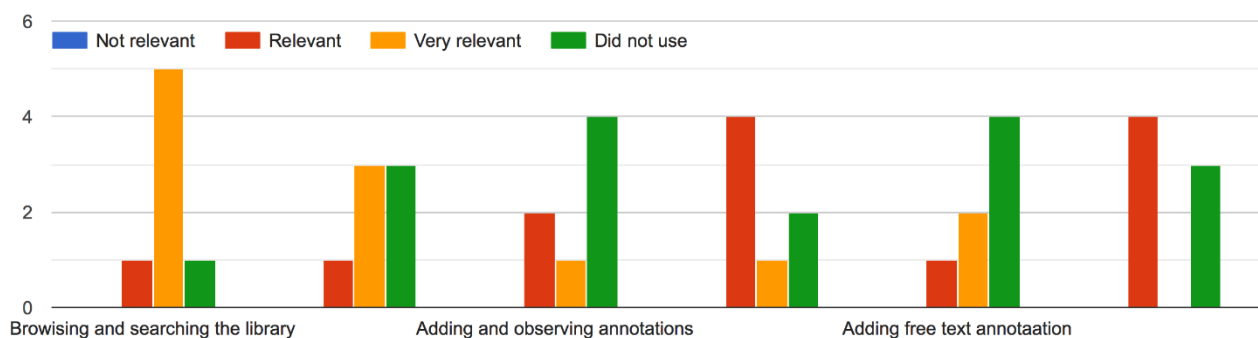


Figure 43. Image showing the results from question 10

For the WEP tool, we observed users' behaviour and marked their difficulties and questions, which offered the opportunity to reach several useful conclusions, including both the benefits and drawbacks of the tool. The purpose of the tool, as well as the functionalities that are supported appeared to be clear for all users. They seemed satisfied from the aesthetics and the way that the information is presented. "Minimal design", "clear and attractive" and "usable" were some of the comments of the users. Moreover, the tool received positive comments for the mechanism that was developed as a means to browse and explore courses and activities. The process of setting personal preferences and receiving recommendations, was considered useful and in accordance with their needs.

Regarding the drawback's users appeared to encounter some difficulties on locating their personal courses list (My Courses page) and distinguishing the difference between personal and browsing pages. Furthermore, for some users that have not previous experience in a particular dance genre, or in dance in general (e.g.,

UI/UX experts) it was challenging for them to understand some of the dance terms, as they were unfamiliar with those. A search bar seems as a useful addition for users with dance experience. Finally, there was a common request, when an activity was completed, next recommended activity to be proposed directly in the viewer's page.

Dance partner's experience

1) How have you found your experience of doing the demos for WhoLodancE?

- a) I have imagined the WPW, WhoLodancE performative workshop, as a nomadic way to convey to large audiences, in a playful way, the outcomes of the research project. I have found the experience very useful as to make general and specialized audiences be at ease with sophisticated digital tools. My deep belief is that these tools are complementary with the act of live teaching and choreography making. Therefore, the showing of very short performances has been useful for creating the link with the artistry contained in the different dance genres involved in WhoLodancE. [L][L][L][L][SEP][SEP]
- b) The tools allowed me to see the fluidity and the modules differently. I could see differently.
- c) It was surprising for me and I have been teaching and dancing for many years and I have never seen the joints of the bodies doing the movements of the body in this way. The dancers were dancing, and I was watching the avatar, the computers that were translating the movement, and there it was the first time I realised how precious it was for us to have the movements captured in this way. And when I saw the "arrow man" it was even surprising, even if confusing, it was possible to look at it and really study this... so I started saying that we have new material for our database of movements.

2) Which of the tools do you think you would use in your practice?

- a) The movement library, the search engine for similarity, sonification of movement qualities and the blending engine for the playful investigation of unusual dance combinations.
- b) Yes, the movement library.
- c) Yes, the segmented figures would be useful. [L][L][SEP]
- d) All of them would be useful.

3) How would you use them?

