Interactive video in serious games

exploring the use of interactive video for Clima Futura

(excerpt)

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Master's thesis

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2.   Terminology

(…)

Narrative sequence

A narrative sequence is a storyline. In interactive video it is a possible path through a set of linked video sequences, dynamically assembled based on user interaction.
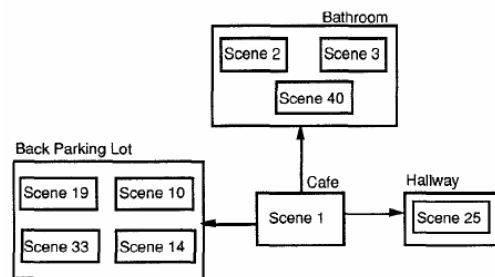

Figure 1:   Spatial Map of Narrative Sequences (Sawhney et al, 1996)

Figure 2 contains a basic example of an interactive video. The user can choose in the first scene whether (s)he will go to the *back parking lot*, *bathroom* or *hallway*. All these choices result in a different path through the narrative. The various locations all contain scenes. These scenes in turn can be interlinked or linking to other locations. In this case, the author provides the links, but the user chooses his or her own path through the available material.

6. Interactive video and XML

When developing the interactive video prototype, different options were considered to define the storylines. At first, the application used embedded cue points to define the choices in the video. Later in the project, a text-based approach was preferable, so the annotations can be edited by hand. The most logical choice would be XML, so an XML structure needed to be defined. In this chapter. Therefore this chapter contains the basics of XML, a structure for interactive video and the actual application of the structure in the Clima Futura prototype.

6.1. XML basics

XML is the 'Extensible Markup Language', and it facilitates the creation of documents and data records that are platform-independent. The tag structure of XML resembles traditional HTML, but the word *Extensible* already indicates that you can add your own tags. XML is an open standard, and recommended by the World Wide Web consortium (W3C) [1].

XML contents

XML documents should conform to all of XML's syntax rules. A file that complies to this level of correctness is called *well-formed.* A basic XML-file looks like this:

```
<?xml version="1.0" encoding="UTF-8"?>


<contact-information>
          <name>Hugo Huurdeman</name>
          <email>hchuurde@few.vu.nl</email>
          <initials="HH" />
</contact-information>
```

The XML-example starts with the *XML declaration*, which indicates the XML version and (optionally) the character encoding. After that, there is one root tag (or container node),

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which contains all other nodes. The lower nodes in the hierarchy are called *child nodes*. For example `<name>` is the first child node of `<contact-information>`.

An XML-document contains both *markup* and *text*. The markup, like `<name>` in the example, describes the structure of the document, while the text is the actual information. [2] The markup is specified using *XML-tags*, which include the `<` and `>` characters. An example of a s*tart tag* is `<email>`, while `</email>` is an *end tag*.

Attributes can also be specified in XML. They are single properties for an element, and use *attribute name* and *attribute value* pairs. The tag <initials="HH" /> is an empty-element tag, and contains no text inside it, but does contain an attribute. Attributes should be quoted, and inside a node, an attribute name can only be used once.

XML Schema

The first part of this section covered the *well-formedness* of XML. Another aspect is the *validity*. An XML-document is valid if it conforms to certain semantic rules. Users can define these for themselves, or enforce an XML-schema. XML-files must then conform to this schema, and this can be checked automatically. Different languages for the specification of XML-schemas can be used.

An XML-schema for the Clima Futura pilot can be found in Appendix D.

6.2.   An XML structure for interactive video

For interactive video, an XML-structure had to be defined. This gradually evolved during the project. The application used multiple files at the beginning of the project, but at the end of the project, the video annotation had to be defined in one, compact, XML structure.

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[2] http://www.xmlnews.org/docs/xml-basics.html

Basic requirements

To dynamically play videos based on user interaction, an XML-file for interactive video should include several elements. A playlist for videos is needed, that adapts itself to the choices of the user. Furthermore, the videos need to be linked to each other, to provide choices to the user. To allow the user to make choices, clickable hotspots need to be defined. Another important aspect is flexibility, the structure should allow the addition of future features.

Clima Futura XML elements

During the development of the interactive video application, several elements turned out to be important. These elements were subjects, videos and overlays:

▫ Subject: a (small) collection of videos, that is played sequentially (it could also be called a playlist).

