A system for creating and listening to context-aware stories outdoors

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Abstract
CASTOR is a novel software infrastructure and set of interfaces that has been designed for supporting all the cycle of creation, management and delivery of context-aware stories outdoors. The software infrastructure and the user interfaces were tailored to the skills of children of the Primary School, for being used in the context of educational curricula targeted at teaching the structures of narration. In [8, 9] we gave a description of the experimentation of CASTOR with a class of children, focusing on the effects on engagement and learning. This paper is focused on the technical features of the software infrastructure and the set of user interfaces. Using these interfaces, stories can be created on the locations where they are supposed to happen, can be refined in the classroom or at home for improving the quality and can be delivered to listeners, respecting all the context conditions specified by the story creators. The extended abstract is an excerpt from the paper *A software infrastructure for managing the lifecycle of context-aware stories* published in the proceedings of the ACM IDC 2013 Conference [10].

Author Keywords
Authoring; computer supported education; context awareness; multimodal mobile interface; storytelling; web interface.

ACM Classification Keywords

H.5.2 [User Interfaces]: Interaction styles, prototyping, user-centered design; K.3.1 [Computer Uses in Education]: Collaborative learning, computer assisted education.

General Terms

Design, Experimentation, Human Factors.

Introduction

CASTOR is one of the first authoring systems allowing the direct creation of structured stories in-situ, rather than the simple gathering of materials, using an extended set of context dimensions for augmenting the engagement of the listeners of the narrations. The software was tailored to the skills of children of the Primary School and was experimented in an educational project that involved a class of pupils aged 7. During the experimentation the children learned how to build, modify and listen to engaging context-dependent stories in classroom and outdoors. From the experimentation emerged different findings related to the understanding of the context-aware story model, the role of the environment for engagement, learning and collaboration, and the potential of CASTOR for bridging structured learning and outdoor experiences. Further details can be found in [8, 9]. This paper will focus on the description of the software infrastructure, detailing the features of the set of interfaces covering all the story lifecycle.

Related Works

There are a number of models and architectures for computer-enhanced storytelling [1]. Most of them rely on the analysis of narratology. The whole infrastructure of CASTOR is based on a story model adapted from the work of the Italian researcher Cesare Segre [11], chosen because of its generality and suitability to different literary genres. The solution is compliant with the *drama manager* approach, where the software infrastructure controls the narration on the basis of the story model and of the narrative choices of the author [6]. Storytelling has always been a powerful means in the educational curricula, not only for developing literary skills, but also for improving the interest of children for other educational domains. Personal computing has been used in the last years to support the creation of stories in the classroom. In recent years the rapid evolution of mobile technologies has permitted to support outdoor activities, such as fieldtrips [4]. A number of technology-enhanced fieldtrips have used storytelling as a means for supporting the learning of literacy and science skills. In [4, 12] children were involved in the exploration of a historic English country building, supported by mobile devices for listening to the content prepared by curators and teachers and for gathering their own content. Hansen et al. [5] designed an environmental drama where storytelling and study of natural sciences were mixed. The students listened to the narration delivered by mobile devices, but at the same time were asked to perform different assignments, involving sketching, collecting soil tests and taking pictures. While both approaches offer a very structured experience in terms of the content delivered to children, they are more focused on the gathering of materials for completing the work in classroom rather than on the creation of narrations in situ. Fails et al. [3] describe one of the few proposals for supporting both the creation and the listening of stories in-situ, even though the different parts of the narration have a loose coupling with distinct locations. Our proposal shares with [4, 5] the integration of classroom and outdoor activities and with [3] the attention for the direct creation of stories in-situ, but provides in addition a precise geolocatization of the story locations and increases the number of context dimensions that are relevant for the narration. While context-aware applications have been primarily conceived for informing the users and diminishing their cognitive load, in this proposal the context [2] has been used also for increasing the engagement of the users. Besides, while the dimensions of the context are several, only a part of them have been extensively used in context-aware architectures conceived for the educational domain. The available implementations often limit the use of the context to the location [4, 5], for delivering appropriate content and augmenting the user engagement. Often the reason for that is the limitation of the devices, lacking sensors for monitoring an extensive set of parameters. The software architecture presented in this work permits to overcome some of these limitations, building the knowledge of the environmental context on a set of web services that are queried using the user location as the initial parameter.

