WHOLODANCE

Whole-Body Interaction Learning for Dance Education

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Deliverable 9.5

First Intermediate Report

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Introduction

This Deliverable provides a brief account of the work carried out during the first twelve months (M1-M12) of the Wholodance Project. The main activities in the project agenda were following:

- Kick-off meeting
- Release of the Dissemination and exploitation strategy plan
- Preparation of the dissemination materials including:
    - The standard Project Presentation
    - Project Website
    - Graphic Identity (Logo and standard font)
    - Preparation of Posters presentation of the project
    - Preparation of 7 Videos for dissemination
    - Delivery of more 300 photos at any relevant event for the project
    - Activate social networks (Twitter, Facebook and Vimeo)
- Release of the Self-Assessment plan
- Release of the Quality Assurance Guidelines including a definition of a standard form for deliverable review process
- Release of the first Wholodance Newsletter
- Organization and participation of two general meetings
    - At M7 in Thessaloniki hosted by Athena, together with MOCO 2016
    - At M12 in Milan hosted by Politecnico of Milan
- Wholodance workshops with external participants
- First Users' Board Session in Milan, M12
- Preparation and submission of the Intermediate Report and relevant Review

During this twelve-month period, several meetings and telephone conferences (TCs) were held for the whole consortium and also tailored for Tech partners and Dance partners.

After a brief presentation of the project objectives in phase 1 (i.e. within the first year), the key activities for the strategic governance of the project are described and the action plans that they led to are summarised. The subsequent sections are dedicated to the description of the work progress, and all relevant information about the internal management of the project and the events that took place in the course of the year. The report ends with the final statement of the meeting in Milan, which concluded the activities of phase 1, and the general conclusions about the overall progress.

Project objectives in phase 1

As described in the DoW, the Wholodance Project plan has three major phases, each consisting of a series of conceptual steps with 3 major milestones and spread over 36 months of activity.

The current reporting period, covering the interval of time M1-M12 signifies the conclusion of Phase 1 and the beginning of Phase 2.

During Phase 1: Preliminary definitions and ground-truth data acquisition (M1-M12), the main objectives of the Project have been:

- **On the management side**, to ensure a timely completion of the Motion capture data collection, the storage and organization of the data in the dedicated database organized by Metadata and the establishment of standard procedures as defined in the quality assurance deadline and the self-assessment plan.

- **On the Dissemination and communication side**, to define the graphic identity of the project, design of the website and social accounts and providing video and photo material of all the capturing process and the main dissemination events.

- **On the Dance/teaching side**, the Acquisition of the preliminary knowledge coming from the end-users and a First definition of the learning scenarios and of the different users' profiles.

- **On the technical side**, the Embryonic definition of the semantic representation models, the development of the Pipeline for the motion capture process and the completion of the Data acquisition stage of the capture process.

Deliverables due in the period M1-M12

Number	Title	Lead	Type	level	Due Date (Months/Day)		Delivered
D9.1	Kick-off meeting report	Lynkeus	Report	Public	2	29th February	2nd March
D9.2	Project Presentation	Lynkeus	Report	Public	3	31st March	4th April
D8.1	Dissemination and exploitation strategy plan and preliminary materials	Lynkeus	Report	Public	3	31st March	14th April

D2.1	Recruitment protocol and informed consent form	Covuni	Report	Public	3	31st March	14th April
D9.3	Self-Assessment Plan	Lynkeus	Report	Public	4	30th April	11th May
D2.2	Outcome of the pipeline development	Motek	Report	Public	6	30th June	2nd July
D1.1	State of the Art Survey	Athena	Report	Public	6	30th June	30th June
D1.2	Interviews Report	Covuni	Report	Public	6	30th June	2nd July
D1.3	Workshop Report	Athena	Report	Public	8	31st August	2nd September
D2.3	Outcome of the capture Process	Motek	Report	Public	8	31st August	5th September
D2.8	Multi-sensor integration Report	Motek	Report	Public	8	31st August	2nd September
D9.4	Quality Assurance Guidelines	Lynkeus	Report	Public	8	31st August	7th September
D1.5	Data Acquisition Plan	Athena	Report	Public	10	31st October	3rd November
D2.4	Trimmed linear database of curated data sequences	Motek	Report	Public	10	31st October	3rd November
D1.6	HLF Definition for the Learning Scenarios	Athena	Report	Public	11	30th November	1st December
D1.4	Definition of Learning Scenarios – Needs Analysis	Athena	Report	Public	12	31st December	31st December
D5.1	Data Modeling, Data integration and data management plan report	Athena	Report	Public	12	31st December	31st December
D9.5	First Intermediate Report	Lynkeus	Report	Public	12	31st December	24th January, 2017

Strategic Project Governance Activities

During the first year of the project, the partners of the Consortium have been involved in a consensus building process to elaborate some key strategic decisions about how to move forward in the best way possible toward the achievement of the project goals for the first year.

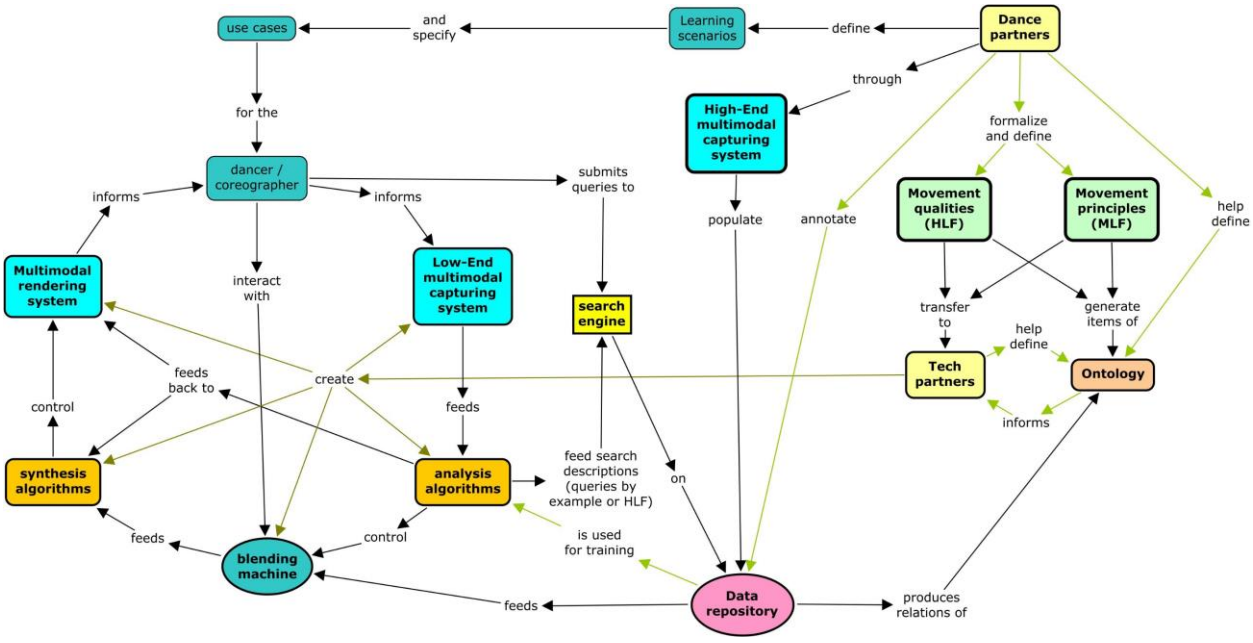
The first consensus building discussion has been held at the end of the meetings in Thessaloniki and Amsterdam, resulting in the design of an interesting approach focused on trying to converge on a first understanding of all the project's implications (as well as on its taxonomy and glossary), as stemming from pursuing all along one movement principle, namely "directionality". This approach was meant to provide a first comprehensive example allowing to check especially how high-end technologies (e.g. Motion Capture) and quality analysis can be applied to directionality, thus making it possible to start gathering useful feedbacks from the end-users, in particular during the WhoLoDance Users' Board, eventually held at the first internal review meeting in Milan (hosted by POLIMI) in December 2016.

The demo focused on the work implemented by Motek, for the motion capture repository blending engine, which was already incorporating the results of extracted high-level and low-level functions, the work on dynamic symmetry already demoed by Infomus and Stocos, as well as of similarity search analytics, all of which are to be carried on by Athena, PoliMi, UniGe, and PeachNote.

The discussion converged in a document, which outlined the key tasks and relevant schedule for the months ahead.

After this meeting, and as an extension of the document mentioned above, various partners were involved in a new discussion, initiated by a draft document provided by Polimi.

This process has led to developing a concept map, outlining a working scheme involving all the blocks developed within the project, together with the relevant information flows.



This concept map describes also the roles of the involved actors, emphasizing the information that each block requires in order to be able to operate (interdependencies).

The role of dance partners and tech partners were also better defined, for the sake of mutual understanding and also to clarify the respective contributions and dependencies:

- **Role of dance partners**
    - Formalize and define movement principles and movement qualities
    - Help create a dance movement ontology
    - Define learning scenarios and specify use cases
    - Populate data repository with high-end movement excerpts
    - Annotate data repository with movement descriptions (excerpt by excerpt)
    - Help split movement excerpts into one-instance segments
    - Test, validate and help improve the developed applications, in particular:
        - closed-loop applications involving analysis/synthesis
        - search engine
        - blending machine
- **Role of tech partners**
    - Application of user centered design tools to identify the needs of the domain and specify the requirements regarding the various tools.
    - Develop and apply technologies for populating the data repository with motion capture, video and music data.
    - Develop a blending machine for seamlessly chaining movement excerpts according to the requests of the choreographers/dancers
    - Develop analysis algorithms for extracting and tracking MLFs and HLFs (through a capturing system)
    - Develop synthesis algorithms for generating a feedback for the choreographer/dancer (through the rendering system)
    - Develop feedback systems based on direct rendering of the output signals produced by the analysis system (HLF, MLF, etc.)
    - Help define a dance movement ontology
    - Develop a search engine based on both direct query mechanisms and/or examples and/or HLFs and MLFs
    - Offer technical support to dance partners' tasks such as formalization of descriptors, segmentation, annotations, etc.

Finally, the document also provided some thoughts about the next steps to be undertaken both regarding the concept of directionality (e.g. defining the semantics of Directionality and a metric to measure it, select a metric to measure movement qualities related to Directionality, annotate the performance of dance partners, and design the applications capable of making a profitable use of a feedback on the Directionality, and the associated movement qualities, of a live or recorded performance), as well as the similarity (e.g., in particular, the need of separate objective similarity from perceived (subjective) similarity, therefore defining both the concept of low-level similarity and of perceived similarity (high-level), to this end annotating similarity of pairs of performances in order to build a similarity measure, defining a metric for the low-level similarity and for the high-level similarity, as well as developing a query-by-example search engine and a query-by-live-performance search engine)

Finally, a list of critical issues has been discussed, which included:

- **Definition of movement principles**
    - Need of a clear distinction between movement principles as MLFs and movement qualities as HLFs.