▫ Video: a Flash Video file, indicated in XML by the filename

▫ Overlay: clickable hotspots in the video, that can respond to actions of the user; and indicate possible choices

Overlays are an important element of interactive video. If you need to specify these manually, though, this takes a lot of time. To reduce the time needed to add overlays, the Clima Futura pilot uses a 5x5 matrix to specify overlays. Of course, this is less precise than specifying exact coordinates, but the advantage is that only a few parameters need to be set to show the overlay. A more extensive explanation can be found in the next section.

6.3. Clima Futura pilot XML-structure

Below you find the XML-structure of the Clima Futura pilot application. The *subjects*, *videos* and *overlays* can be seen here, as they are the main contents of the XML-structure.

```xml
<?xml version="1.0" encoding="utf-8"?>
    <subjects>
        <subject name="Example">
            <longname>Example subject</longname>
            <score>5</score>
            <videos>
                <video file="001_Example_01">
                    <question>A clip question is specified
here</question>
                    <rightanswer>true</rightanswer>
                </video>
                <video file="002_Example_02" repeat="true">
                    <branchquestion>A branch question is specified
here</branchquestion>
                    <overlays>
                        <overlay time="0" position="01" size="12"
label="AnotherSubject" />
                    </overlays>
                </video>
            </videos>
        </subject>
```

XML Nodes

Subject

A subject contains a collection of videos. The 'name' parameter is the (unique) name for the subject, that is also used for the video filenames (see Appendix B). The videos of a subject are automatically played after each other. Subjects have a 'longname', that is displayed in the interface during the video and when the mouse is hovering over a link. Furthermore a subject has a score, ranging from 1 to 5 (awarded when the player clicks on that subject). The score is multiplied by 1000 in the application itself to get a more 'game-like' value.

Subject		
Attribute:	name	String
Subnodes:	longname	String
	score	Number
	videos	

Table 1: Subject node

Video

A video is a sublevel of a subject. Per node, a video is specified using the 'file' attribute (corresponding with the filename of the video, without the extension). Optional parameters of a video are:

- *repeat=true*, when the video needs to be repeated (useful if a user *has* to make a choice)
- *leadsto=true*, when the video automatically leads to another subject.

For a video, there are *clip questions* and *branch questions*. Clip questions (between <question> tags) are the questions that are displayed during a video. The right answer is specified using the <rightanswer> node. A branch question is a question when there are multiple choices possible. The answers to the question are specified in the overlays (see below)

Video		
Attributes:	file	String
	repeat (opt)	Boolean
	leadsto (opt)	Boolean
Subnodes:	question (opt)	String
	answer (opt)	String
	branchquestion (opt)	String
	overlays (opt)	

Table 2: Video node

Overlays

An overlay is a 'hotspot', a spot to click on in the video itself. As has briefly been described in the previous section, the application creates overlays by using a 5x5 overlay system.

(0,0)	(1,0)	(2,0)	(3,0)	(4,0)
(0,1)	(1,1)	(2,1)	(3,1)	(4,1)
(0,2)	(1,2)	(2,2)	(3,2)	(4,2)
(0,3)	(1,3)	(2,3)	(3,3)	(4,3)
(0,4)	(1,4)	(2,4)	(3,4)	(4,4)

Figure 2:   Coordinates of overlays & a sample overlay

Key elements of an overlay are the coordinates, width and height. The coordinates are located in figure 14 above. The width and height of an overlay can be 1 to 5 units. So an overlay at the position (1,2), which is 3 units wide and 2 units high, looks like the figure on the right.

Now these overlays need to be specified in XML. This is done via the (obligatory) *time*, *position*, *size*, and *label* parameters. To provide a short notation, the position and size parameters are indicated by a combination of the two single-digit numbers (for position x and y; for size the width and height).

The *time* is the moment when the overlay should be shown, measured in seconds from the beginning of a clip. The *position* can be 00 to 44, which are short notations for the coordinates (0,0) till (4,4). The *size* can be 00 to 55, short notations for (0,0) and (5,5). The label corresponds with the subject name it refers to, that also needs to be specified in the XML-file. So the overlay in 0, at the position (1,2), with a size of (3,2), is specified by the following tag:

```
<overlay time="0" position="12" size="32" label="Example" />
```

Up to 2 additional overlays can be specified using additional *position2*, *size2*, *label2* and *position3*, *size3*, *label3* parameters.