- a) As personal research tools during the period corresponding to the conceptual and dance-oriented preparation prior to rehearsing with dancers for a new piece, for example. As tools for dedicated and experimental workshops. [L][L][L][L][SEP][SEP]
- b) I would show the mocap and say to people to study the library. I like the similarity search tool, and this would be very interesting to be able to find similarities. Similarities among Greek dances would be very useful.
- c) It would be great to learn it through the system and support that learning.
- d) At the conservatoire and also in thinking about choreography.

4) What do you think should happen next?

- a) These tools, once made very easy to use, should be spread out, shown, tested and evaluated with dancers in a large variety of contexts: dance schools, dance companies, dance research centers, conservatories, scientific and technological research institutions, even presented to people dealing with movement animation, video games design, etc. [SEP]
- b) We are showing the tools and we have to show the results with many more people. It needs more time, more exploration and more people.
- c) Now, I like that there is a call for Segmentations as it will be very good for us to learn more and to compare more with other people.

5) What has surprised/ frustrated you about using the tools?

- a) Very happily surprised by the conceptual and creative involvement of the technology partners putting a lot of positive efforts and work at comprehending the high complexity and richness of movement in dance and choreography.
- b) The tools themselves taken separately are potentially useful for opening new ways of thinking processes for dance teaching, exploration and composition. [SEP] A bit frustrated by the fact that there was not enough time to fully integrate the various tools in order to finalize one particular outcome: the development of an immersive holographic interactive set made to explore movement for creative purposes.
- c) We needed more time and more time to be together.
- d) I was worried about the “marriage” of the technology with the history and the tradition. But I was very happy to see that we can use the technology, use it correctly, and then we can see how it enhances the maintaining of the cultural heritage and I can see the magic and I was sold that it is beneficial for the dance forms.
- e) I can share a story. One of the dance teachers I work with said to me that she had been working with a student for years and it was only after seeing her avatar with the Choreomorphy tool that she finally could see and understand what was happening with her neck.

Public testimonies

The following are direct quotes from several of the events that were held where the Consortium demoed the tools and invited the audience to participate in a very controlled manner. The quotes come from paper questionnaires that were circulated after the event.

1) Would you be interested in integrating any of these tools in your working environment?

“I think all of them are useful.”

“Yes. Archives”

“To offer access to a database of examples, accurately catalogued.”

“Yes. Can help to better analyse movement, hence to convey it in the best possible way.”

2) Could you see yourself using any of these in your work? If so, can you tell us which and how?

“Sensors to create music for the dance lesson.”

“Definitely yes. For archival of dance it is helpful especially for folk dances.”

“Yes - interaction of the body language and its sounds with actors and their word.”

“For educational purposes the movement catalogues (to learn them).”

3) Which tool(s) did you find most appealing? Why?

“The one of sonification of the movements and music.”

“Sonification -the work with sound of body movement.”

“Sonification, it modified the relation between gesture and sound.”

“It depends from applications. The one for searching movements.”

“Movement library, ‘cause it is clear and complete in the visualisation.”

“Choreomorphy, it is immediate and suitable for many age groups.”

4) Which tool(s) did you find least appealing? Why?

“All of them are interesting in the vision of the future.”

“Motion blending, not clear.”

“Motion blending”

“Ankle brace, not precise response for the movement.”

“Blending - too artificial.”

Discussion

Overall, from the results from the online questionnaires (see Appendix for questions) for the WML, annotation tool, segmentation tool and WEP show that the participants could see the value of the the tools in a dance learning and creative environment. The scores for these questions were generally rated from 3-5 on a Likert scale of 0-5, where 0 was 'Not Very' and 5 was 'Very Much'. This shows that the potential of the tools for learning and creating could be seen. 60 % of participants thought that these tools would affect their creative practice and the browsing and searching in the WML was felt a very relevant feature for learning and creation.

