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Designing Interactive Comics to Affect Time Perception

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Abstract: This research aims to explore how to design interactive comics to affect time perception. Time perception plays a crucial role in many aspects such as consciousness, memory of the past and future. These aspects are related to self-directed learning. Therefore, designing a visual storytelling system to express time using interactivity to affect reader's time perception could be valuable for educational purposes.

Keywords: Time perception, interactive comics

1. Introduction

Comics as a visual information and communication medium has been used in education and training related fields (Gordon, 2006; Mallia, 2007; Tatalovic, 2009). It is convenient for translating information into visual language at a relatively low cost. The most important attribute of comic medium is sequentiality (Eisner, 1985; McCloud, 1994), which means it contains "time".

Along with the growing popularity of electronic devices, comics reading behavior migrates from paper-based to digital forms. Several existing interactive comics also contain voice, animation and playful interactions. However, research shows that people still prefer paper as a medium for reading, especially in-depth reading (Liu, 2005). In our opinion, in order to create clear expression methods and a natural reading experience that can enhance comprehension with digital comics, time could be the key.

Timing and time perception are crucial in digital learning and interactive storytelling. The way we read may have different effects on learning. Toplak et al carried their study on the connection between time perception and reading difficulties and found problems with time perception can cause reading difficulties (Toplak, Rucklidge, Hetherington, John, & Tannock, 2003). According to Angrilli et al (Angrilli, Cherubini, Pavese, & Mantredini, 1997), there are three particularly relevant factors that have been shown to affect perceived durations: 1) attention and amount of information processing; 2) arousal; and 3) affective valence.

We consider that there are at least four kinds of "time" in the context of interactive comics: 1) Real time in reality; 2) Perception of the time in reality; 3) Time in a story; and 4) Perception of the time in the story.

We intend to explore how interactive comics as a carrier can affect the time perception of the readers, and as a further step, their learning. The current hypothesis is: Interactive Comics can Affect Time Perception. This hypothesis breaks into research questions below:

1, How interactive comic elements affect time perception?
2, How to detect reader's time perception through interactive comic reading?
3, How to combine comic elements and interactivity for certain time perception?
4, How to measure and evaluate effects of comic elements and interactivity on time perception?

2. Research Framework

2.1 Time concepts

In a broad sense, time is considered as "a number of changes (Coope, 2005)" which has directions (McTaggart, 1908) and the sense of direction helps us define past, present and future.

In the context of reading digital comics, perception of the time in reality would be how long reader estimates his/ her time spent on reading. Since a story contains narrative line which also fits the definition of a number of changes, time also exists in story. And because of the time in story should not necessarily match real time in reality, we could have our own understanding with narrative time.

This study will discuss about the perception of time based on the understanding of time with directions. There are three basic forms: linear, circulatory and no time. Time perception can be linear, circulatory, unordered, speed-up or slow-down and out-synced.

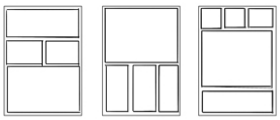
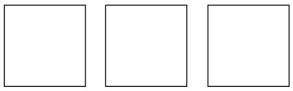
2.2 Two different types of motion as input for interaction design

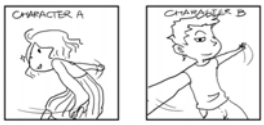
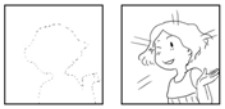
Motion has intrinsic element of time. To study time perception in relation to interactive comics, it is a plausible starting point to look into motion as expressed in comics, as well as possible user actions taken in motion for interaction with comics.

2.2.1 Motion as expressed in comics

Bakhtin pointed out that in the literary artistic chronotope (literally, "time space"), spatial and temporal indicators are fused into one carefully thought-out, concrete whole. "Time, as it were, thickens, takes on flash, becomes artistically visible; likewise, space becomes charged and responsive to the movements of time, plot, and history."(Bakhtin, 2002) There are many examples of mapping different types of motion into static visual forms (Tufte, 1991). As Scott McCloud claims, Comics is an artist's map of time itself (McCloud, 2000). In the context of virtual storytelling, space (image size and layout) is also important. In table 1, selected comic elements can help us see how comics as a static medium expresses motion.

Table 1:Comic elements that contain "motion".

Comic element	Schematic image	Motion	Comic element	Schematic image	Motion
Perspectives		Perspective switch can cause narrative changing and attention changing.	Movement: Small-> Big		Change between small and big.
Serialize		Narrative goes on through serialization.	Movement: Far-> Close		Change between far and close.
Pages		Narrative and reader's reading path go through pages.	Movement: Slow->Fast		Change between slow and fast.
Panels		Narrative and reader's reading path go through panels.	Movement: Gentle-> Strong		Change between gentle and strong.