To remove one or more overlays from the screen, you can provide the overlay time without any parameters, like: `<overlay time="4" />`

Overlay		
Attributes:	Time	Number
	position (opt)	Number
	size (opt)	Number
	label (opt)	String
	position2 (opt)	Number
	size2 (opt)	Number
	label2 (opt)	String
	position3 (opt)	Number
	size3 (opt)	Number
	label3 (opt)	String
Subnodes:	-	-

Table 3: Overlay node

6.4.   Narrative structure visualization

To clarify the structure of the application, right before it will be specified in the XML-structure, the first four levels of the video tree for the Clima Futura interactive video application are visualized in Figure 15. It is an adapted version of the 'Spatial Map of Narrative Sequences' by Sawhney (see section **Error! Reference source not found.**, Figure 1:). The next section shows the corresponding XML-structure.

- ▫ The large boxes are subjects, that contain smaller videos (which are played sequentially)
- ▫ A *Q* indicates a video with a *clip question*
- ▫ *Branch points* are striped
- ▫ Scenes with a *hidden hotspot* have an striped oval in it and connected to the resulting subject
- ▫ Subjects with one connection automatically lead to another subject
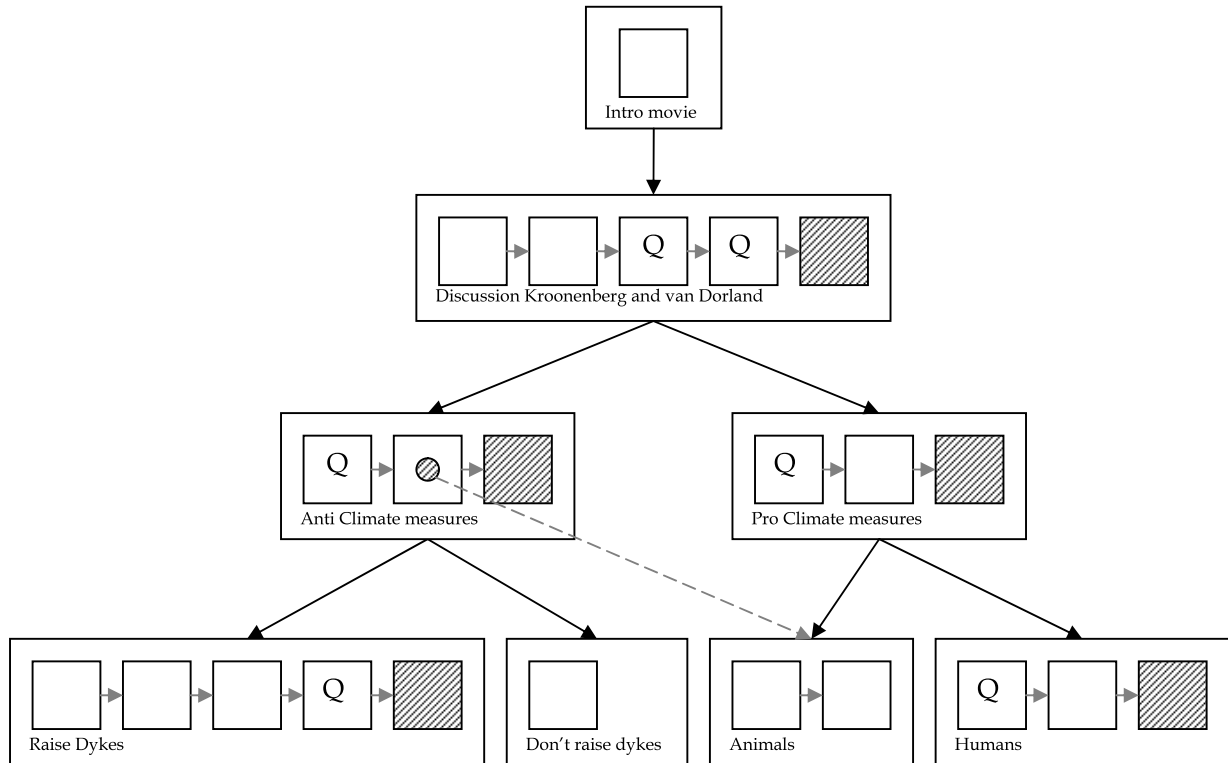
Figure 3:   Video branching structure

Some theoretical background on narrative structures can be found in the next chapter.

