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An Interdisciplinary Approach for the Digital Media Landscape of the 21st Century: Storytelling as an Instrument in Design Education

Abstract Recent technological advancements have started to lead the development of products and services in all areas of design. However, these innovations have been suspected of having diverse effects on human beings due to the new needs and original activities that they have introduced into our lives. In order to weaken the dominating position of today's digital media, the scholars in design education need to base their approaches on the consciousness of human beings by introducing the aspects of real time and physical space as primary components of the design process. Owing to the advantage of bringing people, places and actions real time, storytelling is recognised for its potential to act as an active mechanism that communicates events and provides the needed contextual information. This research looked for interdisciplinary ways to improve interactive media design education through storytelling, involving the exchange of information between spatial, material and media entities. In the frame of this study, the concept of interactive exhibiting was chosen to work for the creation of the experiences that require bodily performances with respect to the architectural qualities of space and time, and storytelling was used as an instrument to provide a setting to create the participatory experience. An approach supporting this aim was applied for the development of conceptual spatial communication projects with the students of Communication Design Program between 2009 and 2012. The analysis of the students' works reflected the benefits of integrating the place-based and time-based aspects into design education on the basis of storytelling, especially for members of the young generation, who are already natives of such media landscape.

Introduction

Our interaction with information technologies moved on to a new level of understanding with the introduction of the term “ubiquitous computing” coined by Mark Weiser in 1991. While this term denoted the concept of “being present at every time and everywhere”, it also pointed to the invasion of these technologies in our daily life through their characteristic “invisibility”. Although these hybrid products and services support our daily tasks by providing faster, more comfortable and safer alternative networking modes, they also display a tendency to create their own customs by shaping the users' daily life and basic habits. In fact, all new

technologies carry the risk of creating their own needs that force new requirements on the users, as they not only add or exclude but also change all relations and root structures fundamentally (Norman, 2010). Especially in the twenty-first century, the arguments are based on the belief that these technologies are not created to provide for the needs of the people and that the needs related to these technologies are being created afterwards; however, they are created “only because it’s possible to do so” (Postman, 2004). From the perspective of the discipline of design, however, it should always be remembered that the quality and essence of any designed product, varying from a building to a web site, lies in the expressiveness in terms of its content and how well it can fulfil its function (Norman, 2010). This conflicting condition of the digital media landscape has been primarily affecting the behavioural and perceptual systems of the young generation. As educators, the most important point we confront in the area of design education is to bring our students up as contextually strong and highly sophisticated designers of tomorrow (Tasa and Orhun, 2013). Therefore, the educational approaches used in this discipline need a reconsideration of the strategies for teaching design on the basis of the transformational effects of these technologies.

By extension of the studies carried out, stories are identified as an important source in building blocks of knowledge, the foundation of memory and learning, as they reflect the human experience as a set of connected events with roots in space and time. While stories address many functions, storytelling provides an area for designers to develop methodologies that arouse the users’ creativity and intuition. The storyteller has to prepare the necessary language, tools and media in order to present the message of a story effectively and efficiently (Tally, 2012). As stories are composed of time, spatiality, drama, causality and personification, the art of storytelling is recognised to be a fresh yet solid educational tool for design education to guide describing a context or a situation, illustrating problems, launching design discussions and exploring a design concept (Bruner, 1990; Quensenbery and Brooks, 2010). The aim of this study is to make use of storytelling as an instrument for design students to generate better user experiences and to bring consciousness to their design tactics.

In this study, we tried to combine the constructive nature of storytelling for developing a context for the digital media landscape with the support of the concept of interactive exhibiting, as the meaning emerges from the contextual experience (Salen and Zimmerman, 2004). This research examines the conceptual interactive exhibition design student projects, which are based on narratives for special contexts, developed for the Spatial Interaction Design Course in the Communication Design Department of Yildiz Technical University between 2009 and 2012

with the aim of assessing the benefits of storytelling as an instrument in design education. It is our claim that such an approach will enable interactions, develop more engaging interventions in the frame of suitable contexts and support the innovation of future products and services.

The Effects of Digital Technologies and Tools on Users

In the last 20–30 years, digital technologies have spread out and thus are referred to with the term “pervasive computing”. Wi-Fi, Bluetooth, GPS and similar satellite and networking technologies are integrated with tools, which enables the involvement of virtual reality in physical architecture and enhanced spatiality in the fourth dimension (Bullivant, 2005). The effects of technology on an individual’s daily life can be observed in his interaction with other people, devices and settings. Intellectual and cognitive processes are not just products of neurological activities but also the outcomes of complex and mutual interactions between the brain, the body and the designed context that we live in (Clark, 2010). As the digital arena starts to override the analogue ways of doing things, we encounter the designed contexts to be based on reductive and deconstructing systems. For example, the internet technology that forms the substructure of the web has a pattern designed to protect the whole, even if some parts are missing. In parallel with the information architecture, this fragmented information appears in data packages connected to each other without a central structure. Each piece of data follows a different path in the packaging structure, which can be considered to be meaningless on its own as the content of every package is a tiny segment. At the end, it is impossible to track which part of the information comes from where and to consider a transparent information flow (Lanier, 2010). So, we actually are working in systems that are represented by bits, categorised and listed separately in the multiple-choice databases.