    - Need to come to a definition of movement principles that can be encoded as algorithms with no need of training.
- **Segmentation and annotation**
    - Need to have access to already segmented and annotated data, in order to develop algorithms, whether training-based or model-based,
    - Need to split excerpts into segments that are uniform/coherent with respect to a given descriptor of interest (e.g. a segment describing a given movement principle/quality should only contain one instance of that movement) and should be annotated accordingly.
    - Need of a contribution, to this end, of the dance partners for this initial task for segmentation/annotation.
- **Synchronization of multimodal data**
    - Need of keeping all multimodal streams associated with each other and in synch, crucial for the upcoming applications (real-time feedback, multimodal search engine, etc.).

The latest consensus building session was held at the end of the annual meeting (held in Milan on December 4th and 5th), and resulted in the Final Statement (see p. 45). The key action points and strategic decisions can be summarised as follows:

1. It is crucial on this stage to provide the opportunity to dance- and tech-partners for a practical "physical workshop" situation, which can bridge any possible gaps in their communication and mutual understanding. The forthcoming conference in Conventry on the 24th-25th of January 2017 is meant for this end.

2. The forthcoming actions will be aimed at ensuring that by the end of the project measurable, concrete, and strictly specified tools will be available, based on:
    - Clearly identifying what is expected from dance experts (and test users) in order to approach a proof of content early enough: i.e. what are the dance experts concretely expecting a first prototype will be able to do and feed-back (in particular in terms of similarity search) for improving dance teaching and expanding creativity.
    - Having a proper running prototype of the final product, which will be open to user-driven fine-tuning.
    - Questioning in depth and validating the library of movements and the blending engine functionalities.

3. The WhoLoDancE consortium needs to analyse in depth the licensing issues that may be associated with the release of its final products. Further research related to intellectual property/privacy associated with motion capture data will provide knowledge that can play a significant role in fostering the project's exploitation.

4. WhoLoDancE developments have focused until now on technical aspects of dance, such as the vocabulary of movements. The aspect of internal expression, energy and personality of the dancer have not yet been taken into account, but thorough research in this direction will be an important goal in the next phase. In any case, WhoLoDancE ambition remains the development of tools that can facilitate teaching and choreographing, and certainly not replacing the dancer or the choreographer.

Progress made per work package (WP)

WP1 – Learning Models and Technical Requirements

Progress

WP1, led by ATHENA RC, is the work package where the users' needs, learning objectives and Scenarios and technical requirement are defined based on current learning (formal and informal) practices and approaches for dance teaching. As Dance Learning is a very complex and wide field in terms of objectives, methodologies and practices, which are usually genre specific, school or company specific, it is crucial to clearly define use-case and learning scenarios to be implemented throughout the project. Taking into account the lack of standardization in Dance Learning in general, as well as the fact that ICT-based Learning for Dance is a new field and there is limited previous work to build upon, the output of WP1 is of fundamental importance for the whole project.

WP1 has successfully accomplished all related tasks and activities that were due within the first year.

To meet the objectives of the WP1, a number of activities was organized as a close collaboration of the involved partners, such as: a) literature survey of the state of the art on dance learning and technologies, b) questionnaires, online surveys, and interviews with dance practitioners c) workshops, working sessions and focus groups, and d) interdisciplinary discussions between dance and technical partners to achieve common understanding and vocabulary. As a result of the successful collaboration with MOCO16 (3rd International Conference on Dance Computing) the WhoLoDancE Workshop was organized, as well as a workshop for dance practitioners at the Researcher's Night in Athens. All relevant deliverables have been submitted on time (D1.1, D1.2, D1.3, D1.4, D1.5, D1.6).

The work within WP1 has been disseminated in the "HCI and the Education Technology Revolution" Workshop @ AVI2016 and the related short paper was published in an academic journal[1].

Main Results

The work within each task in WP1 progressed as follows:

T1.1. State of the Art Survey

The task had as a main outcome a survey on: 1) the existing Learning methodologies for the selected dance genres as described in the proposal and 2) a systematic overview of previous work and related projects (EU or other) in using ICT for Dance. This survey was reported in deliverable D1.1 State of the art survey:

D1.1 State of the art survey (M6): Taking into account the lack of formal and fully described methodologies for each dance genre and context, this report selected the state-of-the-art approaches, needs and contexts to serve as a basis for the rest of the project activities. The deliverable consists of two parts: a) Part a) Dance Learning Models and b) Dance and Technology State of the Art (SoA). Part a) presents the recent advancements in dance education in relation to general contemporary learning approaches, the most significant of these models, and discusses the potential benefits of the use of interactive technologies based on recent relevant literature. Part b) presents the outcomes of recent research advancements in the design and development of tools to support dance teaching in learning through different technologies (Interactive whole-body experiences, Motion Capture, Virtual and Augmented Reality, Sonification, Annotation tools, Desktop and Mobile apps, etc). This presentation includes references to the relation of these recent

[1] HCI challenges in Dance Education. K.El Raheb, A. Katifori, Y. Ioannidis, EAI Endorsed Transactions on Ambient Systems 16(9): e7"

advancements to the main objectives of WhoLoDancE: 1) Investigate Body Knowledge, 2) Preserve Cultural Heritage, 3) Innovate the teaching of dance, 4) Revolutionize choreography, 5) Widen the access and practice of dance.

T1.2. Interviews of Learning Experts, Dance Practitioners and Technology Providers

Based on the State of the Art Survey, COVUNI organized interview sessions with Dance Learning Experts, Dance Practitioners as well as Technology Providers. The aim of this task was to complement the outcomes of D1.1 with input from the wider community, including the perspective of actual practitioners. The results of this activity have been report in deliverable D1.2

D1.2: Interviews Report focuses on presenting the research findings carried out primarily by the COVUNI team but included work from other consortium partners such as ATHENA, Lynkeus, LCGW, K.Danse and STOCOS. The above mentioned partners contributed in the recruiting of professional dancers and teachers and distributed and collected a number of questionnaires that were used for this deliverable. An examination of how dance, technology and movement principles align is at the crux of this document and the data generated from this work, will directly feed into later parts of the project.

T1.3. Dance and ICT-based Learning Workshop

The objective of this task was to organize an interdisciplinary event workshop, which would include the presentation of the project objectives and the initial outcomes as well as talks by various invited speakers such as Dance Educators and Learning Experts, Technology Providers, Whole Body Interaction and HCI Researchers, Movement Analysts, and Dance-related Researchers. The workshop would bring together an interdisciplinary community, raise questions on the topic of the project, generate feedback, and clarify the actual needs of the community.

The WhoLoDancE Workshop was organized in Thessaloniki, Greece, as part of the MOCO 2016 Conference. The results of the workshop are reported in deliverable:

D1.3. WhoLoDancE Workshop report (M8), the workshop entitled "Dancing with Technologies: Interact to learn, analyze to create" took place on the 6th and 7th of July in Thessaloniki. The workshop has been mainly organized by ATHENA RC with the collaboration and support of all other partners of WhoLoDancE project and it was a Satellite event of the 3rd International Symposium on Movement Computing.

Overall, the WhoLoDancE workshop has been a successful event and has fulfilled all three objectives that have been set: a) communicate the objectives of the project, b) network with the wider community, c) get concrete feedback on the primary conceptual frameworks of WhoLoDancE. The collaboration with MOCO16 significantly contributed to the achievement of the above objectives, and the venue has been proved to be an excellent choice for the event. The mixed background of the participants from choreographers and dance practitioners, to science technologists, artists and designers led to fruitful discussions and fertilized the hand-on sessions with new perspectives. Finally, the attendance to the workshop was satisfying (31 participants), although the two days of MOCO16 which have been prior to the WhoLoDancE workshop were full of activities.

T1.4. Definition of Learning Scenarios

This task includes the drafting of particular use-case scenarios for the various Learning approaches and modes of interaction, aiming at two main concrete outcomes a) to assure the user-centered perspective of the system and its use in different contexts according to the needs of the dance communities (T4.1.1 Needs Analysis) and b) to define the technical requirement and specifications for the various functionalities to be offered to the users (T1.4.2 Requirements elicitation for Application Scenarios and Interface Definitions with Respect to framework Integration).

The results of this task are reported in deliverable **D1.4 Definition of learning scenarios – needs analysis (M12)**. This report presents a detailed analysis of user needs and elaborates on identified learning scenario types for dance, concluding with the selected scenarios to be implemented throughout the project. In order to compile these scenarios D1.1 State of the art survey has been taken into account in combination with a number of activities that have been organized, involving dance experts and practitioners. These include the distribution of a number of questionnaires and online surveys, targeting different aspects of the project conceptual framework and the dance practitioners' relation to technology tools for dance, the organization of two workshops (WhoLoDancE Workshop and the Researchers' Night Workshop) as well as several focus groups involving practitioners from within and without the consortium.

T1.5. Technical Requirements for Data Acquisition

This task provided the specification of 1) methodologies of acquiring motion capture data, 2) dance expert representatives who will participate in data collection, 3) a plan for selecting data from each Dance Institution Partner using the appropriate methodologies to address the needs of the different use-cases. The work has been carried out in collaboration with Coventry University and the Dance Companies and in coordination with WP2 and resulted in **Deliverable D1.5 Data Acquisition Plan**. This deliverable according to the project time-plan had a delivery date later than the conclusion of the motion capture sessions as foreseen from the same time-plan. As a result, the deliverable reports both the data acquisition plan as it has been formulated before the realization of the sessions and also gives an overview of the results of the process. The deliverable reports in detail about the methodology and rational for choosing representative movement sequences from each dance genre, the numbers of performers captured, as well as the context of the Motion Capture sessions in Amsterdam and Genoa, and provide also some numbers about the resulting movement library.

T1.6. Definition of High Level Features Required for the scenarios

The main outcome of this task is a list of the main categories of High Level Features that is worth considering for addressing the needs of users within the scenarios. **Deliverable D1.6 HLF Definition for the Learning Scenarios** presents the methodology and outcomes of T1.6. It includes the lists of the various vocabularies which will be used for describing the different characteristics of movement, mood and context of dance (e.g., syllabi, movement qualities, mood, movement principles, formal vocabularies etc.), and the rationale of selecting specific approaches, among the existing ones. The aim is to provide a detailed framework for understanding general movement and learning principles, as well as the particularities of individual dance syllabi and promote a deeper understanding of user needs that will lead to a solid and appropriate theoretical framework and technical specifications for the technologies to be developed.

The four dance genres WhoLoDancE focuses on represent a variety of dance practices that range from academic, historical and theatrical systems of dance (ballet), to traditional art forms of intangible cultural heritage (Greek Folk, Flamenco), and contemporary practices that embrace creativity and experimentation (Contemporary dance). The particular characteristics and syllabi of these dances are examined in this report and relevant HLFs are reported.

Furthermore, the report presents a set of ten Movement Principles which summarize the most fundamental and essential learning objectives, beyond the limitations of each genre, and could summarize the higher level features and embodied concepts that each dance learner deals more or less, in every dance class. This first list of Movement Principles has been validated with the wider community of dancers, dance educators, practitioners and choreographers of different styles through different means.

The movement principles are thoroughly analyzed to present their main characteristics and features. They are complemented with movement qualities as well as a number of common actions that might exist in any movement sequences.

The work reported in D1.6 will be used to guide the learning scenario definition work in D1.4 and the development of appropriate representation models for dance in the context of WP3.

Open Issues

The work for the further refinements of the HLF features will continue as part of WP3 Task.