6.5.   Application of the XML structure in practice

Now we have seen part of the narrative structure of the Clima Futura pilot, we can apply this to the XML-structure. Three subjects are included here.

Subject 1: Introduction movie

The first clip involved is very straightforward. It is just a simple Clima Futura intro movie, that is played before the actual information about the climate starts.

```
<subject name="IntroMovie">
        <longname>Introduction movie</longname>
        <score>0</score>
        <videos>
                <video file="000_IntroMovie_01" leadsto="DorlandKroonenberg" />
        </videos>
</subject>
```

The longname is used to produce a more legible name, and there is no score used, because there are no choices yet. The *leadsto* attribute is meant to continue the narrative. It refers to the next subject, which is called *DorlandKroonenberg*.

Subject 2: Discussion Kroonenberg and van Dorland

Very early in the application, you see a discussion between Rob van Dorland, a climatologist and Salomon Kroonenberg, a geologist. This discussion uses five video files, the last of which indicates a branch point.

```
<subject name="DorlandKroonenberg">
        <longname>Discussion Kroonenberg and van Dorland</longname>
        <score>0</score>
        <videos>
                <video file="001_DorlandKroonenberg_01" />
                <video file="002_DorlandKroonenberg_02" />
                <video file="003_DorlandKroonenberg_03">
                        <question>Van Dorland advocates mitigation</question>
                        <rightanswer>true</rightanswer>
                </video>
                <video file="004_DorlandKroonenberg_04">
                        <question>Kroonenberg says we should adapt to climate
change</question>
                        <rightanswer>true</rightanswer>
                </video>
                <video file="005_DorlandKroonenberg_05" repeat="true">
                        <branchquestion>Are climate measures rubbish, or are they really
needed?</branchquestion>
                        <overlays>
                                <overlay time="0" position="01" size="12"
label="AntiClimateMeasures" position2="31" size2="22" label2="ProClimateMeasures" />
                        </overlays>
                </video>
        </videos>
</subject>
```

All videos in this subject are automatically played sequentially. During two of the videos, short questions are asked (the right answers to both questions is *true*). The last video in this subject uses a branch question, and is repeated until the user makes a choice (*repeat="true"*).

Figure 4:   Overlays in the second subject

There is a choice between two options, like indicated in Figure 16. Because this is the first subject of the video, the viewer should get an overview of the subject, so there were no other overlays yet.

The overlays refer to the subjects *AntiClimateMeasures* and *ProClimateMeasures*.

Subject 3a: No climate measures

Overlay (a) leads to a branch with the effects of a negative viewpoint on climate measures. The user gets 3000 points for clicking on this link (represented by a *3* in XML).

```
<subject name="AntiClimateMeasures">
        <longname>No climate measures!</longname>
        <score>3</score>
        <videos>
                <video file="015_AntiClimateMeasures_01">
                        <question>The Watersnoodramp happened in 1952</question>
                        <rightanswer>false</rightanswer>
                </video>
                <video file="016_AntiClimateMeasures_02">
                        <overlays>
                                <overlay time="0" position="11" size="32" label="Animals" />
                                <overlay time="2" position="02" size="52" label="Animals" />
                                <overlay time="3.8" />
                        </overlays>
                </video>
                <video file="017_AntiClimateMeasures_03" repeat="true">
                (...)
```

This subject has one clip question, and a 'hidden' hotspot. The viewer can click on this overlay, but this isn't obligatory; If the user clicks, (s)he is redirected to the Animals

subject; otherwise, the next video is played automatically. The overlay is being moved during the video, because the position of the animals that form the link changes during the video. By altering the parameters, its position and size are changed. The last specification of the overlay time causes the overlay to disappear from the screen.

Subject 3b: Climate measures are good

If the user clicked on overlay (b) in the previous subject, (s)he sees clips about the positive value of climate measures.

```
<subject name="ProClimateMeasures">
        <longname>Climate measures are good!</longname>
        <score>4</score>
        <videos>
                <video file="008_ProClimateMeasures_01">
                        <question>This is a protest against climate measures</question>
                        <rightanswer>false</rightanswer>
                </video>
                <video file="009_ProClimateMeasures_02" />
                <video file="010_ProClimateMeasures_03" repeat="true">
                (...)
```

This subject, like 3a, has an associated score, that is awarded when the user clicks the subject (in this case with a value of '4', which is converted to 4000 in the game).