These technological advancements also cause a variety of transformative effects on the perceptual capabilities of their users through their active visibility and affordance that enable the users to manipulate these tools just by knowing how to operate them, without having an idea on how they actually operate. The first generation computer users had to learn the hardware and logic in detail in order to be able to use the computers; users today, however, perceive everything by its interface value. They are content with this superficiality and thus become inactive (Turkle, 2004). For example, the Google search engine, being one of the most favourable ways to access information on the internet, is said to be spoiling the reading habits of human beings and promoting undetailed and depthless interpretations (Carr, 2008). Location-based applications not only affect the

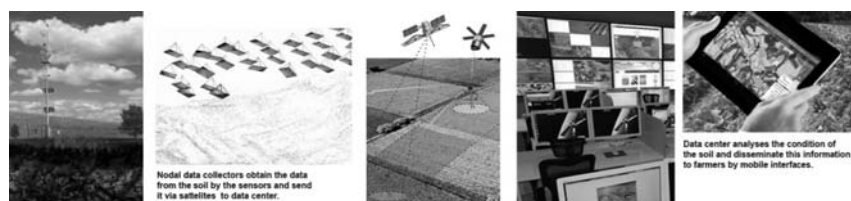
way individuals obtain, practice, spread and interact with spatial information, but also shape their capabilities and perceptions concerning locale and are suspected of enlarging the hippocampus glands in the brain (Hirtle, 2011; Bateson, 2000). Studies have shown that the excessive use of mobile devices causes certain mental and behavioural disorders like “imaginary wobbly syndrome”, “obsessive compulsive disorder” and “attention deficit hyperactivity disorder” (Burrough, 2012). Similarly, messaging through mobile devices and the social media as a new means of meeting people and a widely spread communication method are suspected of being the causes and effects of the weakening physical interaction and friendship practices especially among the new generation. It has been found that when people stay connected more through the virtual network, the danger of feeling lonely increases, which triggers real pathological communication and identity problems and may result in addictions due to the unbearable isolation people experience (Turkle, 2011).

As a matter of fact, the technologies that we embrace today were most likely selected to be realised from among hundreds of alternatives due to the factors of chance and budget. This circumstance results in the development and establishment of inaccurate designs that become the infrastructure or the standard by itself, which generates consecutive systems dependent on that design without any reformation (Lanier, 2010). Therefore, it becomes important to identify the gaps in the design of products in order to compensate for them in the design process of future products.

We reviewed the areas of engineering, technology and science that constitute the background of the concept of interactivity featured in digital media tools. The areas of human-computer interaction and cognitive sciences, which are recognised for their dominance, showed similar evolutions in time in their approaches to the reduction and deconstruction of information. Both areas had not featured the human experience and favoured the process-based traditional approach at the start. However, the indications found in the last 20–30-year span argue for the fact that the cognitive act regarding cognitive science is not independent from the sensorial and movement course of the body and that these sensorial and motor courses depend on the biological, psychological and cultural context on an extended platform (Lakoff and Johnson, 1999). Likewise, in the 1990s, the mainstream approach in the area of human-computer interaction based on interaction-based data processing method was opposed by the concept of “embodied cognition”, which emphasised the importance of “context” and “bodily involvement” (Dourish, 2004).

Meanwhile, advanced technologies are able to provide solutions to the problem of “being at the same place at the same time” by maintaining new modes of communication for humans that connect data from different geographies and time dilemmas (Mitchell, 1999), whereas the contexts for their use remain unclear. For example, a tablet, which is a mobile gadget, is mostly used by the young generation for playing games, reading, listening to music, watching films and connecting to social media. This tool can be suspected of affecting the mental model and social development of a young person negatively when used in this immobile manner. However, from our point of view, a tablet can fulfil its potential through its form and technological competence when it functions to provide non-periodic and asynchronous data for a mobile individual. As in the example of the agricultural project named Tarbil concerning precision farming (Fig. 1), farmers are given tablets to view and control the condition of their crops as they walk through the land. The sensors placed underground both send spatial information via temporal terrestrial monitoring stations and satellite images for the realisation of remote sensing-based agricultural analysis, and disseminate the outcomes to the farmers through these mobile devices (Bagis and Ustundag, 2013).