There was also a desire for the tools to be available on all devices – laptops, iPads, mobile phones. Over 50% of the replies found the tools user friendly and one reason given for not finding them user friendly was access difficulties. This is due to some technical issues with using different laptop configurations and Wi-Fi set ups. This would need clearer guidance in future. The video tutorials were generally seen as helpful although some commented on the speed of some of the tutorials, so these could be re-recorded to slow down the speech.

The WhoLoDancE tools, in particular the Annotation tool, has the potential to contribute to further understanding in this field. Our observations thus far reveal that in the meeting of the avatar, the recorded dancer and the selection of movement quality dance terms, the dance learner is encouraged to engage in a full interaction with the digital dance environment, supporting the stimulation of the visual and kinaesthetic knowledge of the experience.

The VR tool in WhoLoDancE allows the choreographer time to experiment with new material either from a pre-recorded source or to experiment in real-time using motion capture. Some of the tools in the project have been used by a small group of dancers and choreographers so far who have commented on the unexpected richness and fullness of the information they received when experimenting with the technology. When using the tool, users described being immersed in the environment and becoming aware of the peripheral objects.

Avatar was a term that was discussed in the various interviews with dance teachers, learners and professional choreographers that were interviewed at the beginning of the project. Many interviewees were keen to learn more and explore the various types of avatars that the project was designing. It was agreed by most interviewees that having a choice and being able to choose which avatar to use and having a variety of avatars is desirable for learning, teaching and creative environments. As one participant said 'Different types of avatars are useful and necessary'. Other participants said that it would be great to have the option to personalise and see 'a bit of themselves' in the avatar. Others enjoyed the fact that the avatars were just 'bodies in a space that are not looking exactly like me'. There is a general consensus that having control over the type of avatar one can choose is important. Levels of control emerged as vital in ensuring that the user can have a personal experience with the tools.

The avatars are representations and can serve as primers for students to access their own tacit embodied knowledge. The use of the Annotation tool encourages what is tacitly understood by the dance learner to be communicated to others explicitly. The artists discovered that the visualisations encouraged them to think differently about the space, the bodies (the avatar and the live body) in space and their creative practice in that space. Seeing different types of avatars in the virtual environment has the potential to prime the user and ask them to think differently about how they moved. When the dancer moved with one of the avatars used within the project, its ability to swell and shrink in response to the dancer was intriguing and allowed

for a playful quality and creative exploration of the live and virtual environment. In summary, the general feeling was that the visualisations are an integral part of the creative process. These experiences have been particularly important for opening up debate in the project about the body in VR environments and performance.



Figure 43. Rosamaria Cisneros (Covuni) wearing HoloLens and dancing with her avatar. Photo credits: 2016, WhoLoDance photographer Giulio Bottini

Conclusion

The act of creating an avatar of the dancer, and the dancer seeing herself as an avatar, and to mirror that dancing avatar, encourages the dancer to attend, and respond to the intricacies of the action and movement qualities. These responses have the potential to open up new modes of learning and new understandings about how dancers relate to their own dancing image and to support autonomous learning. The integration of VR and interactive technology in dance performances is leading to new insights and experiments with choreographic methods that may ultimately take dance into a new direction. Mindful of the need to find ways for the WhoLoDancE tools to be more accessible, our aim is to extend the tools to VR and MR devices. Two of the tools that have more potential in VR are the *Blending engine* and the *Movement Library*. The *Blending engine* would allow choreographers to create and rehearse with an avatar in a virtual space, or in their studio using MR, similarly to composers working at their piano. The *Movement Library* is already a useful resource to access a large database of movements, but with VR it will become an important support for engaging with digital records of dance forms such as Greek folk or flamenco that are otherwise hard to find.

