

PerFECT: A Performative Framework to Establish and Sustain Onlife Communities and its Use to Design a Mobile App to Extend a Digital Storytelling Platform with New Capabilities

Abstract. This paper presents how the concept of virtual community can be further elaborated to account for the use of modern digital technologies in a way that promotes the establishment of rich social contexts within which human creativity is exercised and learning happens. The new reality brought about by digital technologies is characterized by new qualities, new opportunities for action, new community affordances, that are captured by the term onlife. This term was initially proposed in the Onlife Manifesto and used in this paper to signify certain qualities that are important in understanding modern digital platforms and applications as well as guide the efforts for effectively extending to provide new capabilities to their users. Specific design principles are presented complemented by a concrete mobile app addressing creativity and learning in the field of cultural heritage to showcase how these principles are put in action. This mobile app enables the users of an existing digital storytelling platform inspired by traditional Shadow Theatre, develop their own digital puppets in an effective way. The use of the mobile app is compared to the need to use external image processing tools and the pros and cons of each approach are presented and linked to the design principles initially presented.

Keywords: Digital storytelling, digital puppets, shadow theatre, onlife communities.

1 Introduction

People learn and create within certain social contexts, in environments, physical or virtual, within which other people are engaged as well possibly with different roles but common goals and expectations to create or learn. People are connected to each other in this process of creating or learning. They even connect to other people that are not present (e.g. with creators of artifacts used, with those that produce the knowledge that learner are trying to assimilate or even with people that will exist in the future and use the products current actors. In this respect, this thesis is employing the overarching concept of community to express the social context within which human creativity is exercised or learning happens.

The goal of the work reported in this paper is to provide a comprehensive approach for supporting Onlife Communities by employing digital technologies within an overarching framework that is informed by current trends in re-conceptualizing and re-thinking about our societies facing the so called “hyperconnected era”. This is reflect-

ed in the term “onlife”, which has been employed in The Onlife Manifesto [1]. This term stresses the fact that the deployment of information and communication technologies and their uptake by society radically affect the human condition, modifying human relationships as well as relationships of humans to the world. The term onlife is a neologism introduced by Prof. Luciano Floridi claiming that “*we are neither onlife nor offline, but onlife*”. Its use in the Onlife Manifesto is related to the fact that the ever increasing pervasiveness of digital technologies lead to a blurring of the distinction between reality and virtuality as well as between human, machine and nature along with a reversal from information scarcity to information abundance and a shift from the primacy of entities to the primacy of interactions.

To elaborate a framework for the establishment and support of onlife communities with the aim to empower members of such communities control how digital technologies support their capabilities to create and learn, there is a need to depart from established engineering practices that are based on monolithic designs done by technology experts. A new conceptual framework is needed that is based on the hypothesis that digital systems can be realized by the composition of elementary components with limited initial design and be put to work by end users, eventually facilitated by IT engineers that play the role of catalysts of change and evolution of those systems towards directions that could not be initially foreseen [2].

Elaborating on this design approach, this paper proposes a framework to establish and sustain of onlife communities, *i.e.* communities of creators using digital tools in a certain domain, emphasizing creativity and learning. This framework is presented in section 2. Section 3 presents eShadow, a platform that promotes creativity within a digital storytelling approach that is inspired by traditional shadow theatre. Section 4 presents how the framework presented in section 2 is applied and how it has been used to interpret how users understand and use the eShadow in order to develop a mobile app that further enhances their creativity and learning potential. Section 5 presents the current status regarding the development and usage of this mobile app. Section 6 concludes and presents directions for future work.