Figure 1. Varying mobile and immobile technologies in the frame of TARBIL agricultural project for precision farming



In line with these developments and the scope of this study, it becomes important to know the context in which these devices are used. In cybernetic systems, “the user” sees his/her relationship with any larger system composed of other people and stuff differently from the others and this is identified as a context. For instance, a letter means something only in a word, that word in a sentence and that sentence in a text (Bateson, 2000). When we look back in history, the demolishing of contextual barriers can be first identified with the invention of telegram, which reduced and deconstructed the concepts of “time” and “space” (Postman, 1985). Clocks, calendars and maps are the basic devices we use in abstracting and conceptualising, which lack the process, experience and other related dynamics (Mollison, 2011). Nevertheless, the transformation of these two

concepts into a quantitative perception separated and isolated them more from each other and human experience. This study focuses on the ways to address this problem caused by the digitisation of information within the design education to support the creation and realisation of new products that are suited to the mental processes of human beings.

Making Use of Cognitive Sciences for the Discipline of Digital Design Education

As indicated in the introduction, these technological developments and their extensive uses have been affecting young generations most intensely through the use of digital tools. Meanwhile, the design of all future applications, services and tools will be created by the youngsters of today, who are already digital natives. This fact urges us to look for alternative design education tactics for interactive digital media. Recent approaches used in digital design education have shown that the students, who already have chosen this field due to their interest in virtual worlds and interaction design, are generally instructed to solve problems pertaining to fictional and virtual cases that have little reference to real physical conditions. So the educational environment can be described as the student working for imaginary cases that are based on digital interaction and realised by code. Student design projects guided by this and similar approaches signalled deficiency in structural efficiency and were observed to result in perceptually and physically weak usability. We believe that an educational approach that supports the relationship of human beings with time-based and location-based aspects will be beneficial in decreasing the effects of digital media. So, in order to figure out how we can combine design education with the concepts of time and space in the frame of cognitive sciences, the following areas are examined:

1. **Awareness of temporal factors:** Every action or interaction occupies time. Time is an abstract concept and, thus, not inherently visual. Much of the terminology we use for time is based on our concrete experience of space and of the physical environment. Human beings tend to structure time spatially in parallel with their philosophical and intellectual tendencies, which can be classified into two groups: The first group structures time as horizontal navigation in the space that reflects the order and timing of occurrences in relationship to locale (Tversky, 1993). This linear condition defines history as an irreversible sequence of unrepeatable events, a definition which refers to time either as stationary and us moving through it in the direction of the future, or as a moving object that moves toward us (Meirelles, 2013). Contrary to modern western

mentality, the second group maintains their relationship with the context of time through observing nature, which can be defined as cyclic and intrinsic. Day and night, the seasonal changes that affect the vital living conditions like migrations, the stages of all living things are the visible processes of this cyclic condition, which determine and guide the measuring of time (Alexander, Ishikawa and Silverstein, 1977; Meirelles, 2013). This cyclic condition points out the existence of the fundamental states in time, which are always present and never changing, and thus builds the important bonds and supports the perceptions of human beings to cope with life. **Either perceived as linear or cyclic, moments are positioned to tell a story of connected events in one direction and are arranged to come one after the other.** So it is possible to say that the designs have to include and structure experiences and interactions in specific sequential orders or hierarchic connections.

2. **Responsiveness to spatial factors:** Human beings represent their spatial thoughts by mental representations. They use spatial metaphors that refer to movement and orientation in order to conceptualise abstract concepts as well as space-based conceptions concerning the arrangements of objects and their spatial relevance (Tversky, 1993). The content of the product is affected due to the architectural quality of the space in which it has been located and how it is located. Thus, spatial context can be perceived as the physical and characteristic qualities of locale to be transformed into a parameter for the usability of a designed product (Rapoport, 1982). **The spatial bond defines the relationship between objects and other objects, objects and humans and between human beings in a specific sequence of events or in a structure.** It does not only maintain the layout of objects, but also undertakes the organisation of the meaning upon which the users communicate with social and cultural values (Nasar, 1988). The spatiality of the products developed for media space can be realised within their virtual boundaries. In any case, these products refer to the existential space, which can be explained as the schemata developed by the brain in the frame of cognitive psychology (Norberg-Schulz, 1979). Non-spatiality is out of question due to the loss of context and meaning caused by the disconnection of the cognitive connections, including perceiving, memorising and scheming (Lang, 1987).

As seen from the brief explanation above, time is structured spatially and space gains momentum with the integration of time. Due to the fact that the concepts of “time” and “space” regulate each other meaningfully, this study gives emphasis to spatio-temporal context, rather than approaching space and time separately. This cognitive skill, which can be identified simply in the perception of travelling

between two points, can be used in everyday life, in the workplace and in science to structure problems, find answers and express solutions, and can also be learned and taught formally to students using appropriately designed tools, technologies and curricula (National Research Council, 2006).

In parallel with the identifications mentioned above, we looked for suitable concepts and practices that can both serve to ground any design problem and be able to refer to both space and time. On a general level, **both contexts refer to the idea of perceiving objects, interactions and human beings in relation to other things, rather than a solid geometry or an isolated experience.** These aspects guided us to review the art of storytelling that hosts and customises a structured account of connected events which can be supported by both physical and media space.