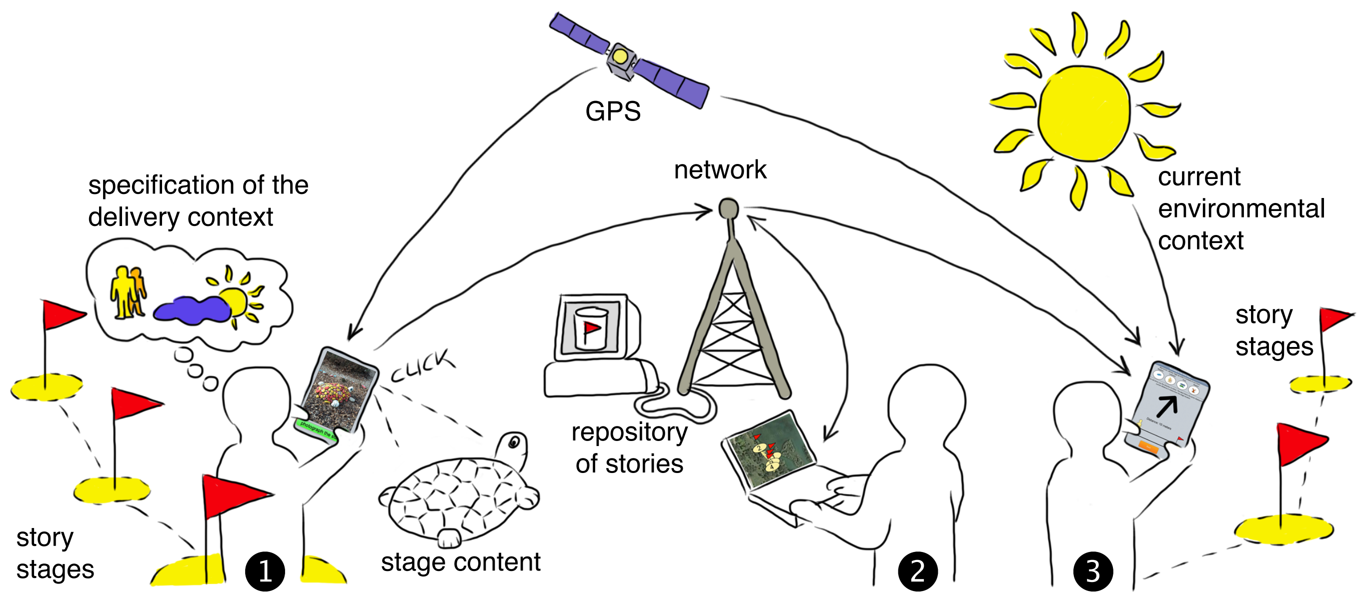

Figure 3. A sketch illustrating the phases of the story lifecycle with CASTOR: (1) creation, (2) editing and (3) delivery.

CASTOR

Our proposal is based on a story model characterized by the definition of locations (i.e., *stages*) where the narration happens and the association of fragments of content to these locations. A story can be composed by one or more stages defined in sequence. For each stage the author associates an appropriate content and decides the values of the context parameters for the delivery of the narration. For the current implementation the context parameters include the *time*, the *season*, the *weather* and the *number of listeners*. For example, as shown in Fig. 2 by a screenshot of the CASTOR authoring interface, the author may decide that a given story should be delivered when the user enters the locations of the stages, but only at twilight, in winter, when there is a thunderstorm and when the listener is alone. The goal is to augment the cognitive and emotional involvement of the story listeners. Alternatively the author may operate inclusive choices, selecting for example the *always* value for one or more context parameters. Please refer to [8] for additional details. The client-server infrastructure for the creation and the delivery of stories has been designed starting from the story model summarized above. The infrastructure supports the scenario sketched in Fig. 1, where a set of clients access a web-based application server for managing the different phases of the story lifecycle. All the stories are stored in a database connected to the server. The first client from the left (see Fig. 1-1) is a tablet application used for creating the story on the field, defining the context parameters for the delivery and communicating the story data to the server; a GPS sensor embedded in the device is required for logging the locations of the story stages and communicating them to the server, for inclusion in the database of stories.