Character(s)		Character's movement.	Movement: Black & white-> Color		Change between black & white and color.
Word		The change of amount of information, font.	Movement: Abstract->Concrete		Change between abstract and concrete.
Object		The time change of object. (e.g. sun rises, clock clicks)	Movement: Invisible->Visible		Change between invisible and visible.
Line (drawing style)		The change of drawing style can cause attentional motion.			

2.2.2 Motion in reading and interacting with comics

Traditional reading activity can be considered with three parts: 1) Eyes (moving in a range, gazing with scale); 2) Hands (holding reading material, flipping leaves, supporting reading); and 3) Static reading material.

Digital reading activity however, contains more opportunities such as eye-tracking, voice control, facial expression recognition, gesture recognition, keyboard control, touch screen control and handle control. Various examples in this area emerge. For example, de Lima et al. presented a storytelling system that allows users to interact with virtual characters by sketching objects on the paper(De Lima et al., 2014).

Also, the reading process with digital context can be dynamic. The "motion" can be occurring either in visual expression in the comics or reading activity of the reader. For example, either the panels are stable while eyes moving through panels, or, eyes can be more or less stable in a certain range while panels are moving.

2.3 Mapping time perception on to motion

As we explained in 2.2, there are two types of motions in the context of reading interactive comics: one is expression motion and the other is reading motion. The relation between these two motions themselves and with time perception remains unclear. We plan to conduct several experiments to test this by mapping time perception on to motion. For example, to test how different interactivity can influence time perception, we can define several reading control methods: mouse goes forwards means go forward in narrative time while mouse goes backwards means go backwards in narrative time. The different mapping way we choose will bring different reading experience, and we assume it will also have different effect on time perception.

2.4 Combine time perception, motion and narrative structure

Actually, we are also curious about whether different time perception will lead to different understanding of the same story. This idea came from generally western culture tends to see time linearly while eastern culture sees it circularly. We believe by separating time, comic expression elements and interactivity, we will be able to express different understanding of time in on comics.

3. Current Status

This research follows a research through design approach and can be seen as an iterate process.

It would require several iterations to complete this research. In order to find the proper way to affect time perception, several experiments to test combinations between comic elements and interactivity are required, and usability might also need to be improved. We will collect data through designed experiments. Each experiment can be seen as part of the general iteration process and contains its own process: goal, methods and expected result.

We are currently finished creating an interactive comics prototype—*The Dreaming Wine* and conducted to the first visual expression experiment based on our framework. We believe the results we are analyzing can provide us a deeper understanding of the research question and enlighten approaches for further research.

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References

Angrilli, a, Cherubini, P., Pavese, a, & Mantredini, S. (1997). The influence of affective factors on time perception. *Perception & Psychophysics*, *59*(6), 972–82.

Bakhtin, M. M. (2002). Forms of Time and of the Chronotope in the Novel: Notes toward a Historical Poetics. *Narrative Dynamics: Essays on Time, Plot, Closure, and Frames*, 15–24.

Coope, U. (2005). *Time for Aristotle : Physics IV.10-14*. *Oxford Aristotle studies* (p. 202).

De Lima, E. S., Feijó, B., Barbosa, S. D. J., Furtado, A. L., Ciarlini, A. E. M., & Pozzer, C. T. (2014). Draw your own story: Paper and pencil interactive storytelling. *Entertainment Computing*, *5*, 33–41.

Eisner, W. (1985). *Comics & sequential art*. Poorhouse Press Tamarac, FL.

Gordon, A. S. (2006). Fourth frame forums: interactive comics for collaborative learning. In *Proceedings of the 14th annual ACM international conference on Multimedia* (pp. 69–72). ACM.

Liu, Z. (2005). Reading behavior in the digital environment: Changes in reading behavior over the past ten years. *Journal of Documentation*.

Mallia, G. (2007). Learning from the sequence: The use of comics in instruction. *ImageTexT: Interdisciplinary Comics Studies*, *3*(3).

McCloud, S. (1994). *Understanding Comics*. *Understanding Comics* (p. 224).

McCloud, S. (2000). *Reinventing Comics: How Imagination and Technology Are Revolutionizing an Art Form*. *Perennial New York* (Vol. 118, pp. 122–123).

McTaggart, J. E. (1908). The unreality of time. *Mind*, 457–474.

Tatalovic, M. (2009). Science comics as tools for science education and communication: a brief, exploratory study. *Jcom*, *8*(4).

Toplak, M. E., Rucklidge, J. J., Hetherington, R., John, S. C. F., & Tannock, R. (2003). Time perception deficits in attention deficit/hyperactivity disorder and comorbid reading difficulties in child and adolescent samples. *Journal of Child Psychology and Psychiatry*, *44*(6), 888–903.

Tufte, E. R. (1991). Envisioning information. *Optometry & Vision Science*, *68*(4), 322–324.