The Interplay Between Storytelling, Spatio-Temporal Cognition and Design Education

According to the discussions and identifications above, storytelling is recognised to be a beneficial instrument that can support the idea of creating awareness for spatio-temporal context. While it is a well-known area to be used in design education for triggering students' creativity, we examined this subject in order to detect ways or methods of relating to spatio-temporal context that would reduce the transformational effects of technological tools and services by providing an alternative workspace. Driven by its own nature, a story assumes a certain time and space, whereas storytelling undertakes the function of conveying the intended message of a story by giving additional meaning (Quensenbery and Brooks, 2010). All of the components of events occur at various places at different times. A preceding event sets the context for the next event. Thus, events in an episode are linked together to form a chain. Due to the direct connections between these events, time ordering becomes an important parameter of the story (Satish, Jain and Gupta, 2009). So, on the basis of the story, the designer is directly connected to the concepts of space and time and has the capability to improve the concepts to be contexts by making use of storytelling.

In order to fulfil its function, the art of storytelling has always used every possible media and technology. A story can be told in writing, through pictures or moving images, or spoken live or through recorded audio or video. Digital technologies are valuable for offering some level of entertainment by performing the above-mentioned ways in digital space; yet they will be most beneficial when they are recognised and used for instituting interactivity (Miller, 2008). In today's experience-based culture, the element of interactivity is recognised to

be an important element enriching the skills and strengthening the knowledge related to interactive applications ranging from video games to online training and education. Having expertise in this area of design, interaction designers can benefit from storytelling by creating personas, describing the context of use and identifying personal goals.

As a matter of fact, stories do not only belong to the storyteller but to the audience, too. Each person imagines and experiences the story in a different way (Quensenbery and Brooks, 2010). With the integration of technological tools and applications, storytelling becomes an immersive and participatory area in which members of the audience become active players and can influence the narration and its progress. At the end, each individual will be expected to have a unique and personal imagery of a completed story (Porteous, Cavazza and Charles, 2010). With the support of both digital and physical data, digital designers can make use of storytelling to generate methodologies and obtain results for the solution of design problems that may give birth to new technologies, tools or complex information architectures.

There is not a single way to construct a story, especially where digital technologies are concerned. However, in the frame of spatio-temporal cognition, two different streams are recognised:

1. **Spatio-temporal structures** that refer to the representation of time (Meirelles, 2013; Vasiliev, 1997; Peuquet, 1994): i. Time geography aiming at the visitors experiencing how much time it took for events to happen in space, when the time is that one specific object visited one specific place, ii. Historic geography reflecting what has happened in past times, what objects were present at a specific time in a specific place, iii. Cultural geography concerning where events have happened through time, what the location of one specific object at a specific time was.
2. **The type of changes that occur to spatio-temporal context** over time (phenomenological perspective) (Bok, 2000): i. existential changes that include the appearing, disappearing and reviving of objects and relationships; ii. changes in the spatial properties of objects such as location, size and shape; iii. changes in thematic properties.

Making use of the art of storytelling for the spatio-temporal context in the frame of these definitions and classifications for the design of interactive digital interactions and products looks promising. The following section involves the approach for adapting this idea to design education through the stages of briefing, conceptualising, planning and executing processes for this interdisciplinary approach.

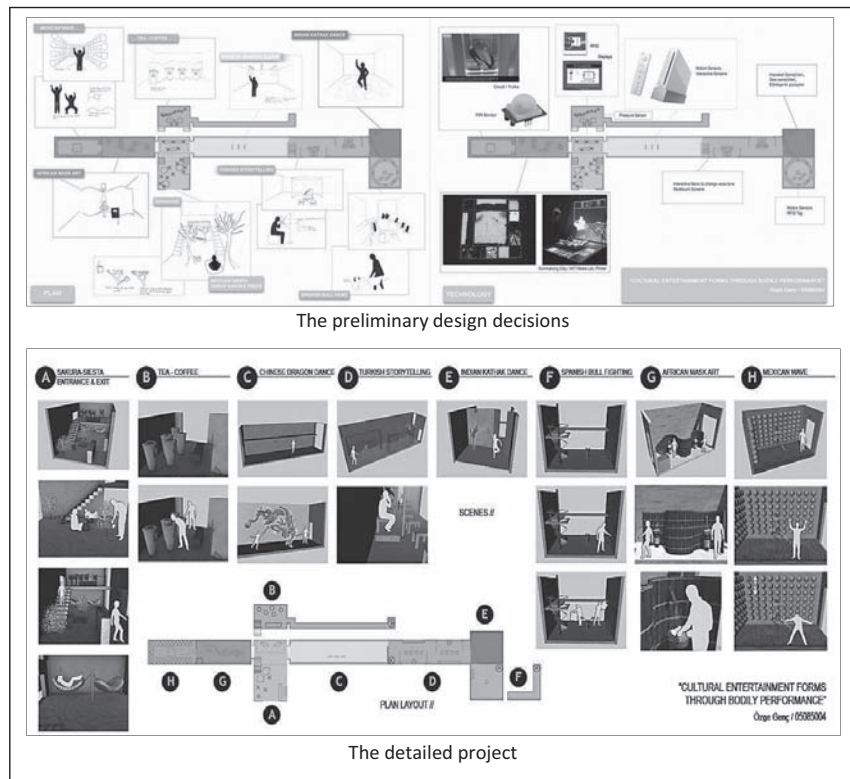
An Interdisciplinary Approach for Making Use of Storytelling in Design Education