2 The PerFEct framework

Technology can be seen, in many cases, as a catalyst for the formation and/or support of certain social structures. Cabitza et al. [3], offer many interesting ideas and concepts supporting this observation. They emphasize the fact that end users are increasingly more required to act as active contributors at use time, thus becoming “producers” of contents and functionalities. The term *expert user* is suggested to describe a situation where an expert in a particular domain with main goal to develop the technological capabilities available on that domain. An expert user engages in creative/authoring activities without being a professional software developer. Usually the role of *end user* and that of an expert user are played by different people that may also belong to different communities. Furthermore, Cabitza et al. [3] suggest the role of *meta-designer* to describe the work done by professionals who create the socio-technical conditions for empowering end users in acting as active contributors of con-

tents and functionalities. A meta-designer creates open systems that can be further developed by their users acting as co-designers. However, apart from the technical conditions necessary to set up such environments, there is a need to effectively create the social conditions that will allow expert users to build and adapt the artifacts to be used by end users. In response to this need, a special user role is specified: *maieuta-designers*. A maieuta-designer creates the necessary preconditions for facilitating expert users appropriate the design culture and technical notions necessary for the meta-task of artifact development and involving as many end users as possible in the process of continuous refinement of the artifact, by improving participation. The user of the term “maieuta” directly references the Socratic method of getting people acquire notions, motivations and self-confidence to undertake challenging tasks.

End users, expert users, meta-designers and maieuta-designers engage in certain interactions with each other as well as with the digital artifacts and tools causing the emergence of a co-evolution phenomenon. Meta-designers focus on designing and providing the most effective tools that may sustain the co-evolution between end users and expert users. Maieuta-designers facilitate the transition from the role of end user to the role of expert user thus empowering people to appropriate and contribute to their digital artifacts. If certain end users are not interested or fail to move towards the role of expert user, maieuta-designers may facilitate system evolution by systematizing the reporting of opportunities or shortcomings, as identified by end users, and proposing solutions handled by expert users or even suggest further technological contributions from meta-designers. As a final result of all these interactions, two co-evolution processes emerge:

- The first cycle addresses the interactions between end users and the system. It refers to the use of software devoted to the end users. It is shown in **Fig. 1** (left) with three homocentric cycles of arrows that represent the action-interpretation cycle at the lower level, the task-object cycle at the middle level and community-technology cycle at the upper level.
- The second cycle is analogous and it is shown in **Fig. 1** (right). It addresses the use of the technological environment and the corresponding software components as building blocks of the system in continuous evolution. Three homocentric cycles (levels) are present here as well: action-interpretation, task-object, and community-technology.

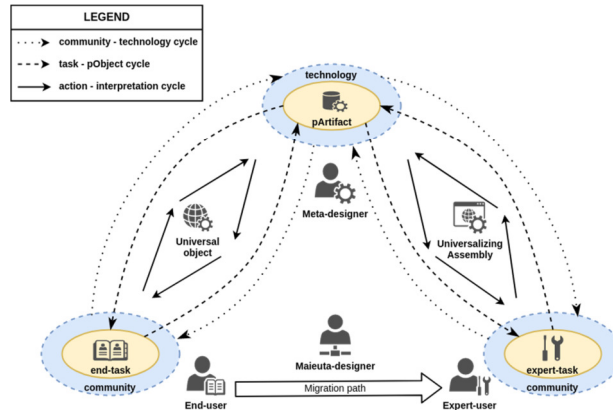


Fig. 1. The main components of PerFECT framework

There is a clear symmetry between the two co-evolution processes in terms of their constituent interaction cycles. In particular:

1. The inner interaction cycle in each co-evolution process addresses actions initiated by the corresponding user role or software that are interpreted by the other party, software or user role respectively.
2. The middle cycle refers to the co-evolution of the user task and the related digital artifact within the boundaries of the system.
3. The outer cycle captures the idea that the overall environment within which a user is working (community), co-evolves with the technology that supports the operation of the environment.

All user roles (end users, expert users, maieuta-designers and meta-designers) together with the digital artifacts, tools and even underlying physical objects used to embed the technologies used (*e.g.* within the so called Internet of Things or other settings that enhance physical objects with new affordance that exploit the capabilities of digital technologies) are considered as a whole: an *Onlife Community*. This term is used to emphasize the fact that all user roles, via their interactions along with the two co-evolution processes, create an aggregation of humans that engage with other humans as well as with machines and natural entities in mindful interactions in a way that generalizes the notion of online communities offering new opportunities for creative expression and learning.