Ultimately, this subject also leads to a new branch (which is not included here).

7.   Narratives in a game context

The narrative is an important aspect of interactive video. This chapter attempts to provide a theoretical basis for the use of (interactive) narratives in games, mainly focused on interactive video and games.

7.1.   Narrative form

Narrative has been called a fundamental way that humans make sense of the world (Bordwell & Thompson, 2001). We read, learn, tell and even dream stories. So narratives are an important aspect of our lives.

Definition

Narrative, in film theory, is defined as:

> A chain of events in cause-effect relationship occurring in time and space (Bordwell & Thompson, 2001).

To make sense of a narrative, we identify its events and link them by cause and effect, time and space. We can also infer things that are not explicitly defined. In order to do these things, we can make a distinction of a story and a plot. The story contains both the inexplicit and explicit events, while the plot only includes the explicitly presented events, but also the nondiegetic [3] material (i.e. not part of the story world, like credits).
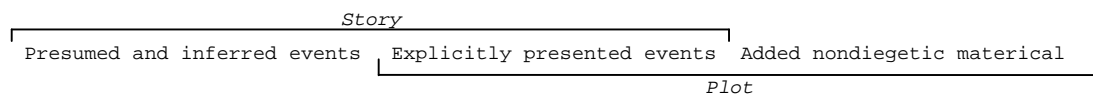
```
                                     Story
    ┌─────────────────────────────────────────────────┐
    Presumed and inferred events │ Explicitly presented events │ Added nondiegetic material
                                 └─────────────────────────────────────────────────┘
                                                  Plot
```

Figure 5:   Story and plot visualisation (Bordwell & Thompson, 2001)

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[3] Diegetic = everything that exists in the story world

Cause-effect, time and space

The usual agents of cause and effect are the characters in a story, but also non-human agents can be used, for example the shark in the movie *Jaws* or the tornado in *Twister*. Spectators search for cause and effect:

> In general, the spectator actively seeks to connect events by means of cause and effect. Given an incident, we tend to hypothesize what might have caused it, or what it might in turn cause. (Bordwell & Thompson, 2001)

Another important aspect of the definition is the time. Important aspects are *temporal order, temporal duration and temporal frequency.* Many films present events out of chronological order. We are (usually) not confused, because the events are mentally reordered by ourselves - from the plot order we derive the story order. The temporal duration is the duration of certain stretches in the story. On the one hand, there are the story and plot duration, and on the other hand, the screen duration (the time to watch a movie). Some elements of a story can be repeated multiple times, e.g. to emphasize them or to view them from a different angle (the temporal frequency).

Finally, the space in narratives often plays an important role. It can either be visible in the video itself, but also in a different way, for example a person telling a story about his experiences (and our imagination fills in the locales that are never shown).

A broader context

Bordwell & Thompson's definition is mainly focused on traditional forms of narrative. These days, it is possible to construct new forms of interactive narratives, which are usable in games.

As Pennefather observes, there is a difference between 'participative' and 'contemplative' interactivity. Participative interactivity is used in games, while contemplative interactivity is used in traditional cinema (Pennefather, 1994).

Weinbren also indicates that traditional cinema is very much different from interactive cinema:

> Much of cinema's power over us is our lack of power over it… It could be argued that the introduction of viewer impact on the representation is a destructive step for the cinema (…) To find interactive forms in which desire can be sustained will require the construction of a new cinematic grammar. (Weinbren, 1995, pp.19-20)

While maybe not a real 'destructive' step for the cinema, the introduction of viewer impact, be it in a game or interactive video, has a big impact on narratives

Narrative in gaming

In video games, different models can be used to describe the narrative. Majewski proposes three basic models of predesigned video game narrative:

- The *string of pearls* model, where the player essentially moves from one pre-designed event to the next, with a greater amount of freedom of action between the events.
- The *branching narrative* approach, where the player is occasionally able to affect the narrative by choosing from pre-designed narrative paths.
- The *amusement park* approach, where the player is located in a world with many possible narrative plots to tackle.