As indicated by its natural qualities, storytelling is recognised for its potential to provide the needed contextual information in the frame of design education. The power of the social practices shaped in such an approach is believed to be beneficial for the students to devise meaningful tools that bring the user, the system and the context of use into a productive relationship (International Organization for Standardization, 2009). The discipline of design covers a wide range of expertise areas like architecture, industrial design, communication design, graphic design, fashion and textile design, interior design etc., and storytelling can be applied in each of these areas, if this practice is perceived rather as a process or a medium for sharing, interpreting and offering the content and meaning of a story to an audience. Besides, it is impossible to neglect the possibility of integrating digital technology with the products of each area or to avoid the contributions for the advancements in design and innovation.

In parallel with the discussion above and the scope of this study, a design brief that could be worked on with digital design students was planned on the basis of two objectives: 1. Focusing on the performative aspects of body with respect to time with the aim of generating embodied interactions, 2. Increasing the awareness of spatio-temporal context with the support of storytelling.

These ideas were structured into a design brief on the basis of interactive exhibiting. Guided by this concept, the brief was based on the idea of communicating a story in a three-dimensional space using participatory digital technology that linked varying interactive narrative experiences (Lorenc, Skolnick and Berger, 2006). Space was expected to become a meeting point for the potential audience and the actors for interacting with a range of responsive digital applications and tools (Betts, 2008; Bullivant, 2007). These experiences would be created to support the content of the story, while the tools, objects and actors were to constitute the language of the storytelling (Hughes, 2010). The design of the setting became an important aspect to enhance and reveal the text and the story, which can be described as the translation and adaptation of the architectural qualities of space with dramatic time (Parker, Wolf and Block, 2008). At the end, the conceptual exhibition projects were expected to involve a storytelling in which the user's primary form of interaction becomes the moving within the story that is composed of the organisation of the spaces or the information. The works were required to support multi-layered communication that involved the design of navigation for both the physical and digital space.

Figure 2. The project named “Cultural Entertainment Forms through Bodily Performance” by Özge Genç focused on the different approaches of cultures to entertainment rituals. In it, she selected bodily performances and organised them in the physical working area according to the spatial needs of the performances. The aim of the project was to allow the visitors to experience how much time it took for events to happen in space.



This approach was studied with the undergraduate students of the Department of Communication Design in the studio design course. As advised by the art of storytelling, the students were guided to develop their projects through two stages. At the first stage, they would conduct research and shape their theme and story together with the possible interactions, technologies and tools, and at the second stage they would focus on the customisation of the project that is suitable for the potential audience through the design of the spatial organisation and navigational aspects (Satish, Jain and Gupta, 2009). The conceptual designs will be developed

for a specific physical space and are expected to take account of the spatial data. The stages of developing the design projects are shown in Figure 2. The upper scheme includes the research concerning preliminary design decisions for the selected theme and the suitable technological solutions that support the experiencing of the story. The folio below involves the finalised and submitted version of the design project that involves the staging of experiences, spatial layout and the scene design, which make up the language of the storytelling.

At the beginning of the studio design course, the design brief was clearly explained to the students, in terms of the objectives, the process and the physical working site. Afterwards, five weeks were dedicated to accomplishing the tasks of the first stage. At the end of this period, the students submitted their design decisions as preliminary sketches and layouts to the jury and got feedback. Subsequently, at the second stage, the students were guided to structure the theme through storytelling, which involved the design of the sequence of interactions that were organised spatially. On the completion of the students' work at the end of the twelve-week period, the same jury evaluated their success in achieving the objectives of the studio.

The Analysis of Designs for Maintaining the Spatio-Temporal Context Through Storytelling

This design brief was applied between 2009 and 2012 in the Spatial Communication Design Studio of the Department of Communication Design at Yildiz Technical University. The students assigned to the course had no prior experience with spatial organisation methods in architecture, scene design and industrial design but were accustomed to graphic and interaction design and trained to create novel user interfaces for interactive tools to manipulate digital information.

At the start of the studio, the students experienced difficulties with adapting to working with physical data, as they were used to working in a digital environment in their prior studios. Nevertheless, as they were forced to abandon their habits, they started to understand the dynamics of physical space and time and to generate ideas. At the end of the process, 90 percent of the 72 students were able to achieve the goals set out in the brief with varying levels of success.

In the scope of this study, our curiosity lay in the tendencies to structure the storytelling. The student projects were sorted into two groups based on the way they refer to spatio-temporal context:

1. Representation of time through geographical compositions: The stories in these projects were composed of a sequence of events and they involved a linear style

of storytelling, in which one event is experienced after the other. The examples shown were given to express how storytelling contributed to the realisation of time geography (Figure 2), historic geography (Figure 3) and cultural geography (Figure 4). The common approach to design was the perception of time as a static form. With the support of storytelling, the students were able to reflect the spatio-temporal aspects of design by providing the visitor with interactions based on bodily performance.