Within this framework an important notion is used to describe blends of machines and physical objects that generalize the notion of software or tool: The notion of *universality*. In both centers of the two co-evolution cycles in **Fig. 1** this notion is explicitly used to characterize the artifacts employed (universal objects on the left and universalizing assemblies on the right). Universality addresses the issue of *causality* in digital representations. A universal object is essentially an object that exhibits a behavior that can be understood by humans because it is based on causal relationships with other objects or processes. A universalizing assembly, on the other hand, is con-

sidered as certain assembly of digital artefacts that creates a new type of artifact that can be understood and manipulated as a universal object. The term universality is adopted from Brenda Laurel's seminal book "Computers as Theatre" where it is considered as an important aspect of all representational worlds that goes back to Aristotle's Poetics where the idea of universal actions was introduced:

"... an action is universal if everybody can understand it, regardless of cultural and other differences among individuals. This would seem to limit the set of universal actions to things that everyone on the planet does: eat, sleep, love, etc. Aristotle posits that any action can be "universalized" simply by revealing its cause; that is, understanding the cause is sufficient for understanding the action, even if it is something alien to one's culture, back-ground, or personal 'reality'." [4], p. 94.

Within the PerFECt framework, the meta-task of expert users is to enable the universalization of certain objects by exploiting available tools in the form of performative artifacts (pArtifacts) to account for the incorporation of the idea of performativity in digital technologies. Performativity describes the relationship between humans and the artifacts they create that is triggered by social interaction. Such interactions continuously recreate the bonds that keep the society as a whole. Niedderer [5] emphasizes that performative objects are designed to facilitate mindful awareness of the physical and symbolic social actions and their consequences within which they are used. The term *performative artifacts* (pArtifacts) used here, captures the idea of intentional design for social interaction, to create and sustain social bonds and call for symbolic social actions that re-create the social contexts within which we live in. Consequently pArtifacts offered by meta-designers are essentially the catalysts for the establishment and sustenance of onlife communities supporting the bonding of their members as well as the bonding between their members and the artifacts they create and use.

To make the above concepts more clear and understand how the PerFECt framework can be used to better understand how digital technologies are actually used and what kind of social interactions they facilitate or promote, a particular case will be presented next. The specific software studied is a digital storytelling platform that is inspired by traditional shadow theatre. The next section presents its main features.

3 eShadow

Shadow theatre is a storytelling tradition of many countries Far East and Middle East using flat articulated puppets which are held between a light source and a translucent screen or scrim. The cut-out shapes of puppets may include translucent color or other types of detailing. With the advent of cinema and TV, the popularity of shadow theatre has declined. However, in many cases it still remains a favorite entertainment for many children and adults and a way for personal expression as a means of dramatized storytelling.

Shadow theatre is a medium with significant educational value within the wider context of drama and performance arts [6]. This is due to its ability to engage people and promote their creativity. In particular children and adults find their own ways to act and imitate, create dialogues, get inspired and convey their own messages, direct, become stage designers, sing, strengthen their self-confidence giving life to the puppets, improvise and create their own stories. Thereby they cultivate their oral speech skills and develop in multiple modes their intelligence (multiple intelligences) in an entertaining manner.

eShadow (<http://www.eshadow.gr>) is the digital version of shadow theatre [7]. It enriches traditional features with digital technology elements: It offers a new way of dramatized and personalized digital storytelling. It enables the production of rich multimedia content interactively using innovative input devices and supports online collaboration. Puppets used in eShadow have the same structure as the traditional figures shadow theater. In particular, they consist of two or more parts which are joined together by joints as shown in **Fig. 2**.



Fig. 2. Examples of shadow theatre articulated puppets. Red circles represent joints that connect puppet parts. The puppet on the left is a two-part one with one joint while the puppet on the right is more complex one having four parts and three joints that connect them.

The female puppet on the left of **Fig. 2** consists of two parts: the top and bottom of its body which are connected with only one joint. The male figure to the right of **Fig. 2** consists of four parts: The main body, waist and two legs. There are three joints: one that connects the main one body with waist and two that connect the waist with left and right legs respectively. These two typical cases (with four or two parts) capture the structure of most figures of traditional Greek shadow theater.