Interactions and expectations with regard to other WPs

WP1 has close interactions with all the other work packages as it provides the conceptual framework of the project and defines the user needs and scenarios that will guide subsequent development. Especially in the case of task T1.6, D1.6 define what are the different high level ontologies/vocabularies (Syllabi, Movement Qualities, Movement Principles, etc.) to become the focus of the work within WP3.

Deviations, if ever, from the original work plan

For report D1.2 the COVUNI team was asked by the Consortium to translate the questionnaires into French and Greek. This was an unexpected task and cost that the COVUNI team coordinated. This led to a delay in disseminating the report to wider networks, which slowed down the gathering of data and the analyzing of that data.

WP2 – Multimodal Sensing and Capturing Analysis

Progress

WP 2 started as planned with setting up a custom pipeline for high definition motion capture of dance masters from the 4 selected dance genres: Greek traditional dance, Classic ballet, Contemporary dance and Flamenco.

In parallel, the recruitment protocol and informed consent form was created and used to focus on the right dance talents from within the consortium members and external dancers.

Creating of a dance data repository for teaching aims involved developing the methodology that led to creating the right shot lists. Since each genre involves an infinite number of movements, we developed a taxonomy of movement principals per genre. The movement principals were used to create an extensive shot list per genre pertaining to each movement principle.

There were in total 3 motion capture sessions in this workpackage. The 1st (Two day) session that took place in Genoa at the InfoMus lab, was mainly an exploratory session that examined the use of multi-modality in the usage of optical motion capture next to accelerometer based sensors, video capture and audio recordings.

The second and the third sessions that took place at the Motek studio in Amsterdam were the main target of the work package, namely to create an extensive motion capture repository of the selected dance genres. Each session was spread over 10 days. The motion capture sessions were divided to capture days dedicated to specific genres and within them, specific motion principles.

The outcome of the capture process were data sets exceeding 2000 individual shots, some of those shots were segmented and trimmed. Over 6000 motion segments were processed to yield the actual repository.

Work is still commencing in the process of the trimmed linear database of the curated data sequences. Metadata is being extracted and will be used for the other work packages dealing with similarity search and HLF/LLF extraction.

WP2 involved also the creation and development of 3D avatar scenes used for real-time and offline visualizations of the motion capture data. Avatars from the perspective of the dance teacher / choreographer were created. The avatars included: Arrow-based visualization avatar that assisted in showing both the dancer and the choreographer, the direction of each body-part during the dance. A motion envelope deformer avatar that assists in showing interactively the volume of the dancer in the space, a Bot-like avatar for illustrating of the overall motion qualities and dancer presence and a dynamic visualization of the path of the dancer in the space using particle systems.

Each avatar development was created in several stages, the 3D modelling stage, the rigging (creating an Inverse kinematic skeleton to connect to the capture data), lighting, shading and texturing phase and an optimization stage for robust real-time performance.

One of the main tasks of WP2 involves the creation of a blending engine that will be able to blend between any motion capture sequence and any other from the repository. This will enable choreographers and teachers to create custom teaching curriculum from the capture repository in an interactive manner. This task is ongoing.

In addition, an investigation into Multi-sensor Integration was carried out for the purpose of examining the base line cost effective hardware solutions for dance schools. Optical motion capture systems like the ones used at InfoMus and Motek are cost prohibitive for most dance schools, we were looking at the range of

available (and in development) hardware for achieving good quality, multi-modal motion capture at the dance school locations.

Main Results

- Motion capture pipeline was defined and executed
- Movement principals were defined and used during the motion capture sessions
- Guidelines for motion capture, marker templates and performance quality standard were defined and used.
- Motion capture sessions were carried out successfully
- Dance data repository of the selected genres has been created and is in various processing stages
- Blending engine is in development
- Research into multi-modal sensor integration was carried out
- 3D avatar scenes were created and implemented

Open Issues

1: The limitations of blending dance sequences through the blending engine while maintaining cohesive biomechanical realistic motions is being addressed.

2: Unification of motion data formats for robust real-time visualizations are still in discussion among partners.

3: Dataset exploration interfaces for applications developed by different partners in their respective WP's need to be integrated into an integrative tool suite.

4: Dance teaching methodologies using the motion capture repository and the tool suite is still an open ended discussion.

Interactions and expectations with regard to other WPs

- The defined and extracted HLF / LLF from the data repository will need to be either integrated inside the blending engine, or be ran as a standalone application communicating interactively with it.

- Best method for life size volumetric display is still an ongoing research. This technology is in its infancy and we are not sure if it will be usable during the duration of the project. Several other solutions are in development using MR and VR.

Deviations, if ever, from the original work plan

So far, the only deviation from the original work plan is that the blending engine development is taking longer than estimated, due to the complexities of blending human motion from sequences captured in different times and spaces, while maintaining movement realism and correct biomechanical principals.

WP3 – Semantic and Emotional Representation Models

Progress

WP3 concerns three main topics: semantic representation models, multimodal signal analysis and modelling, development platform and libraries.

As far as the semantic representation models is concerned, generic actions (e.g.,Turn, Jump, Step, Bend, Extend, Slide) and specific vocabularies of syllabi have been collected and a set of Movement Principles and Movement Qualities commonly used to describe dance movements have been provided. The formal definition of Movement Principles and Movement Qualities is an ongoing process and is part of the creation of an ontology, by means Semantic Web technologies, starting with Directionality (e.g., the volumes, directions, body parts, axes, planes, lines, the cube). The technologies used for the purpose is OWL (web ontology language) and Protege Ontology Server an editor that allows the collaborative creation within the consortium.

As for multimodal signal analysis and modelling, data were first processed in order to provide a uniform dataset in terms of data format: C3D and FBX are used for motion capture data; there is an ongoing discussion within the consortium whether to adopt JSON format as the standard to represent structured data in web applications. For the purpose of multimodal analysis, a large set of low-level features able to provide an effective characterization for each type of data were defined and extracted. The principle types of data considered here are: motion capture data, video and music.

Motion capture systems generates a cloud of points, each associated with an absolute position. In order to make easier to extract some information such as the orientations of the body parts, a hierarchical representation (rigid bodies) composed by clusters of markers is also produced. This allows to define a skeletal human model described by a fixed undirected graph. The vertices are identified by the positions of the joints (marker cluster's barycenters) specified at each frame. Analysis methodologies are being investigated on this particular representation model: intra-network driven solutions, with a particular focus to game theories enable the measurement of how energy propagates in body joints and to estimate the path along which energy flows through the "dancer body network". From the cloud of points and the hierarchical representation a set of low-level feature are extracted such as trajectories of specific points in the space and orientation. Exploiting low-level features, preliminary models for the analysis of some Movement Principle, such as *balance*, are built based on rule-based approaches.

In certain conditions, video recordings can be used to measure movements of specific parts of the body and/or full-body movements. To obtain more accurate measures, e.g. on translation and rotations, sophisticated techniques based on the variation of the motion field such as optical flow and trackers based on pattern similarities have been exploited (kernelized correlation filters - KCF), tracking learning detection (TLD).

As far as the joint music-dance analysis is concerned the work was mainly focused on the extraction of rhythmic information from video, mocap and music in flamenco and Greek dances. As basilar steps of the analysis a set of tools have been developed for the automatic matching: multimodal streams related to the same session are bound and aligned. As a preliminary study on rhythm analysis, in order to extract rhythmic information from music an automatic musical beat tracking have been developed. The relationships between dance and sound/rhythm/musical elements relevant within each genre have also been explored by gathering feedback from the dance community through surveys and interviews. Motion capture sessions focusing on Flamenco dance highlighted the close connection between movement and rhythm within this genre and together with the feedback from respondents' points to the way in which expressiveness, emotion and intention are features that might emerge in the dialogue between dance and sound/music.

As far as the development of platform and libraries is concerned, various libraries have been developed for feature extraction, data fruition, visualisation and annotation. The main platforms and languages used within the consortium are Unity, Eyes Web, Python and JavaScript.

Main Results

- Design and implementation of an initial prototype of the Ontology
- Development of a set of tools for low-level feature extraction for multimodal signal modelling and analysis
- Design and implementation of a set of tools for data fruition, organization visualization and annotation

Open Issues

An intense interaction with the dance partners is needed in the next months in order to reach a more formal definition of Movement Principles and Movement Qualities.

In order to effectively create methods for multimodal data modelling and analysis a manual annotation of part of the acquired dataset is crucial. This is particularly evident for data-driven approaches.

Integration of different platforms in order to build uniform solutions.

Interactions and expectations with regard to other WPs

The definition of the set of data formats to adopt in the project for each data type is also functional to *WP5 Data Integration & Data Analytics*. WP5, indeed, addressed issues related to data organization. WP5 also concerns data fruition, for this reasons, it will benefit from automatic synchronization techniques and visualization tools developed in WP3.

T4.2.2. Generic middleware architecture design and implementation includes the design and the implementation of web-based applications. Web-based tools developed in WP3 will be the basic bricks for software will be developed in T4.2.2.

Deviations, if ever, from the original work plan

Some delay, not very significant, from our initial plans occurs because of the organisation and annotation of multimodal data. Much time has been needed to reorganise, align and annotate data in order to be suitable for our needs.

WP4 - Automated Analysis of Multimodal Features and Similarity Search

Progress

WP4 concerns development of the search and similarity infrastructure that will support multiple use cases and integrate the HLFs prepared in the WP3.

The main focus of the first 12 months in the WP4 was requirement elicitation and the development of the similarity engine that will later serve the specific use cases determined in the WP1. A plan has been developed for integrating the search and similarity component with other components, notably with the UI (including the blending engine) and the HLF extraction effort, using a web service approach.

The basic algorithms in Java have been implemented and their performance was demonstrated to all partners during the general meeting in Milan. The collected mocap data have been parsed and made available to our algorithms. The users' requirements have been understood with regard to search and similarity and based on the preliminary results and this made possible to elicit more specific feedback from them that will direct the work over the coming year.

An efficient scalable algorithm for computing pairwise similarity between motion sequences of a pre-defined length have been implemented. The algorithm operates on time series of motion captured data.

In collaboration with PoliMi a web-based demo was created that allows to browse the pre-computed similarity pairs: all pairs of 3.3 second long sections of motion sequences deemed to be similar by our similarity algorithm implementation, in the order of descending similarity. The demo highlighted the viability of our approach and provided insights into the choices that have been made while designing the algorithm and its abilities to our partners, in particular to the dance partners, who for the first time were able to easily follow our progress and approach based on visual examples.

The algorithm and implementation are very performant, being able to effectively compute pairwise sequence similarities over the whole corpus of collected mocap data in only several minutes time on a multi-core server. The algorithm is parallelizable in the number of dimensions of mocap data, which for the dataset ranges between 72 and 168. The computation of self-similarity for each dimension of a 2.8 GB large dataset was performed in several minutes using one core. Since the computations for different dimensions are independent, the computation can be done in parallel. And if processing the whole data set of about 18 hours' worth of mocap data takes two minutes, incrementally adding new mocap data to the system can be accomplished in real time and doesn't involve any delay at all.

Such performance makes it possible to provide a responsive platform, on which our partners developing mid- and high-level features can iterate and experiment with feature design quickly. It also makes us confident in the scalability potential of our platform that will be capable of handling orders of magnitude more data going beyond the scope of this project.