Figure 3. The aim of Evrim Aytemür’s project named “Prehistoric Times” was to allow the user to experience the activities of early times and organised the space in a sequence corresponding with the development stages of mankind in prehistoric times. With the idea of making use of the linear condition of the architectural space in parallel with the historic sequence, this student developed a series of events and experiences that were supported by times gone by. Visitors’ experience of the exhibition began with cave life, agriculture and art, and ended with the visit to the early settlement. In each section, visitors experienced the specific activity of that time dilemma with the support of digital technologies. In other words, time was represented as a still object and the visitors moved in time, in parallel with the geometry of the physical space.

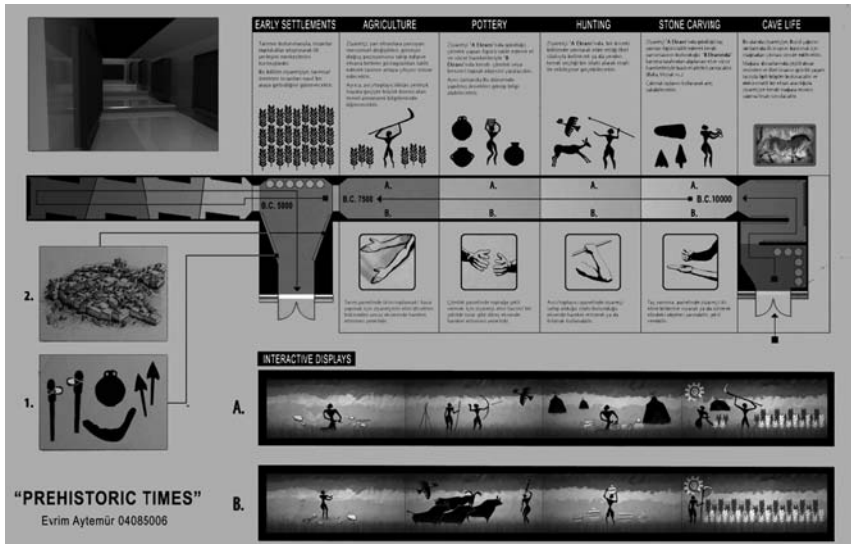
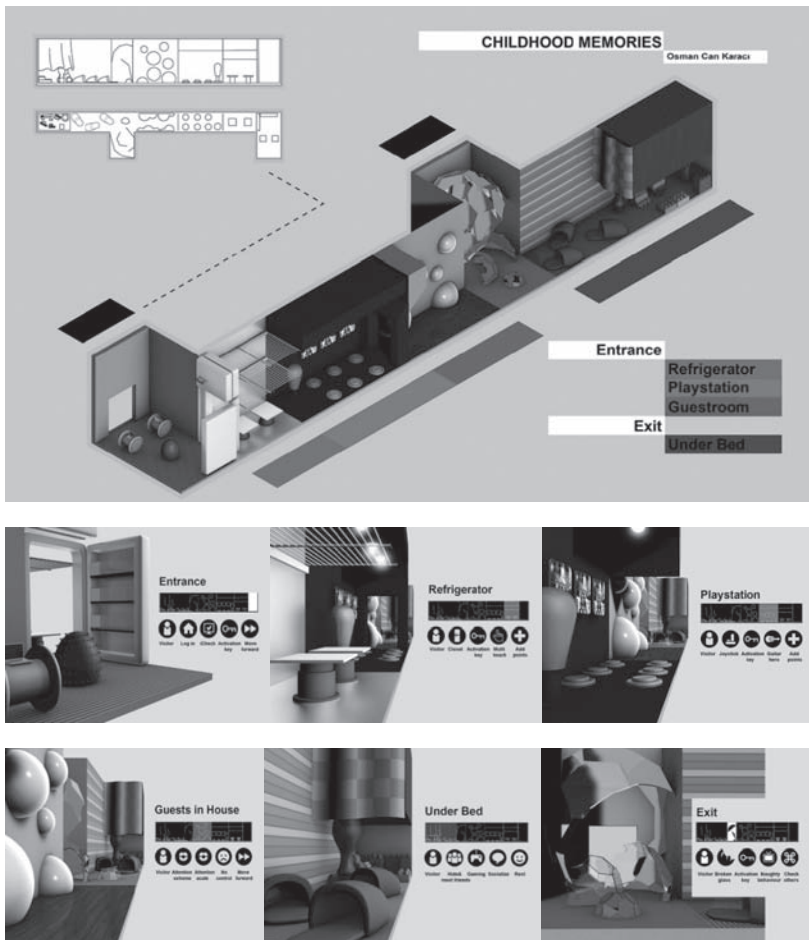
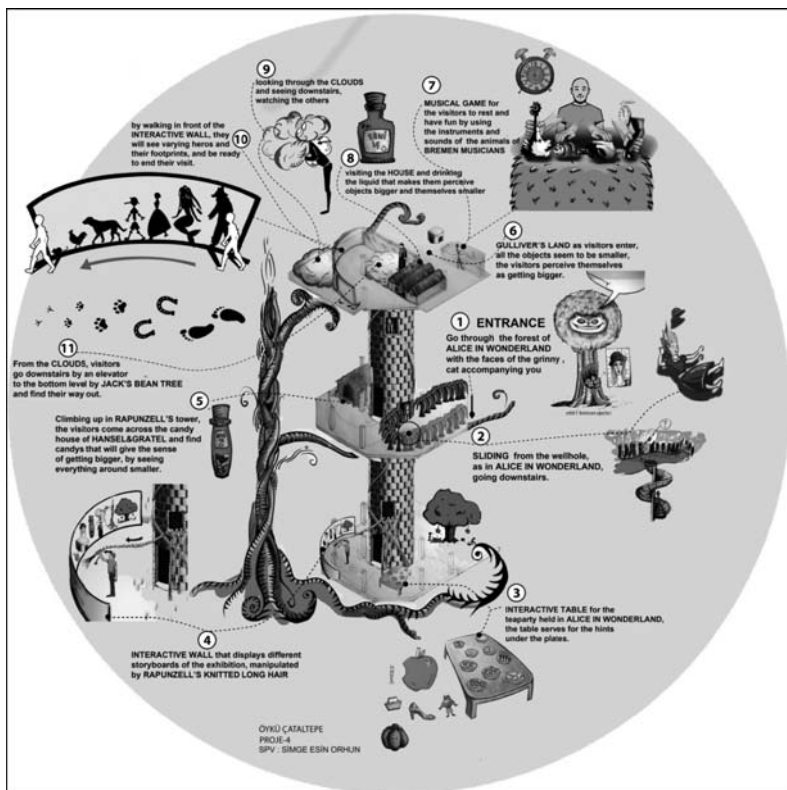