Overall the WEP tool has been characterized attractive, with great potential. The added value of using such a tool, instead of a simple video platform was clearly mentioned. Presenting organized content, with particular objective, is highly needed especially for younger people and children. Although maybe it is difficult to imagine users learning to dance solely through a web-based tool, it can offer curated, high quality material, made by experts. It is also important that the content is comparable, so that the user can understand the movement rather than being distracted by other things (e.g., body and skills of the particular dancer, costume, background, etc.), see similar movements and particular hierarchical structures e.g., turn→ pirouette, pirouette en dehors, en dedans). However, future improvements should be also taken under consideration, such as the enrichment of the content and tutorials regarding a more effective understanding of the used dance term.

Appendix

WhoLoDance consent form

INFORMED CONSENT FORM

Participant
No.

WhoLoDance – Whole-Body Interaction Learning for Dance Education

You are invited to take part in this research study for the purpose of collecting data on evaluation of the prototype digital tools.

Before you decide to take part, you must **read the accompanying Participant Information Sheet.**

Please do not hesitate to ask questions if anything is unclear or if you would like more information about any aspect of this research. It is important that you feel able to take the necessary time to decide whether or not you wish to take part.

If you are happy to participate, please confirm your consent by circling YES against each of the below statements and then signing and dating the form as participant.

1	I confirm that I have read and understood the <u>Participant Information Sheet</u> for the above study and have had the opportunity to ask questions	YES	NO
2	I understand my participation is voluntary and that I am free to withdraw my data, without giving a reason, by contacting the lead researcher and the Faculty Research Support Office <u>at any time</u> until the date specified in the Participant Information Sheet	YES	NO
3	I have noted down my participant number (top left of this Consent Form) which may be required by the lead researcher if I wish to withdraw from the study	YES	NO
4	I understand that all the information I provide will be held securely and treated confidentially	YES	NO
5	I am happy for the information I provide to be used (anonymously) in academic papers and other formal research outputs	YES	NO
6	I understand and agree that the information I provide may be shared with the following third parties: University of Athens, Lynkeus (Rome).		
7	I am happy to be <u>audio recorded</u>	YES	NO
8	I agree to take part in the above study	YES	NO

Thank you for your participation in this study. Your help is very much appreciated.

Participant's Name	Date	Signature
Researcher	Date	Signature

WhoLoDancE consent form and disclaimer



Please read and sign this form

I agree to participate in the WhoLoDancE Evaluation process which is hosted by the WhoLoDancE Consortium and Coventry University's Centre for Dance Research. I understand and consent to use the tools in the following way:

- I am free to use the use the WhoLoDancE tools for the agreed period; in this case it is the Autumn of 2018.
- I am granted free use of the tool for desk-based research and/or practical tasks related to my own dance and technology research
- I am **unable** to distribute the tool and the link for either commercial or non-commercial purposes. After the Summer period I agree to not reuse the tool or to share it with anyone else.
- I understand that participation is voluntary and I agree to immediately raise any concerns I might have with any member of the WhoLoDancE Consortium. Contact person is Rosamaria Cisneros ab4928@coventry.ac.uk
- I understand that no remuneration is due in exchange for this work.

Disclaimer: the tool has undergone testing in various settings and the Consortum feels strongly that the tool is safe to share with Macbook and PCs Laptops that have an operating system of 10.9 or higher. Since the tool is in its prototype stage there may be unexpected crashes and bugs. We encourage the user to save frequently and back up regularly and to use the tools at their own risk.

I agree that the WhoLoDancE Consortium would not be responsible for loss of work or other problems that the software may cause to me or my computer.

For more information or any questions and concerns, I understand that I can contact:

Sarah Whatley at s.whatley@coventry.ac.uk or Rosamaria Cisneros ab4928@coventry.ac.uk

Please sign below to indicate that you have read and understand the information on this form and that any questions you might have about the testing have been answered.

DATE: _____

Please print your name: _____

Please sign your name: _____

Subject's Signature

WhoLoDancE participant information sheet

Wholodance – Whole-Body Interaction Learning for Dance Education

PARTICIPANT INFORMATION SHEET

You are being invited to take part in research evaluating digital tools. Sarah Whatley, Professor and Director of the Centre for Dance Research at Coventry University is leading this research. Before you decide to take part, it is important you understand why the research is being conducted and what it will involve. Please take time to read the following information carefully.