Main Results

The main results reached in the first 12 months for the WP4 are:

- Design and implementation of efficient similarity algorithms operating on mocap data
- Collection of the technical and user requirements for search and similarity infrastructure
- Demonstration of the similarity results in a web demo

Open Issues

An integration of the mocap sequences recorded with different sets of features is needed (for example, with information on finger motion and without). Currently such sequences have not been yet compared.

To experiment with weighing different dimensions/features differently and evaluate the quality of the search and similarity output under the condition of non-equal feature weights is needed.

The integration of the mid- and high-level features into our similarity computations and evaluation of the performance of the similarity algorithm when operating on various features provided by partners is also needed. In particular the performance of our implementation on features that change only rarely needs to be evaluated.

A low-friction easy to use web service should be provided for other partners to work with. The service will allow them to submit new mocap recordings, new features for existing recordings, custom feature weight templates useful for pre-defined search modes, and the ability to filter search results by metadata.

A reference implementation of a client for our API that will import the previously collected mocap data into the web service should be provided and made available to all partners.

The performance of a streaming set up of the system should be tested, in which the mocap and HLF data live as a stream will be received. The particular software implementation of the stream handling needs to be evaluated by all involved partners (Peachnote, PoliMi, and UniGe).

Interactions and expectations with regard to other WPs

The implementation and architecture has been informed by the outcomes of the WP1, in particular D1.4 and D1.6. WP4 has been working with data collected in WP2, in particular D2.6 and D2.7. The data were obtained from the data repository that has been set-up in the context of the WP5 data management work, by Athena RC. A collaboration between Peachnote and PoliMi was put in place on the creation of the first web-based demo, the technology for which belongs to D4.4. The requirements regarding the mid- and high-level features and their use in the search and similarity context have been discussed with the partners at UniGe and PoliMi in the scope of the WP3.

We are looking forward to using the FBX file parser developed by PoliMi in order to improve our input data handling. This tool will allow to compare mocap sequences recorded with different numbers of features (e.g. with and without finger motion data).

The integration of the outcomes of WP3 (the mid- and high-level features) into the similarity platform will continue. All necessary APIs for our partners to operate our similarity infrastructure efficiently and independently without coordination delays will be provided. This shall hold for both partners submitting new data for use in similarity computations, and for those developing convenient user interfaces building on top of our functionality. The aim of WP4 is to provide a system that is simple yet flexible enough to cover all the search and similarity related user requirements that we have become aware of.

Deviations, if ever, from the original work plan

There have been no noteworthy deviations from the original work plan so far.

WP5 – Data Integration and Data Analytics

Progress

The WhoLoDancE WP 5 is responsible for the overall data management infrastructure to be built and deployed by ATHENA RC with the objective to collect, store, pre-process and manage the multimodal data acquired in the project.

The work within this work package has progressed according to the Description of work and has resulted in the installation and set-up of the main data management infrastructure of the project, which is described in Deliverable 5.1 Data modelling, data integration and data management plan report.

Main Results

The main results of the work within Work Package 5 in the reporting period include the following:

1. Conceptual recording of dataset information.

The process of comprehending and driving conclusions on data sources related to the project is an integral part of the WhoLoDancE data management approach. For gathering information from partners, a special questionnaire has been designed and implemented by the project's data management team and has been populated by the individual data-providing partners, resulting into a set of dataset descriptions that were used to plan the data management infrastructure.

2. Data storage set-up and FTP server

An ftp server with appropriate storage capacity has been set-up and made available to the consortium for the storage of the motion capture, and other data generated during the project.

3. Definition of the metadata model

Following the completion of the motion capture sessions, the resulting material has been examined in order to propose an appropriate metadata schema that will make it accessible among the consortium, by both technical and user partners. The WhoLoDancE data model covers:

- element referencing approach (i.e. how dataset/metadata elements are cross referenced)
- descriptive metadata that allow datasets to be discovered and consumed by end users (and services)
- structural metadata that allow datasets to be handled by the system and consumed and explored by services (and users)
- semantic extensions: the approach of project for handling semantic metadata

The metadata model has been defined and implemented in a CKAN metadata server installed and configured for the needs of the project

4. Data management system

A set of dataset management practices and tools that can be used for storing, delivering, preserving and licensing the data evaluated for the needs of the project, complying with best practices, and generally acceptable paradigms in the context that the project activates have been defined. Data management has been implemented with an FTP server along with a CKAN metadata server to organize the files in appropriate metadata schemata and ensure access through search and browsing. More specifically, the following data storage elements and repositories are included in the WhoLoDancE platform:

- A file-based object store for depositing binary data objects. The repository is implemented over a redundant store with one delayed replica and is accessible via a number of standard protocols such as FTP and HTTP, while special protocols are also available depending on the data type (e.g. streams for

media objects). Items in the repository obtain URLs that can be disseminated via standard web means, yet access may be provided only with granted credentials.
- CKAN metadata repository tailormade w.r.t. configuration and plugins, to fit WhoLoDancE project data and metadata servicing needs. Offers full web UI for managing and accessing metadata and a rich set of REST web services for consuming/exploring projects datasets.
- A relational database management system (PostgreSQL) for managing dataset metadata, behind the CKAN repository and pilot-specific services.

This work is reported in Deliverable **5.1 Data modelling, data integration and data management plan report**, which provides technical information about the type of data which are being produced, managed and maintained by the data management platform and the methodologies applied for the data integration and management in order to deliver the various applications of the project. The deliverable presents also the data model of the project data and the policies for ensuring data interoperability and integration across project's services, be it data management or end-user ones.

Open Issues

A decision should be reached within the consortium on licensing issues and access to external parties related to the datasets of motion capture data produced within the project.

Interactions and expectations with regard to other WPs

Apart from its role in defining the data management practices within the project, WP5 has the role of monitoring and implementing the integration of individual applications and services.

To this end, there is a close interaction of this WP5 with all the technical work packages of the project and namely WP2 to ensure appropriate storage and modelling of the motion capture data and the integration of the services for their representation within learning scenarios in WP6, as well as WP3 and WP4 to support the storage of the conceptual frameworks and ontologies produced and the semantic analysis services.

To this end it is expected that all the responsible partners for this WP will collaborate closely with the ATHENA data management team to ensure that the technological solutions selected are in-line and can be integrated in the final project prototype.

Deviations, if ever, from the original work plan

No deviations within this period.

WP6 – Multimodal Rendering, Holographic/volumetric displays Development, and Whole Body Interaction Interfaces

Progress

The activities for WP6 will start at M21 as indicated in the DoW.

Main Results

No results have been achieved yet

Open Issues

No issues have been raised.

Interactions and expectations with regard to other WPs

The other WPs more related to the work carried out on WP6 are WP7 and WP2 and since there is only minor delays on the completion of the tasks in those WPs, the work in WP6 is planned to start and be completed as expected.

Deviations, if ever, from the original work plan

None

WP7 – Evaluation and Validation of ICT-based Learning

Progress

WP7 regards the Evaluation and Validation of the UCT-based platform and his lead by Covuni's team. A discussion with ATHENA's team on the methodologies for evaluating and validating the prototypes with users in early 2017 is ongoing. Focus groups, researcher evenings and observational methods are on discussion. These methods will be produced and described in detail in the deliverable D7.1 due at month 15.

However, a number of activities in WPs 1 and 2 have been completed that are crucial for the preparatory work and successful completion of the work carried out in WP7, namely the definition of the Learning Scenarios and Movement Principles. These are presented in deliverable D1.3.

Main Results

All interviews, questionnaire participants and survey participants responded well to the Movement Principles, thereby validating the Movement Principles as a reasonable foundation for the work on the project. Each interviewee was able to engage with the Principles in relation to their own work. The responses indicate that many dancers develop an expert practice through engagement with a range of dance techniques and modes of making/performing work. There are some dancers who develop an expert practice through focused training and technical development. Some teachers create their own spoken language strategies and pedagogy to reach and engage their students fully.

In terms of the Movement Principles, the technologists all agreed that directionality, Gross and Fine Motorics and rhythm were all important to the development of the tool. They see these as important because they are common terms in their technological language and have used them in their work.

In summary, the surveys and interviews indicated the following:

- The Movement principles are widely recognized as a useful foundation to most dance practices.
- Imagery is a valuable tool for learning, teaching and practicing dance.
- Dancers use technology in their practice including some digital technologies but most prefer simple to use, accessible, portable and affordable tools.
- There is interest in what an avatar tool can provide for dance learning, teaching and performing but some in the dance community are unsure of how it will benefit their work so will need persuasion.
- An avatar tool that is effective, easy to use and supports the teaching, learning and creative processes of dance will be the most effective

Open Issues

- A large portion of the participants were open to the use of a holographic tool. However, about 40% of the participants were unsure whether they would learn movement form an avatar and whether they would use such a tool in the learning environment. It is this group of people that will need persuasion.
- An Impact Plan and public engagement activities need to be continually considered as this is a metric of the university and may contribute to the Research Excellence Framework (REF).

Interactions and expectations with regard to other WPs

The interactions with WP2 and MOTEK have been frequent and successful thanks also to the involvement of a member in Covuni's team which works with motion capture and dance as an artist and is able to contribute

a unique perspective to the technical discussions with the technical partners the motion capture process. Continuation of these fruitful interactions is expected to successfully continue.

Deviations, if ever, from the original work plan

The preparation of deliverable D7.1 Usability and Learning Experience Evaluation Report, which is due at month 15, is slightly behind.

WP8 – Communication, Dissemination & Exploitation

Progress

A series of dissemination and communication activities were carried out during the first 12 months of work in WP8.

The Project website and Dissemination Material have been created and regularly updated.

Apart from the preliminary materials, some particular features have been added to the website and the dissemination channels have been further developed and implemented. (For a detailed report on the dissemination material see deliverable D8.1)

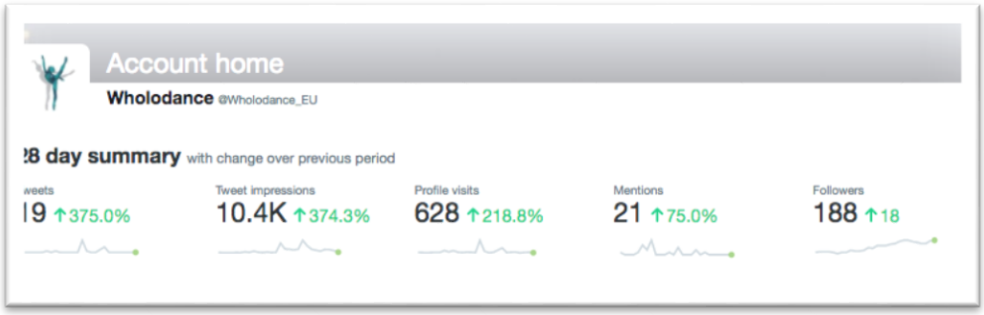
The updated website highlights also the most important activities performed within the first year of the project. The events' section of the website includes the details of each event in which the Wholodance partners participated.

In the media section of the website, 7 relevant videos have been uploaded that describe the 3 Motion Capture Sessions, the General meeting and the workshop which took place in partnership with Moco 2016 in Thessaloniki.

The dissemination material has been produced and delivered through the dissemination channels (Twitter, Facebook and Vimeo).