Figure 4. The project by Osman Can named “Childhood memories” focused on how a child perceives his home environment, starting from the living quarters and ending up in the private area. This project was based on a child’s schemata and perceptions of the different parts of his house, in parallel with what had happened there. The project was based on cultural geography concerning and focused on developing themes, where the events had happened through time. Interactive tools placed in the thematic areas guided the activities in those areas so as to enhance the communicative aspect of the project. Each section in the house was depicted by suitable metaphoric objects and interactions to reflect how a child perceives that specific area. The scene design and the scaling of the tools were intended to remind the visitors of their childhoods through the provided cultural-geographical structure.



- Representation of space and time through creating awareness in experience: The works that can be included in this group developed their storytelling either in parallel with thematic changes (Figure 5) or existential changes (Figure 6).

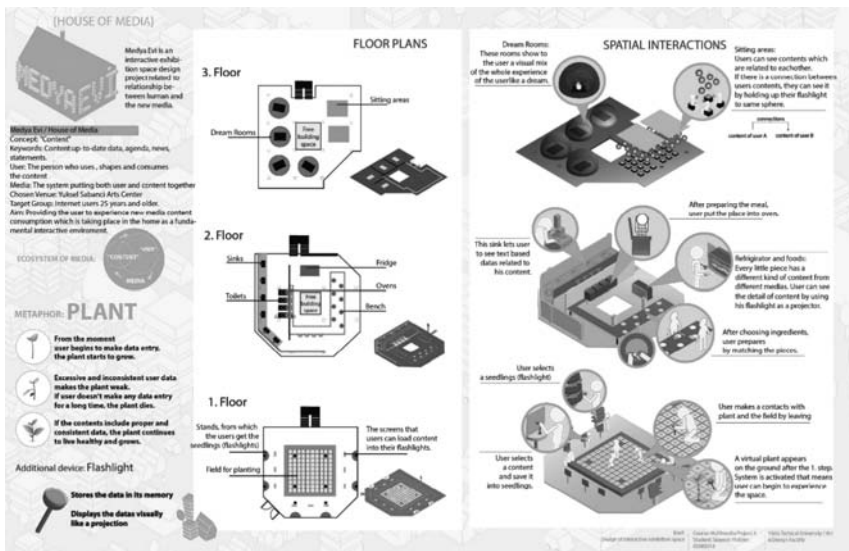
Figure 5. The project by Öykü Çataltepe named “Stories of Childhood” was based on the thematic changes caused by each story that refers to the changes in the values or attributes of space. The storytelling focused on the visitors’ varying experiences and imaginative perceptions triggered by the stories. Different iconic elements from well-known children’s stories were featured in order to make the visitor more familiar with the experience. The integration of interactive technologies enhanced the storytelling and contributed to the unique character of the exhibition.