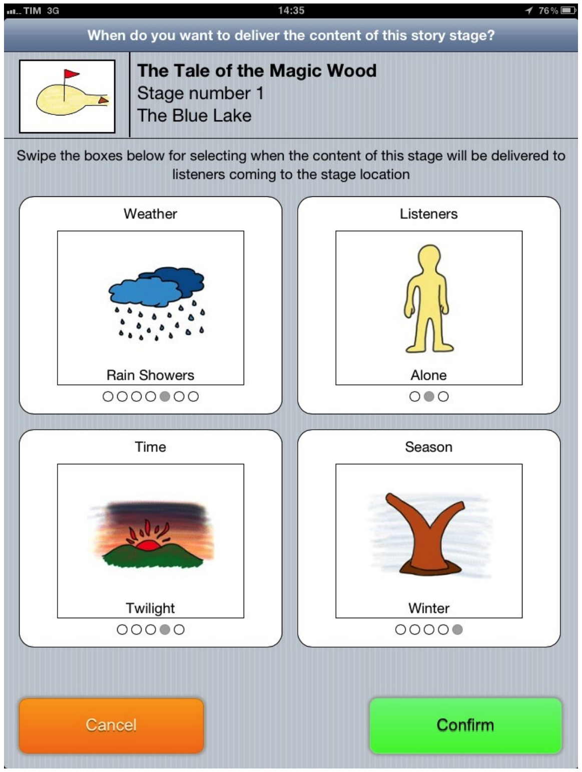

Figure 2. A snapshot of the app interface for defining the context parameters associated to the delivery of a story.

The second client (see Fig. 1-2) is a web application accessible from any standard web browser, that permits to retrieve on the server the data of the stories created outdoors and to modify them, in classroom or at home. The third client (see Fig. 1-3) is a tablet application used for delivering the stories in the locations where they have been created. At the time of the selection of the stories by the listener, the client retrieves from the server the set of context values indicated by the authors during the creation of each story and matches them with the current context values. For overcoming the limitations of most mobile devices that usually don't include sensors for monitoring an extended set of context parameters, the knowledge of the environmental context values is built using a set of web services. The web services are queried using the user location as the initial parameter. Of course a GPS sensor is still required on the client for retrieving the appropriate data (e.g., the weather conditions associated to the current user location). By default only the stories characterized by a complete matching can be listened by the users. Most of the implementations were realized using web technologies, for permitting to port them on different systems. In particular, thanks to the adoption of the Phonegap framework [7], we implemented the tablet apps as web applications embedded in a native shell. The Phonegap framework, available for most of the modern mobile platforms, enabled also to manage the hardware of the mobile devices, such as the GPS, the camera and the microphone that ordinarily can't be accessed by a web application. Resuming, the adoption of this platform allowed us to couple a rapid development of the client interfaces and the ease of delivery for different operating systems and devices.

Conclusion

The infrastructure presented in this paper features a number of novelties, among which the possibility to create complete stories on the field and the use an extended set of context dimensions for augmenting the user engagement during the listening. The infrastructure was tailored to the needs of children of the Primary School and experimented with a class of 19 pupils in order to measure the benefits of the tools for engagement, learning, cooperation, social inclusion and integration with the traditional teaching methods. The encouraging results have been reported in [8, 9]. In the following months we plan to continue our design and implementation work, refining further our approach and completing the introduction in our architecture of more complex story structures. The possibility of integrating additional media, such as videos and texts, will be considered for further augmenting the expressivity of the narration.

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