Statistics on the impact of the social network of the project within the first 12 months of the project:

The twitter account has been in constant growth as shown in the statics table of M12



1.Summary of the M12 activities on Wholodance twitter Account

Below the statistics related to the **twitter** account of the project for the first 12 months of the project. The social channel was fully operative starting at M3 waiting for the Graphic Identity and the website to be completed and fully operative in order to gather the traffic into a more stable source of engagement where the interested public could find more complete and relevant information.

Month	Number of Tweets	Tweet Impressions	Profile Visits	Mentions	New Followers
December	16	8971	441	6	8

November	6	3036	315	24	11
October	2	2532	171	9	17
September	1	2687	290	19	13
August	2	3398	200	24	-3
July	57	21100	828	30	25
June	11	9547	441	13	Data not available
May	41	30800	1262	29	Data not available
April	9	3913	424	13	Data not available
March	5	2418	380	6	Data not available
TOTAL	**159**	**88396**	**4752**	**173**	**188 (Total Followers at M12)**

The **Facebook** channel was set up at M5 in order to function as a key junction between the Website, Twitter and Vimeo.

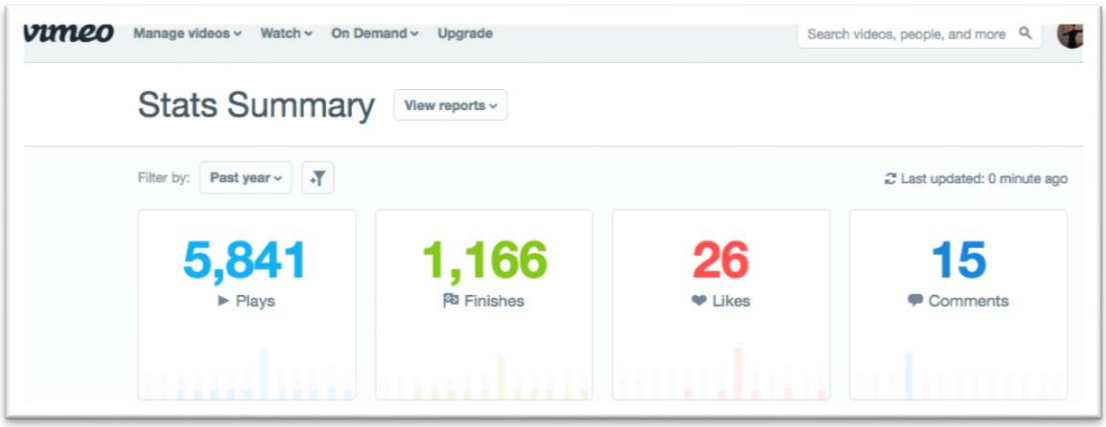
Below the statistics related to the Facebook account of the project:

Moth	**Reach**	**Posts Clicks**	**Reactions, Comments and Share**
December	578	39	20
November	5512	580	473
October	99	16	1
September	258	28	14
August	576	34	22
July	11930	1080	585
June	2755	288	184
May	1664	563	187
TOTAL	23372	2628	1486

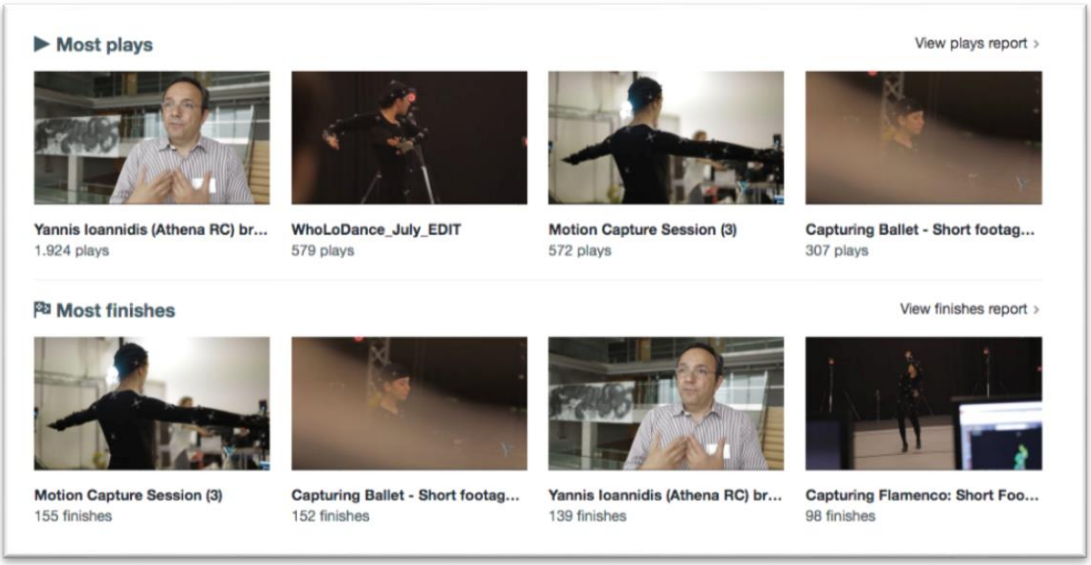
Vimeo Channel:

In the vimeo channels the videos produced where uploaded together with some other video regarding relevant projects of the Dance partners that are related to Wholodance Project.

Below the data related to the channel



2. Statistics on Vimeo's channel in the first 12 months of the project



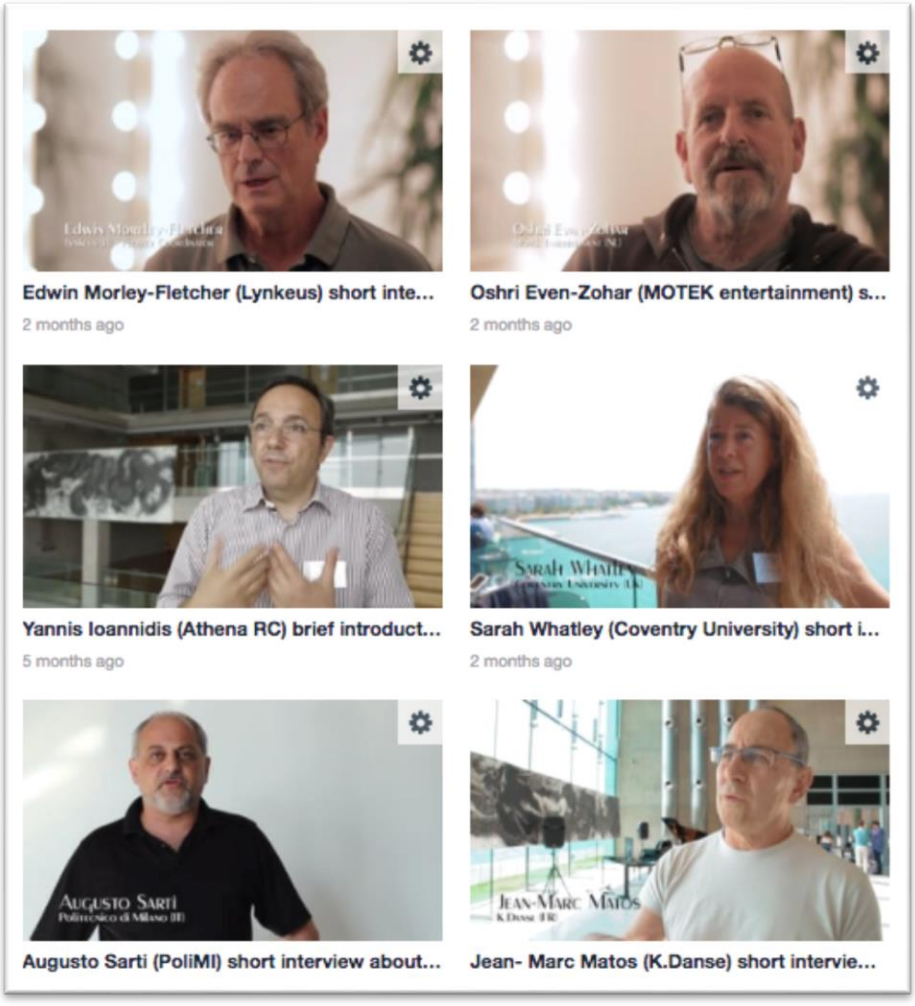
3. Most successful Wholodance's Videos

4. Geolocalization of the viewers of Wholodance's Videos

The Videos produced where meant to be organized in three different formats:

1. Interviews to the partners and external contributors

Several partners have been interviewed and the content was either published separately or mounted into the other videos as short excerpts

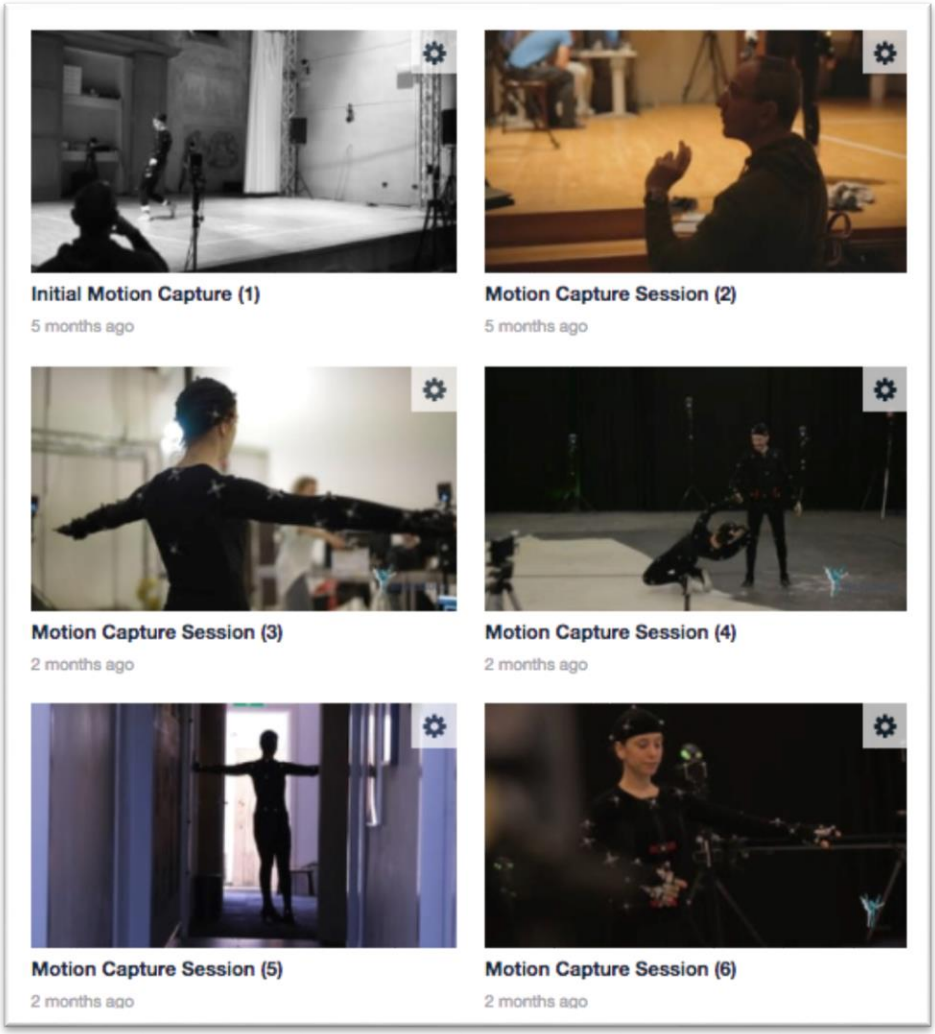


5. Covers of video interviews

2. Footage of the Motion Capture Session

The motion capture sessions have been recorded and edited. Original music was composed in order to perfectly fit the images. For each motion Capture Session, 3 different video formats were released of each Motion Capture Session.