Most important factor that guided and inspired the development of storytelling in terms of representation of time was the architectural quality of the space. In a linear space it was possible to generate a direct connection between events, whereas

in multi-storey spaces it was very difficult. Some works involved storytelling that studied the spatio-temporal context from the phenomenological point of view and composed novel scenarios that focused on user experience. Especially the category of existential themes yielded fruitful results in raising the awareness of space and time to the upmost level, together with the innovative approach of connecting three floors with an additional mobile or wearable object in order to maintain the unity of the exhibition and the experience. These tools were generated in line with the storytelling and were intended to be used by the visitor during his visit. All of these tools were meant to collect location-based data, which would affect later interaction or the route or the end result.

Figure 6. The project by Yasemin Yildirim named “House of Media”, showing each visitor the extent of unnecessary information collected and consumed through social media, in terms of their personal approaches. The main actors include household items divided into three floors: the garden at the entrance, common areas on the first floor and private sectors at the top. Plant seeds were sown in the garden, and every visitor was given a flashlight for collecting and disseminating information for varying uses within the house. In parallel with a reasonable collection and use of information, the plant of each visitor reflected the existential changes in growth until the visitor left the exhibition. If the information was collected unnecessarily and consumed for unrelated functions, the plant would die.



When the earlier works of this group of students were compared with their works created in this design studio, the scale of sophistication, creativity and contextual consistency of design of the latter stood out positively. In the surveys, the students highlighted the constructive learning outcomes due to the integration of the physical environment in the design brief and indicated the satisfaction they got for being able to understand the potential of interactivity in their projects with a solid content.

Concluding Remarks

In today's world, science is constructed into technological advancements, which has intense effects on daily life other than social theories, philosophy and psychiatry. It is believed that the overbearing role of technology can be weakened by increasing the visibility of the techniques of doing, rather than accepting the technology as it is. In order to achieve this objective, bodily involvement gains in importance together with the integration of spatio-temporal factors in design, both of which were separated from daily activities due to the alternative modes of communication provided by networking technologies and digital tools.

One reason to suspect digital technology of transforming the perceptual and behavioural aspects of human beings lies in the inappropriate or non-designed contexts in which most gadgets have been used. This aspect becomes increasingly important in the area of digital design education as the young generation are already digital natives and alien to the analogue way doing things. It is the argument of this study that the concept of interactivity, which is the most beneficial aspect these technologies can offer, can enhance the design of digital tools, if this concept is lifted to a higher level by the art of storytelling, and bring about a better definition and terms of use for the gadgets by the provided context.

In the frame of this study, the concept of interactive exhibiting was chosen for the creation of the experiences that require bodily performances and refer to the architectural qualities of space and time. This concept was also found suitable for the work with the students of communication design, as the discipline deals with design problems that involve interaction and the displaying of information. Within the frame of the course, the students were asked to work on developing conceptual exhibition design projects for a specific physical space. The designs were expected to involve the use of spatial aspects and organisation methods merged with the idea of creating motion and interaction in physical space.

On a general level, it is possible to say that the works created in the design studio were successful in providing diverse examples of storytelling supported by interactive tools to create the participative experience. The conceptual designs

either focused on the representation of time or chose to deal with spatio-temporal phenomena. The first group of projects focused more on the bodily performances in space and less on technological innovations. A linear style of storytelling was favoured in most of the designs, with time perceived as a series of events. The second group of projects, on the other hand, showed a greater keenness to discover the extent of interactivity and experiencing a theme. Besides structuring the physical and virtual information, they also bound these two with a mobile tool in order to create a much more individualistic experience. The tools included tablets, eyeglasses, gloves, headphones, flashlights, helmets, memory sticks and cards, and were chosen according to need and guided by the narratives. With the aim of making the visitors experience the story in multiple ways, complex information architectures connecting three different layers of information were studied by the storytelling. The mobile tool, either carried or worn, is able to create an endless number of combinations that are based on the navigation and interaction of the individual. It can also be integrated with the whole story to define the ongoing steps or routes and to guide the visitor. This group of solutions were recognised not only to improve the capabilities and design skills of the students, but also to enhance creativity with regard to future tools and technologies through well-defined needs. Obtaining such outcomes from this approach proved the need for the integration of spatio-temporal aspects into design education and showed an alternative method for the development of digital technologies and tools in line with the real needs and design ethics.

The findings have shown us that every spatial and temporal condition brings its own circumstances, which may lead to different results. Another important outcome gleaned from this study, one which concerns designers working in the area of human-computer interaction, is the need to identify each design problem as constituting a challenge that cannot simply be solved by the integration of a tool. So it becomes important for designers to work with the art of storytelling in selected contexts within the planning stage in order to maintain suitable tools for user experience.

Designers working in the area of digital media today are facing opportunities that can lead them to be the innovators of the products and technologies of the future. The interactive experiences, tools and technologies will continue to progress and become more advanced, which in turn will call for new scenarios with changing settings. As innovativeness and creativity become valuable assets in today's world, the undesirable effects can be reversed and the technology can be utilised to bring positive outcomes for the society.

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