The most common approach might be the 'string of pearls' model. The branching narrative approach is somewhat less common. A problem with true branching narrative is that it requires more (cutscene) material, thus costs more.

> Wing Commander IV being the extreme example, at a cost of over US$12 million, and a 480 page script – of which, in a single game, the player would only see a certain portion. (Majewski, 2004)

Finally, the amusement park approach is often tied to the RPG-form, where the emphasis is on the evolution of the character's abilities. There can be a central plot, but

because of the evolutionary approach a large world with many possibilities is needed. (Majewski, 2004)

Interactive video and narratives

If we would situate the pilot application's interactive video in the video game narrative model, it should be part of the branching narrative approach. After all, it contains different branches, that can be affected by the viewer using pre-designed narrative paths.
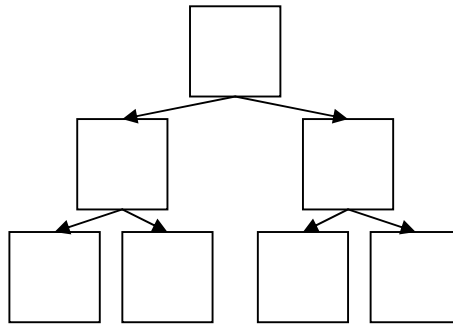

Figure 6:   Branching paths

Still, the use of branching narratives can cause some problems in narratives. Aristotle once described a plot in his *Poetics* as "the arrangement of incidents", that should follow plausibly after each other. In a branching structure, it is possible that the viewer does not see every video, and it transitions between scenes could not be as logical as in a linear story (not 'plausible').

As Vardi observes, the classic description of plots and narratives might not be fully usable anymore:

> The classic description of plot (introduced by Aristotle in the Poetics) states that there is a determinate structure to narrative. The *dramatic arc* for instance, is a model that represents structure in which tension is built and released over time. On the other hand, interaction is generally constructed as the freedom to do anything at anytime without an implied direction. This

distinction creates a potential for a conflict between narrative and interaction. (Vardi, 1999)

A way to circumvent this problem would be to let the branching paths in an interactive story converge at certain points, so some videos will always be seen (this could be scenes that are vital to building the story). So the interaction is somewhat more limited - a bit more akin to the 'string of pearls' model; with a greater amount of freedom between (obligatory) events.
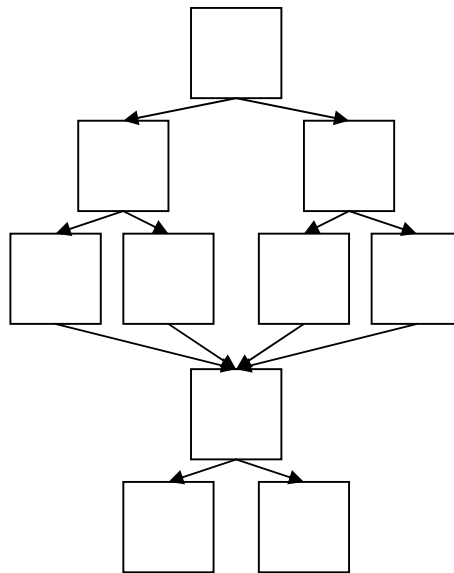

Figure 7:   Branching example with converging paths

When building an interactive video (or game) that contains branching paths, it steadily grows more complex. The example above only contains 10 nodes, but it is already a lot of work to ensure that the narrative continues fluently, and doesn't stop at a 'dead end', as Sawhney indicates:

Another concern is the possibility of "dead ends" to the continuously playing video narrative (what Terry Harpold considers the "moment of the non-narrative"). One of the aesthetic goals in HyperCafe [4] was to never permit a moment where the video would stop and break the cinematic experience of the

[4] Note: HyperCafe is a hypervideo application which places the user in a virtual café, with multiple (fictional) conversations

user. Yet as the nodal structure of the videotext grows more complex, the video authors must painstakingly ensure that all sequences lead to other sequences, and thus all nodes are non-terminating. (Sawhney, 2003)

A (partial) solution to this problem is to use multiple sequences, that are played sequentially, without link opportunities:

> As the author defines the sequence of scenes in the narrative and their structured relationship to each other, he designates some of them as link opportunities for the user. (In general, the number of link opportunities will be substantially smaller than the number of links connecting scenes, as most scenes are fairly brief and are simply linked to the next scene of a narrative for continuity. (Sawhney, 2003)

This is also used in the pilot for Clima Futura and visualized in section 6.4. Every subject links to one or more other subjects (except the end nodes), but the subjects mostly contain multiple videos that are automatically played sequentially. This eases the building of large-scale narratives.