1. One meant to be a teaser, short and direct, targeted onto the general public
2. A longer video that included short interviews to the partner involved
3. Daily short videos, published right after the day of capturing that will cope with the live tweeting done during each day of the Motion Capture

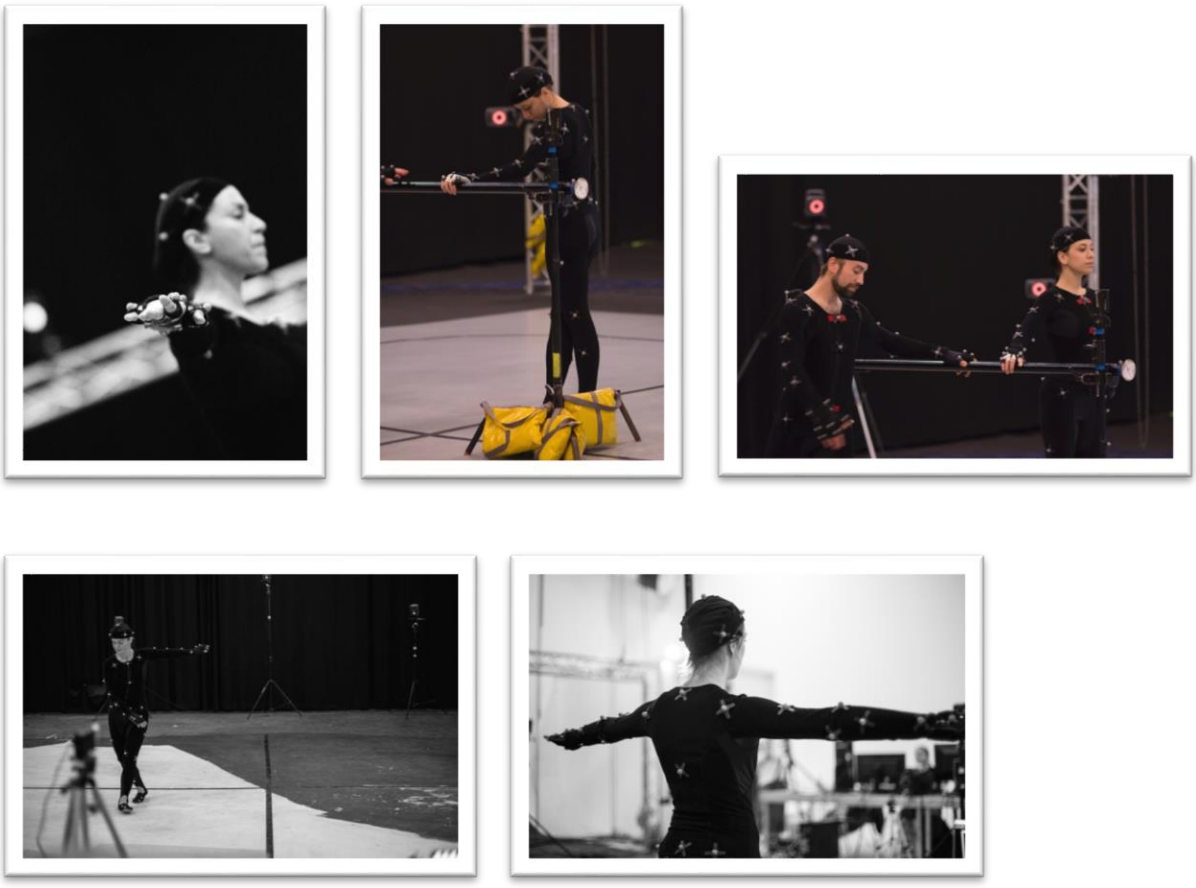


6. Covers of the video footages of the Motion Capture Sessions

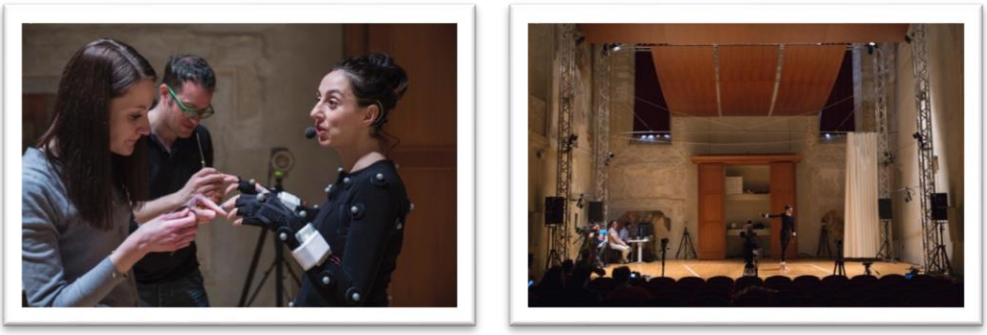
Apart from the Motion Capture Sessions' footages, other Videos of most important meetings and Workshops have been also produced.

7. Cover of the video produced during the general Meeting + workshop at MOCO2016

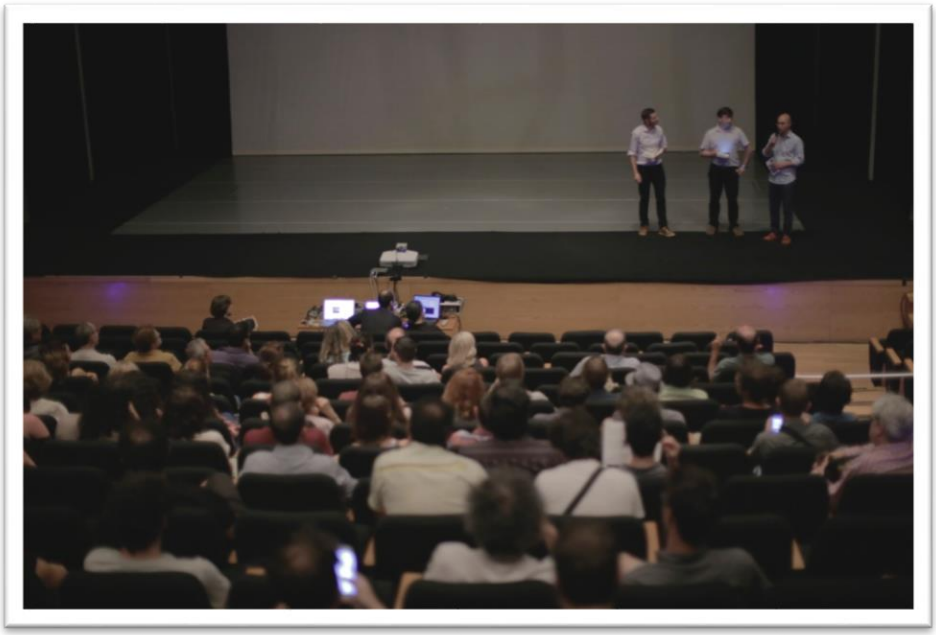
A number of Photos have been taken by professional Photographers during the events and Motion Capture Sessions.



8. Photos of the 2nd and 3rd Motion Capture Session (Amsterdam_May-July 2016)



9. Photos of th[e] 1st Motion Capture Session (Genoa_March 2016)



10. Photos of STOCOS performance at the of the General Meeting + Workshop at MOCO2016

Project Workshops

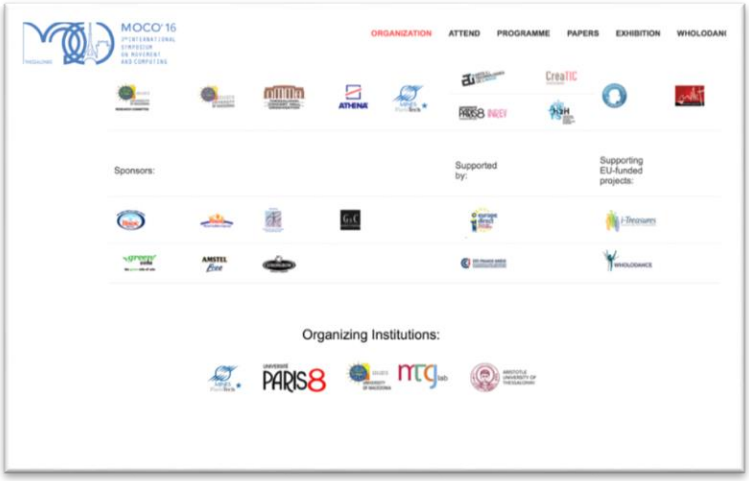
In July a first workshop of Wholodance took place in Thessaloniki (GR) in partnership with MOCO 216 (for a more detailed description please refer to D1.3. Workshop Report)

The main objectives of the WhoLoDancE workshop were the following: a) to present the objectives of the project within the wider context of movement computing, cognition, dance and technology, b) to communicate to and acquire feedback from experts of different relevant background on the initial conceptual framework of the project, c) to disseminate the project and bring together people with relevant interests (dance practitioners, choreographers, new media artists, ICT researchers and developers).

WhoLoDancE workshop "Dancing with technologies: Interact to Learn, analyze to create" brought together experts and researchers from a variety of backgrounds, raising discussions that are hot topics in these

relevant areas. The co-organization with MOCO16 and the close collaboration with the Movement Computing community created an excellent field for exchange of ideas with the wider community not only during the days of the workshop (6th July evening and 7th July) but also during the main conference, since the vast majority of WhoLoDancE partners, have not only attended the main conference but also had the chance to present their previous and relevant work during the main-paper presentations, demos and artistic installations and performances. This fact highlights the excellence of the partners, through their involvement in one of the top and state-of-the art conferences which brings together technologies, computing, cognitive science, human computer interaction, movement and art.

The research interests and topics of MOCO Symposium and WhoLoDancE are obviously very relevant. For this reason, Athena RC came into communication with the organizers and the community of MOCO since the beginning of February 2016. Following a number of communications, between Athena RC, as a representative of the consortium and a fruitful collaboration with the MOCO organizing committee, we came to a common agreement of having the WhoLoDancE workshop as a satellite event of the MOCO2016, at the same venue. Both events have been disseminated and supported through MOCO2016, WhoLoDancE and ATHENA's webpages, posters and social media. The WhoLoDancE project has been announced as one of the supporting-sponsoring EU projects of MOCO. For more details about the dissemination see section 9 of this report.



11. Organization and sponsor of MOCO2016

Users' Board Session

The first Users' Board session was held in Milan on 6th December 2016 at conclusion of the Internal Review highlighting the outcomes of the first year of activity.

12. Panel Discussion at the Users' Board Session in Milan

WhoLoDance Users' Board Session was meant to be an opportunity for gathering expert critical feedback by thought leaders and dance practitioners, and found them willing to share their views with our consortium on the challenges and opportunities for our innovative technologies.
After a first round of demo presentations and a panel discussion, covering the first 11 months of achievements by WhoLoDance, the attendees to Users' Board Session provided comments and suggestions regarding how best to continue our work that fostered fruitful discussions between the partners of the projects and eternal experts in the Dance and Tech communities.