What is the purpose of the study?

The purpose of the study is to gather feedback from you as a dance/technology professional. The study will result in publications (text/video/online) and contribute to the development of the prototype which will explore new methods for teaching and learning dance, and choreographic practices.

Why have I been chosen to take part?

You are invited to participate in this study because you are a dance professional.

What are the benefits of taking part?

By sharing your experiences with us, you will be helping the Wholodance to better understand the how to develop and apply breakthrough technologies to dance in order to investigate bodily knowledge, preserve cultural heritage, innovate teaching and widen the access and practice of dance.

Are there any risks associated with taking part?

This study has been reviewed and approved through Coventry University's formal research ethics procedure. There are no significant risks associated with participation.

Do I have to take part?

No – it is entirely up to you. If you do decide to take part, please keep this Information Sheet and complete the Informed Consent Form to show that you understand your rights in relation to the research, and that you are happy to participate. Please note down your participant number (which is on the Consent Form) and provide this to the lead researcher if you seek to withdraw from the study at a later date. You are free to withdraw your information from the project data set at any time. You should note that your data may be used in the production of formal research outputs (e.g. journal articles, conference papers, theses and reports) prior to this and so you are advised to contact the university at the earliest opportunity should you wish to withdraw from the study. To withdraw, please contact the lead researcher (contact details are provided below). Please also contact the Faculty Research Support Office (email researchproservices.fbl@coventry.ac.uk; telephone +44(0)2477658461) so that your request can be dealt with promptly in the event of the lead researcher's absence. You do not need to give a reason. A decision to withdraw, or not to take part, will not affect you in any way.

What will happen if I decide to take part?

You will be asked a number of questions regarding the use of the tools and how easy they are to use. The questionnaire/interview will take place in a safe environment at a time that is convenient to you. Ideally, we would like to audio record your responses (and will require your consent for this), so the location should be in a fairly quiet area. The questionnaire/interview should take around 10-15 minutes to complete.

Data Protection and Confidentiality

Your data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR) and the Data Protection Act 2018. All information collected about you will be kept strictly confidential. Unless they are fully anonymised in our records, your data will be referred to by a unique participant number rather than by name. If you consent to being audio recorded, all recordings will be destroyed once they have been transcribed. Your data will only be viewed by the researcher/research team of the Wholodance Consortium. All electronic data will be stored on a password-protected computer file on the research portal of Coventry University. All paper records will be stored in a locked filing cabinet at the Centre for Dance Research. Your consent information will be kept separately from your responses in order to minimise risk in the event of a data breach. The lead researcher will take responsibility for data destruction and all collected data will be destroyed on or before 30th June 2019.

Data Protection Rights

Coventry University is a Data Controller for the information you provide. You have the right to access information held about you. Your right of access can be exercised in accordance with the General Data Protection Regulation and the Data Protection Act 2018. You also have other rights including rights of correction, erasure, objection, and data portability. For more details, including the right to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk. Questions, comments and requests about your personal data can also be sent to the University Data Protection Officer - enquiry.ipu@coventry.ac.uk

What will happen with the results of this study?

The results of this study may be summarised in published articles, reports and presentations. Quotes or key findings will always be made anonymous in any formal outputs unless we have your prior and explicit written permission to attribute them to you by name.

Making a Complaint

If you are unhappy with any aspect of this research, please first contact the lead researcher, [Sarah Whatley, s.whatley@coventry.ac.uk]. If you still have concerns and wish to make a formal complaint, please write to:

Professor Neil Forbes

Acting Associate Dean of Research

Bugatti Building

Coventry University

Coventry CV1 5FB

Tel: +44 (0) 02477 658771

Email: n.forbes@coventry.ac.uk

In your letter please provide information about the research project, specify the name of the researcher and detail the nature of your complaint.

ⁱ WhoLoDancE Film- July Edit: <https://vimeo.com/179879432>