In addition, to prevent looking at a static image when a branch point is reached, the clips are repeated until the user makes a choice (also a way to prevent 'moments of non-narratives').

7.2. Rhetorical form

Interactive video, especially in the case of Clima Futura, is not only about narratives. In video, often opinions and arguments are expressed. If you want to convey a particular message or reach a certain goal, which we can loosely describe as 'creating climate awareness' in the case of Clima Futura, it is needed to consider the rhetoric form.

Basics

Documentaries form a basis for this section, because the goal of many documentaries is to persuade the audience to adopt an opinion about a subject (and this could also be valuable for Clima Futura).

Bordwell & Thompson (2001, pp. 122) describes the four basic attributes of rhetorical form:

- It addresses the audience openly, trying to change its conviction, attitude or to take action
- Often, the subject of the documentary is not one of scientific truth, but of a matter of opinion
- If the conclusion cannot be proved beyond question, the maker often appeals to our emotions
- Often arguments are not presented as arguments, but as observations or factual conclusions

Argument types

To persuade the audience, different arguments can be used. These can be *arguments from source, subject-centered arguments and viewer-centered arguments* (Bordwell & Thompson, 2001). Arguments from source try to convince the viewer that the film is a reliable source of information (for example by using a narrator with an authorative voice). Subject-centered arguments are about the film's subject matter, and often use common beliefs, example and logic. Viewer-centered arguments are arguments that appeal to the viewer's emotions.

As Bocconi (2006, pp. 13) states, these argument types can be traced back to Aristotle's categories of persuasion (in his book Rhetoric). Therefore we can distinguish:

- *Ethos*: appeal to the speaker's reputation
- *Logos*: appeal to logic or reason
- *Pathos*: appeal to the emotions of the audience

Rabiger (1998) also discusses different ways a documentary maker can behave. A *propagandist* shows only the evidence supporting predetermined conclusions. A *binary communicator* gives equal coverage to both sides in a controversy. Finally, a *mind-opener* aims at expanding the viewers mind, without manipulating, and presenting a subject in all its complexity.

In my pilot for Clima Futura, I tried to work as a *binary communicator*, and provide multiple views to the rather complicated subject of climate change. Also, the use of multiple views provides a form of dramatic conflict:

> A dramatic conflict is a structural tension that keeps the outcome (..) somewhat in doubt, and keeps the audience interested (Hampe, 1997).

A major difference between documentaries and interactive video is, of course, that in interactive video the viewer can choose the opinion that (s)he wants, and influence the story. However, in the pilot application, this choice cannot be made before opposing views of a subject have been watched.

Interactive video rhetoric issues

The fact that the user can choose his or her own paths in interactive video creates some issues, like: do you want the viewer to see all arguments, or only the line of thought (s)he chooses?

An example: test users of the pilot for Clima Futura showed that almost everyone chose the path in the video that advocates climate measures (whether this is a typical case of 'political correctness' or a real incentive is unclear). When they choose that path, they miss the branch that involves some of the trade-offs you need to make when applying climate measures (that is also briefly described in section **Error! Reference source not found.**), which could alter their opinion.

In the current interactive video application, multiple views on a subject are represented. Then the user makes a choice by clicking on the person (s)he agrees with. After a choice, there are multiple ways to continue with the video narrative. You can only provide videos that are corresponding to the user's choice or, to the contrary, you can show videos that are at odds with the choice. If you want the viewer to have a full understanding of the subject, you can even show both. This depends on what you want to achieve; so the author of an interactive video can also be a propagandist, binary communicator and mind-opener. So when designing the narratives, it is also important to consider the rhetoric.

While there is a lot of literature available about the rhetoric of documentaries, the rhetoric structure of interactive video still needs a lot of research. Serious games, like *Peacemaker*, already create awareness. Interactive video could even increase this awareness, by using appropriate rhetoric.

8.   References

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