13. Sarah Whatley presenting the feedback from the External users at the Users' Board Session

Below the list of participants to the first Users' Board Session:

Proposed Member	N	Occupation	Affiliation

Chiara Bassetti	**1**	Researcher in human action-in-interaction and the role of tools and technologies	Laboratory for Applied Ontology ISTC-CNR
Joseph Fontano	**2**	Choreographer, Professor specialized in Contemporary and Classical Dance	Accademia Nazionale di Danza
Letizia Gioia Monda	**3**	Choreographer, Performer and Researcher specialized in Digital Technologies	Sapienza University of Rome
Goffredo Haus	**4**	Full Professor and Director of the Departement of Informatics at Università degli Studi di Milano.	Università degli Studi di Milano.
Alberto Sanna	**5**	Director of e-Services for Life and Health within the S. Raffaele Hospital, former photographer at La Scala Ballet Company	Ospedale San Raffaele
Ariella Vidach	**6**	Performer, Coreographer and founder of the company Ariella Vidach – A.i.E.P.	Ariella Vidach – A.i.E.P.
Claudio Prati	**7**	Collaborator at the Company Ariella Vidach – A.i.E.P	Ariella Vidach – A.i.E.P.
Benjamin Pech	**8**	Choreographer and Dancer	Teatro dell'Opera di Roma
Daniele Baldacci	**9**	Light Designer, Dance Cinematographer	BluecinemaTV
Leonetta Bentivoglio	**10**	Journalist and Writer	La Repubblica
Anton Koch	**11**	Researcher at Motion Bank	Motion Bank

Main Results

- Creation of the communication channel of the project
- Implementing Dissemination materials
- Organization of 2 main events and workshops
- Coordination and successful submission to two publications in the proceedings of two major conferences
- Project Presentations in more than 15 major European events

Open Issues

No open issues have been raised in the first 12 months

Interactions and expectations with regard to other WPs

Partner collaborate fully in the communication activities and produce content useful to implement and be delivered in the communication channel

Deviations, if ever, from the original work plan

None

WP9 – Coordination & Management

Progress

The activities of the WP in these first twelve months were mainly focused on the Kick-off, definition of the standard assessment and review procedures for the whole project and the coordination of the activities including the organization of the project Meetings and TCs.

Furthermore, the first Users' Board Session has been organized, and more than 15 Dance and Technology experts joined the consortium during the general meeting in Milan to provide feedback on the first outcomes of the project.

Finally, the Teleconferences were regularly held during the past twelve months and specific sessions during the Motion Capture Sessions were organized to discuss relevant issues.

Strategic project governance activities

Main Results

- Kick-off meeting
- Standard presentation of the project produced and circulated among partners
- Definition and circulation of the self-assessment plan
- Definition of the Quality Assurance Guidelines
- Definition of a standard form for the Deliverable Review Process
- Organization of 3 General meetings + several meetings for specific areas of the project
- Organization of 16 teleconferences

Open Issues

The definitions of the features to be extracted and analysed and the creation of the ontology for the developments of the platform will need further interactions between Dance and Technical Partners especially in the next phase of the project.

The compatibility between the applications developed within the platform is a constant concern and special attention is put into ensuring a constant sharing of information between the technical partners about the formats and frameworks they are using.

An issue regarding the IPR management and exploitation of the project needs to be addressed in the next phase of the project and the results of the process will be reported in D8.5 at M18.

Interactions and expectations with regard to other WPs

The partners are collaborative and proactive with regard to the project management and coordination of the project.

Deviations, if ever, from the original work plan

Some delay in the submission of deliverables has been acknowledged in the first months of the project but the definition of clear guidelines and procedures for the Deliverable Review Process, as described in the Deliverable Review Form, has positively contributed on solving the issue.

Financial, Administrative and consortium management relevant information

Financial and administrative information

The Consortium budget will be prepared and presented to the EC at the end of the 1st RP (June 30th,2017).

The prefinancing has been distributed to all partners between the end of January and February 20th 2016.

All partners have been active in all the foreseen activities of the project, thus it can be expected that their overall budget is being spent as forecast. There have been more meetings than planned and the Motion Capture involved 3 sessions of one week each, and we expect that for some partners travel expenses could be higher than those planned.

Consortium Management

The Consortium Agreement was signed by all partners in the month of January 2016.

Wholodance's Meetings

The following tables report about the Project's cooperation activities that have been performed in the first twelve months of the project

Physical Meetings

Meeting	Location	Date
Kick-off Meeting	Rome (IT)	18th-19th Jan 2016
General Meeting + Workshop (In partnership with MOCO 2016)	Thessaloniki (GR)	4th and 8th July 2016
General Meeting + Users' Board Session	Milan (IT)	5th – 6th Dec 2016

In addition to the planned physical meetings, the Motion Capture Sessions were also an occasion for partners to meet and discuss specific issues. On each Motion Capture Session separate meetings were scheduled on technical and technical issues related to the project.

Capture Session	Location	Date
1st Experimental Recording Session	Genoa (IT)	21st-22nd-23rd March 2016
2nd Motion Capture Session	Amsterdam (NL)	1st-10th May 2016
3rd Motion Capture Session	Amsterdam (NL)	10th – 20th July 2016

TCs' list

N°	Teleconference	Date
1	1st Wholodance General TC	18th February 2016
2	2nd Wholodance General TC	25th February 2016
3	3rd Wholodance General TC	7th March 2016
4	4th Wholodance General TC	17th March 2016
5	5th Wholodance General TC	25th March 2016
6	6th Wholodance General TC	21st April 2016
7	7th Wholodance General TC	19th May 2016
8	8th Wholodance General TC	16th June 2016
9	Technical partners TC	23rd June 2016
11	9th Wholodance General TC	31st Oct 2016
12	Technical partners TC	10th Nov 2016
13	10th Wholodance General TC	14th Nov 2016
14	Technical partners TC	21st Nov 2016
15	Dance Partners TC	28th Nov 2016
16	Technical TC	16th Dec 2016

Dissemination Activities

Conferences, Workshop attended/Organised/foreseen

A list of the external meetings (conferences, workshops, etc.) with date and place held during the reporting period or foreseen for the next reporting period is given in the table below with a brief description of type, scope and number of persons attending events.

Title of the event	Place	Date	Attendees/Presenter from the Project
Digital Echoes	Coventry University (UK)	4th Mar 2016	Sarah Whatley, Rosamaria Cisneros Karen Wood
Athens Science Festival	Athens (GR)	6th-10th Apr 2016	Katerina El Raheb Akrivi Katifori
International Dance Day	Rome (IT)	28th Apr 2016	Edwin Morley-Fletcher Stefano Di Pietro
5th EyesWeb Week	Genoa (IT)	6th-10th Jun 2016	Antonio Camurri Paolo Coletta Stefano Piana Stefano Di Pietro Edwin Morley-Fletcher Massimiliano Zanoni Michele Buccoli Sarah Whatley Aristotelis Kasomoulis
HCI and the Educational Technology Revolution_ AVI 2016	Bari (IT)	7th-10th Jun 2016	Katerina El Raheb
CID 44th International World Congress on Dance Research	Athens (GR)	29th Jun-3rd Jul 2016	Katerina El Raheb
MOCO 2016	Thessaloniki (GR)	5th-6th Jul 2016	All partners
Researchers' Night 2016 (Athens)	Athens (GR)	27th and 30th Sept 2016	Katerina El Raheb Akrivi Katifori Aristotelis Kasomoulis
Journée d'étude « L'acteur à travers le prisme du numérique : corporéité, avatar et spectacle vivant »	Paris (FR)	27th-28th Oct 2016	Jean-Marc Matos
DanceHE conference	Leeds (UK)	28th-29th Oct 2016	Sarah Whatley Rosamaria Cisneros Karen Wood

Light Moves Film Festival and Symposium	Limerick (IRL)	4th-6th Nov 2016	Sarah Whatley Rosamaria Cisneros Karen Wood
EUROMED 2016 International Conference on Digital Heritage	Nicosia (CY)	31st Oct-5th Nov 2016	Sarah Whatley Rosamaria Cisneros Karen Wood
HUBIC 2016 @ 20th Pan-Hellenic Conference on Informatics (PCI)	Patra(GR)	10th -12th Nov 2016	Giorgos Tsabounaris Aristotelis Kasomoulis
Europeana Space Final Conference	Berlin (DE)	21st–22nd Nov 2016	Sarah Whatley Rosamaria Cisneros Karen Wood
EuroVR2016	Athens (GR)	22nd -24th Nov 2016	Katerina El Raheb Akrivi Katifori
Virtual Reality Amsterdam	Amsterdam (NL)	1st Dec 2016	Jasper Brekel Stefano Di Pietro
ACM Greek SIGCHI	Athena (GR)	21st Dec 2016	Katerina El Raheb Aristotelis Kasomoulis Giorgos Tsabounaris

Forthcoming

Title of the event	Place	Date	Attendees/Presenter from the Project
Laval Virtual	Laval (FR)	22nd-26th Mar 2017	Edwin Morley-Fletcher Stefano Di Pietro
Digital Echoes	Coventry (UK)	10th Mar 2017	Sarah Whatley Rosamaria CisnerosRuth Gibson Karen Wood
MOCO 2017	London (UK)	28th-30th Jun 2017	Sarah Whatley Rosamaria Cisneros Ruth Gibson Karen Wood
International Dance and Somatic Practices Conference	Coventry (UK)	7th – 9th Jul 2017	Sarah Whatley Rosamaria Cisneros Ruth Gibson Karen Wood

Articles/Papers published, Press coverage, Website development

Type and Scope	Title	MM/YYYY	Details/Comments
Poster presentation and Publications in the proceedings	K. El Raheb, V. Katifori, Y. Ioannidis, A. Camurri, E.K. Cisneros, O. Even-Zohar,,R. Gibson, A. Markatzi, J-M. Matos, P. Palacio, S. Di Pietro, M. Romero, A. Sarti, V. Viro, S. Whatley, **WhoLoDancE project: Towards virtual and holographic dance learning experiences,** EuroVR 2016 (In Press)	12/2016	
Poster presentation and Publications in the proceedings	A. Camurri, K. El Raheb, O. Even-Zohar, Y. Ioannidis, A. Markatzi, J-M. Matos, E. Morley-Fletcher, P. Palacio, M. Romero, A. Sarti, S. Di Pietro, V. Viro, S. Whatley, **WholoDance: Towards a methodology for selecting Motion Capture Data across different Dance Learning Practices**, MOCO'Proceedings of the 3rd International Symposium on Movement and Computing, Thessaloniki, GA, Greece, No. 43 July 2016.	07/2016	
Paper presentation and Publication in a dedicated issue in scientific journal	K.El Raheb, A. Katifori, Y. Ioannidis, **HCI challenges in Dance Education,** EAI Endorsed Transactions on Ambient Systems 16(9): e7	6/2016	

Final Statement of review meeting in Milan (5th-6th December, 2016)

The WhoLoDancE review meeting in Milan concluded the successful completion of the efforts made by the project partners in order to reach the first milestone of the project. This encompasses the acquisition of preliminary definitions and ground-truth data that will allow an in-depth development of models in the second year. The first day of the meeting was dedicated to the exchange of information, ideas and concerns among the project partners, who presented the progress they made during the first year. Every presentation was followed by an in-depth discussion on the state of affairs. The general outcome of this session was that the first year's progress was satisfactory. All partners worked with enthusiasm and all deliverables expected by the end of the year have been made available in a timely manner. On the second day, the Users' Board session was held. A number of distinguished personalities from the dance and choreographic world attended this session, during which they were informed on the project developments and gave suggestions on future improvements. The feedback they provided after completion of the session and their oral contributions during the meeting showed that their overall impression on the project was very positive and that the final product is expected to be extremely promising. In the following paragraphs the activities performed by the project partners in the course of 2016 are summarised. Subsequently the concluding remarks of the meeting are presented, which reflect a number of important issues that need to be addressed in the coming months.