Fig. 3. Synthesis of shadow theatre articulated puppets. On the left, an example of a two-part puppet is shown with its constituent parts and the corresponding joint anchors (red circles) in each part. On the right, an example of a four-part puppet is shown. In both cases the red rectangles represent the boundaries of areas used to place each constituent part.

To synthesize such puppets, one has to develop their parts in certain material, cut them and join them together at the correct joint positions. The female puppet consists, as mentioned, of two parts which are associated with one joint. These two parts are illustrated separately in **Fig. 3** as well as their connecting points (joint anchors) to form the joint of the figure. The selection of connection points, especially for the bottom part affects not only the aesthetics of the figure but also its behavior during handling due to the force of gravity. Wrong point selection will have as a result the lower part of the figure to be unbalanced. Consequently, puppets are tested before the position of joints is fixed.

4 Using the PerFECT framework to understand how eShadow can be effectively used and extended

Employing the PerFECT framework, its concepts and user roles, to better understand the use of tools such as eShadow can be put within a wider context that accounts for the rich social interactions that could be promoted towards the establishment of online communities. In particular, eShadow can be considered as a representative tool on how a community can be established (in the field of cultural heritage and learning) that brings together:

- Software developers supporting the software and providing further enhancements to address the needs of the users.
- Puppet creators that prepare materials, such as puppets, that can be used to support other creators, those that use the platform to develop animations and stories on various themes.
- Storytellers that use materials offered by creators to develop digital stories.

Using the user roles' terminology introduced in section 2, the above categories of participants in an eShadow-based community can be reframed as follows:

- Software developers that support eShadow and implement further enhancements are the meta-designers of the PerFECt framework. As meta-designers, they are expected to offer an open system that can evolve by its users as co-designers. To enable this, eShadow offers an open representation based on json files to enable the creation of content such as digital puppets.
- Puppet creators that develop digital puppets are what the PerFECt framework describes as expert users. They address the needs of end users using the open system capabilities offered by meta-designers to develop new reusable materials.
- Storytellers that use eShadow to develop digital stories are what the PerFECt framework calls end users. They essentially use the creations of expert users in the form of *universal objects*, i.e. digital artifacts that exhibit a certain behavior that simulates the behavior of traditional puppets with all the corresponding causality stemming from the presence of gravitational forces.

Apart from the above mentioned roles, which are directly related to eShadow as a tool simulating and extending a traditional creative environment, the PerFECt framework introduces yet another (fourth) user role: maieuta-designers. This role has a significant contribution in framing and supporting an onlife community addressing the social conditions for supporting the meta-task of expert users and the transition from the end user role to the role of expert user. This transition and support of expert users' tasks are essentially a learning process that takes place within a social context (i.e. the community of users). In the case of eShadow, a typical function of maieuta-designers is to organize workshops where eShadow users can be trained on how to understand and use the representations of digital puppets, how they can use existing image processing tools to develop their own digital puppets [8] or remix existing puppets [9] to meet their particular needs.

After successfully implementing this approach in many primary and secondary schools, with very interesting results showcasing the educational potential of such technologies and their importance in reconnecting young generation with their cultural heritage, a new project was initiated addressing pre-primary education. A certain need was identified to develop traditional puppets before digitizing them. This need came from certain pedagogical objectives. Furthermore, there was a need to support users without skills and available time to engage in the process for preparing digital puppets using image processing software. Using the terminology of the PerFECt framework, this was a situation when maieuta-designers collaborating with end users, revealed a need to communicate with meta-designers to ask for the development of a new generic component that will allow end-users adopt a new way of work in order to become expert users, i.e. puppet creators. The result of this intervention was the design of ePuppet, a mobile application for facilitating the digitization of two- and four-part puppets. Assuming that a traditional puppet has already been created, its parts can be put on a flat surface with a constant color background so that the ePuppet app can be used to take a photo of the parts after appropriate aligning them with predefined templates, one for two-part figures and one for four-part figures (**Fig. 4**).



Fig. 4. Digitization of shadow theatre puppets using ePuppet. The parts of the puppet are put on a flat surface with a constant color background (e.g. on a sheet of paper). The parts and the mobile device are moved as needed so that the parts are framed within the red boundaries shown in screen overlay and the joint anchors (red circles) are positioned correctly. Then, a photograph is taken that is transformed by ePuppet into a correct digital puppet representation.