Being the coordinator of the project, Lynkeus has been primarily responsible for the translation of WhoLoDancE vision into a smooth implementation process. Lynkeus participated in all events that took place during 2016 and it organised and chaired the monthly progress meetings of the consortium. It has been actively involved in decision-making regarding the content of the planned activities, and it ensured that they were successfully executed in time. Finally, Lynkeus reviewed all deliverables, also checking that the appropriate quality assurance procedure had been followed in their completion.

ATHENA RC has been actively involved in the analysis of the needs of potential future users of the dance movement repository. This included the organisation of two successful workshops addressed to dance practitioners. It conducted interdisciplinary discussions between dance and technical partners to achieve common understanding and vocabulary. It developed the storage infrastructure for the WhoLoDancE repository, and set up the metadata server and interface for accessing the resources of the project. It has drafted the system architecture of the WhoLoDancE platform as well as the Data Management Plan, and started investigating the semantic representation and annotation of the data. Finally, it participated in different dissemination events, including two poster presentations of the project, and a publication in an academic journal.

COVUNI has contributed dance expertise to defining movement and learning principles for the project. It designed surveys, questionnaires and interviews for consultation with the dance community (including gaining ethical approval for the process), and it carried out analyses of collected data. It contributed expertise in Flamenco for video examples and for live motion capture sessions held in Amsterdam, participated in the preparation of the State of the Art report, and provided examples of digital dance projects. Moreover it presented the project at various research events and conferences.

POLIMI has been active in three research and development areas. The first one is the development of multimodal analysis methodologies for the extraction of rhythmic information from videos, motion capture (mocap) and music files. This is expected to help in the development of a set of tools for the automatic synchronisation of multimodal streams. The second one is the analysis of movement principles, leading to the implementation of features that are extractable from mocap and can assist in the measurement of directionality. The third one is the development of web-based tools for mocap, video and feature visualisation and data annotation. An *ad hoc* version of the tools has also been developed for the purpose of similarity assessment. A minor delay in the initial plan occurred due to the needed reorganisation and alignment of multi-modal data.

UniGe has been busy with research and development in the area of multimodal analysis methodologies, the modelling of emotional representation, and the modelling of motion signals. Moreover, it hosted the first motion capture session, providing all necessary facilities.

MOTEK achieved a significant progress towards the successful development of the library of motion captured segmented movements and of the blending engine allowing choreographers to combine their preferred selection of such movements into a realistic and consistent movement flow design. Regarding motion capture, it made all necessary technical developments that allowed the realisation of motion capture sessions fit for the WhoLoDancE purposes (e.g. preparation of the marker template, the motion capture pipeline, multi-site protocols, unified file formats, relevant guidelines), and the post-processing of data. Regarding avatar visualisation, it modelled, optimised and benchmarked four different types of avatars. As for the blending engine, it drafted documents for the software design and functionalities, created relevant development coding and standards protocols, incorporated the movement principles into the trajectory of software development, and it coded all aspects of this software.

Instituto Stocos contributed expertise to the definition of movement principles, qualities and learning scenarios, providing practical examples and a wide repository of video recordings. It also provided hundreds of motion capture recordings for contemporary dance and classical ballet during the motion capture sessions in Genova and Amsterdam. It also contributed to the WhoLoDancE workshop at MOCO 16 in Thessaloniki, with sonifications for the movement qualities measurement.

Lykeion Ellinidon (Lyceum Club of Greek Women - LCGW) has been mainly busy with the selection of kinetic patterns and segments from 53 traditional Greek dances, which were recorded during the motion capture session in Amsterdam, and were subsequently inserted in the motions database of WhoLoDance. Throughout the 1st year, Lykeion Ellinidon has also contributed with video recordings of more dance movements during dance lessons, as well as with writing and reviewing parts of the deliverables (mainly for WP1 and WP2).

KDanse contributed choreographic knowledge and dance expertise to the definition of movement and learning principles for the project. It participated in multiple discussions about the list of movement principles and their contents, and for devising synthetic descriptions about the Directionality movement principle for both dance teaching and choreography. During these discussions, a continuous effort was made to communicate choreographic thinking towards the scientific-technical partners in order to convey concepts easily transferable into the computing domain.

Peachnote has been busy with research and development in the area of similarity search. In particular, using its experience on the subject, it focused on identifying those elements in the similarity search algorithms for music that can be transferred in the domain of dance and the modifications that they need to undergo in order to fit the purposes of WhoLoDancE. The results obtained so far have been discussed with the partners and have helped foster a common understanding of the possibilities of similarity search among the technical and especially the dance partners. A resulting discussion has provided key insights into the functional requirements necessary to specify in full detail the next step in the similarity engine development - a standalone service that the partners designing the HLF extractors and the user interface will rely upon. A discussion with the dance partners on the utility of similarity search is expected to validate the suggested future developments in this domain.

The conclusions of the WhoLoDancE Internal Review and Users' Board Session can be summarised in the following remarks collected from the external experts summoned in Milan on 5th and 6th December 2016:

5. The two groups of partners have achieved quite a very large and valid amount of work within the first year, both dance experts and techno-science partners. Objectives were met. The next step is to make these two groups further work together in practical "physical workshop" situations. The forthcoming meeting to be held in Conventry on 24th-25th January 2017 is meant for this end.

6. Despite being a large interdisciplinary project, within the first year of WhoLoDancE a growing convergence in the different pieces of work performed by the partners has been achieved, making it possible for the consortium to outline WhoLoDancE's final goals. The forthcoming actions will be aimed at ensuring that by the end of the project measurable, concrete, and strictly specified tools will be available, based on:
    - Clearly identifying what is expected from dance experts (and test users) in order to approach a proof of content early enough: i.e. what are the dance experts concretely expecting a first prototype will be able to do and feed-back (in particular in terms of similarity search) for improving dance teaching and expanding creativity.
    - Having a proper running prototype of the final product, which will be open to user-driven fine-tuning.
    - Questioning in depth and validating the library of movements and the blending engine functionalities.

7. Regarding high-level features and their verbal labels (movement qualities), it will be important – given also WhoLoDancE intercultural, character – to attentively focus on the translation of such labels. The issue is certainly complex, having to do not only with the far-from-neutral operation of translation, but also with highly metaphoric/evocative language.

8. It is important to take into consideration the knowledge deriving both from theoretical speculations and practical experiences relating to performing dance. Previous experiments made in the past years by other artists, who got in dialogue dance and digital technologies, can help the dialogue between the experts involved in Wholodance and it can support the development of useful tools for studying and teaching several aspects of human behaviour and communication through movement.

9. The WhoLoDancE consortium needs to analyse in depth the licensing issues that may be associated with the release of its final products. Further research related to intellectual property/privacy associated with motion capture data will provide knowledge that can play a significant role in fostering the project's exploitation.

10. WhoLoDancE developments have focused until now on technical aspects of dance, such as the vocabulary of movements. The aspect of internal expression, energy and personality of the dancer have not yet been taken into account, but thorough research in this direction will be an important goal in the next phase. In any case, WhoLoDancE ambition remains the development of tools that can facilitate teaching and choreographing, and certainly not replacing the dancer or the choreographer.

11. WhoLoDancE provides an opportunity for making dance more popular and accessible to different types of 'audiences'. An in-depth analysis of market possibilities during exploitation of the final products should prove to be highly valuable.

Conclusions

Wholodance is now entering Phase II that will concern the models, platform and similarity search basic development. Albeit the minor delays in the completion of specific tasks and the organization of work for the Work Packages, the first Milestone of the project has been successfully reached and the use of resources has been accurately managed.

The first milestone (M12) includes the Preliminary definitions and ground-truth data acquisition. An Alpha version of the platform has been released by Athena and a number of integration also took place with the collaboration of Polimi that will apply the web interface visualization tools to the existing platform. The platform is already navigable thanks to use of a specific metadata server (CKAN Based) and implementations are foreseen to integrate the results of features analysis and extraction by PoliMi and UniGe to the data listed in the Database with the collaborations of the Dance Partners.

Several solutions for the Synchronization of the different streams of data have been proposed and presented at the meeting in Milan. With regard to the Similarity search engine, the construction of the ontology and a detailed definition of the features to be extracted with a particular focus to HLF, some issues have been raised concerning the coordination and communication between dance and tech partners. As coordinator, Lynkeus facilitated the work between dance partners, coordinating the creation of two online documents regarding the definitions of the Principles to be used as a starting point to train the algorithms and start the Machine Learning Process. The wide participations of the dance partners and preliminary feedback given online by the tech partners nurtured the discussion which took place during the meeting in Milan.

Furthermore, in order to address the issue, a meeting at Coventry University has been scheduled for January 24th- 25th in order to have a full two days of workshop in a physical space dedicated to dance were both Technical and Dance partners can reach a final agreement on the latest contested concepts for the further development of the platform and training of the algorithms.

The development of the blending engine experienced some delays caused by the difficulties occurred while finding better solutions for the cinematics of the Avatar. A first prototype has been altogether presented in Milan and a second release will be on February. In order to smooth the coordination and collaboration among technical partners Lynkeus advised to provide the technical details regarding the development of the blending engine to all the partners involved in order to avoid the risk of a lack of collaboration between partners or any compatibility issue in the second phase of the project.

On this direction particular effort has been put into ensuring the sharing of the data format, frameworks and programming language used for the project and for this reason Lynkeus prompted the efforts of Athena for drafting a common shared document for all partners to be aware of the possible compatibility issues.

To ensure the smooth progress of the activities carried out in the project, Lynkeus encouraged and coordinated the participation of external auditors, Dance and Technology experts that could provide useful indipendent feedback to the project. A first Users' Board session was organized at M12 where more than 15 Dance Experts Joined the general meeting in Milan and provided useful feedback to the consortium. Other Sessions are foreseen for the second phase of the project focused on the Models, platform and similarity search development.

Overall, it can be said that Wholodance is on a good track and no major deviations from the original workplan have been experienced. The second phase of the project will be very important as the preliminary version of the interfaces and algorithm should be developed and ready for testing and the exploitation strategy of the project will be clearly defined.

The first phase of the project, crucial to set the work for the second phase has been successfully completed with only minor deviations that have been clearly identified and specific measures have been applied to solve the problem. The clear definition of the self-assessment plan and the standard forms that have been developed throughout the first twelve months of the project, have been clearly proven effective and will certainly improve the project management and risk assessment for the project in the second phase.