The detailed steps followed by a user using ePuppet are shown as a sequence of screenshots in **Fig. 5**. In particular, initially the user provides a name for the new puppet and selects the corresponding template (if it will be a two- or four-part puppet). Next, the user activates the camera of the mobile devices and overlays a guiding template as a slide that is placed over the camera's image. Moving parts of the puppet as well as the devices left to right, up and down and back and forth full alignment of the points is achieved connecting the joint anchors (red dots) to coincide with the connection points of the real puppet parts. After aligning the parts, the user selects the appropriate control to make a photo of the puppet. In the next screen, the user is able to adjust the background color levels to enable its automatic removal to clear the surrounding area of the puppet parts. After that, the application creates all necessary files so that the digital version of the puppet can be used in eShadow and lists the new puppet in the mobile app folder area.

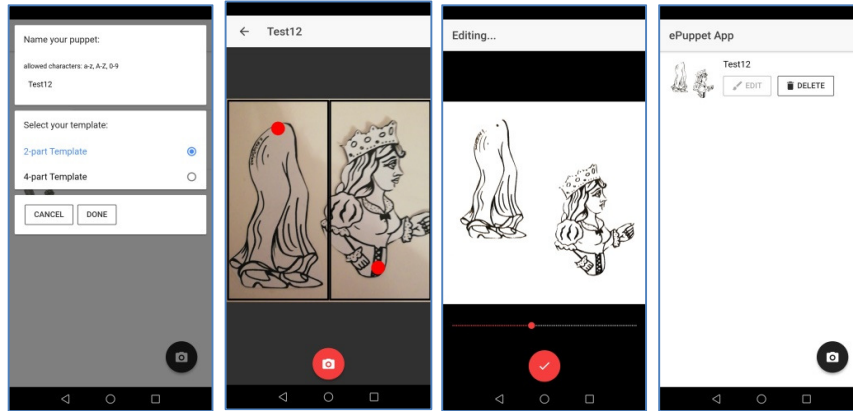


Fig. 5. To create a digital puppet with ePuppet mobile app, the user follows four steps: (a) gives a name to the puppet and selects a template to use; (b) takes a photo of the physical parts of the puppet; (c) adjusts background color levels to automatically remove the background; and (d) stores the files created.

The final output of this process, is the digital representation of the puppet. In particular, two files are created:

- An image file (sprite sheet) with all the constituent parts of the puppet.
- A json file with the information about the placement of the constituent parts in the sprite sheet as well as the position of joint anchors.

Fig. 6 below depicts the json file and the corresponding sprite sheet for the two-part puppet presented above. The representation of the four-part puppet is analogous.



Fig. 6. Digital puppet representation. On the left, the json file describing how the puppet is composed of different parts, where these parts can be found in the corresponding sprite sheet and where the joint anchors are placed. On the right, the corresponding sprite sheet is depicted.

5 Conclusions and Future Work

The concept of onlife communities as exemplified by the PerFECt framework addresses issues related to the establishment and support of rich socio-technical contexts where engaging learning experiences can take place and human creativity can be effectively expressed. As a concrete example of how this framework can be put in action, this paper presents eShadow, a platform inspired by traditional shadow theatre to offer a digital storytelling environment to support creativity and learning.

The PerFECt framework helps in better understanding how eShadow promotes creativity and learning and how it could be further enhanced and repurposed to promote further rich social interactions. Interesting workflows are identified that address the transition of eShadow users from the end user role to the expert user role. Within these workflows, external tools can be used to facilitate this transition and help users develop their digital media authoring skills. Furthermore, new tools can be designed, such as the ePuppet mobile app, to offer new creativity and learning opportunities.

Future work will evaluate the learning effectiveness of using ePuppet in pre-primary schools. Extensive usability testing is also foreseen as well employing standard experimentation tools including emotional response evaluation to document learner engagement potential.

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Puppets depicted in **Fig. 2**, **Fig. 3**, **Fig. 4**, and **Fig. 6** are digital version of original creations by Mr. Nikos Mplazakis, a professional Greek Shadow Theatre puppeteer.

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