Clima Futura @ VU*– communicating (unconvenient) science

Anton Eliëns, Marek van de Watering, Hugo Huurdeman, Winoe Bhikharie
Intelligent Multimedia Group, VU University Amsterdam
eliens@cs.vu.nl rvdwate@few.vu.nl hchuurde@few.vu.nl svbhikha@few.vu.nl

Haroen Lemmers, Pier Vellinga†
Climate Centre, VU University, Amsterdam
lemh@geo.vu.nl p.vellinga@falw.vu.nl

Abstract

In this paper we introduce Clima Futura, a game about climate change. The primary aim of Clima Futura is to gain experience with the parameters affecting climate change and to give access to climate change related research in a playful manner. The concept for the game has been developed as a submission for the yearly Dutch contest for the communication of science. In this paper we will give an overview of the scientific background of the game, the overall design of the game, and our approach for realizing the game, deploying a modular architecture which allows for extending the game with minigames contributed by the community of players.

Keywords and phrases: climate change, science communication, model-based simulation, serious games

Introduction

Over the last couple of years, climate change has come into the focus of public attention. Moved by television images of dislocated people in far-away countries, ice bears threatened by the corruption of their native environment, tsunami waves flooding the third world, and hurricanes destroying urban areas, the general public is becoming worried by what Al Gore has so aptly characterized as *an inconvenient truth*: the climate is changing and human affluence may be the prime cause.

In response to the *pathos* of the media, many civil groups do an appeal on the responsibility of individual citizens and start campains for an *ethos* of climate-correct behavior, by saving on energy-consumption or driving CO2-friendly cars. In the media such campains are either advocated or critized by authorities from public government, and experts from a multitude of sciences, with conflicting opinions. As a result, the general audience, initially with genuine concern about the state of our world, gets confused and looses interest. And more worrisome, the adolescents, looking at the serious way adults express their confusion and ignorance, take distance and may decide that the *climate issue* is not of their concern.

At the Climate Centre of the VU University Amsterdam, we are not happy to observe that *pathos* and *ethos* overtake the public debate, and we actively wish to participate in the public debate bringing our multi-disciplinary scientific background into play. Moreover, since we *borrow the earth from our children*, as the old Indian saying goes, which Al Gore again brought to our attention, we feel that we must take an active interest in bringing the *climate issue* to the attention of the youth, in a form that is appropriate. From this background, we engaged in developing Clima Futura, a multi-disciplinary undertaking, bringing together climate experts from a variety of backgrounds with multimedia/game development researchers. The Clima Futura game addresses the issues of climate change, not altogether without *pathos* nor *ethos*, but nevertheless primarily focussed on bringing the *logos* of climate change into

*www.climafutura.nl
†also at University Wageningen

the foreground, in other words the scientific issues that are at play, and the science-based insights and uncertainties that may govern our decisions in the political debate. Given the state of our knowledge, the science of climate change itself may be characterized as an inconvenient science, and as such an interesting challenge to present by means of a game.

structure The structure of this paper is as follows. First, we will briefly discuss general issues of game design. Then we will describe the context, the science communication contest, the process of developing the concept for the game, and the actual design of Clima Futura. Before discussing the overall architecture of the game, we will characterize our *game event description format*, developed to allow for collaborative design, involving participants from a wide variety of disciplines. We will then outline the technical properties of our proposed game architecture, which accomodates extensions for special interest groups as well as contributions from the community of players.

Game play, simulation and exploration – (re)discovering design

Games are increasingly becoming a vital instrument in achieving educational goals, ranging from language learning games, to games for learning ICT service management skills, based on actual business process simulations, Eliens & Chang (2007). In reflecting on epistemological value of game playing, we may observe following Klabbers (2006), that the game player enters a *magic circle* akin to a complex social system, where *actors*, *rules*, and *resources* are combined in intricate (game) configurations:

game as social system

actors	**rule(s)**	**resource(s)**
players	events	game space
roles	evaluation	situation
goals	facilitator(s)	context

Leaving the interpretion of the elements of such a (game) system, indicated in the table above, to the reader, we may wonder what meaning games have, and looking at the fantasy items and visual effects of current day video games, we may wonder not only what is the meaning of meaningful elements, having a logical place in the narrative, but also what is the meaning or function of the apparently meaningless elements. The answer is simple, involvement and more in particular emotional involvement due to the in-born playfulness of humans. In oppositio to the common conviction that *gaming is a waste of time*, many authors, including Gee (2003), express the opinion that gaming and game-related efforts provide a form of *active learning*, allowing the gamer to experience the world(s) in a new way, to form new affiliations, and to prepare for future learning in similar or even new domains. More importantly, due to intense involvement and the need to analyze game challenges, according to Gee (2003), gaming even encourages *critical learning*, that is to think about the domain in a meta-level as a complex system of inter-related parts, and the conventions that govern a particular domain, which Gee (2003) characterizes as *situated cognition in a semiotic domain*. Without further explanation, we may note here that *semiotic domain* means a *world of meaning* that is due to social conventions and patterns of communication. Cf. Grammar.

An often heard criticism on educational games is, unfortunately, that, despite the good intentions of the makers, they do not get the target audience involved, or put in other words, are quite boring. This criticism, as we will argue later, also holds for many of the climate games developed so far, and the question is how can we avoid this pitfall, and present the impact of climate change and the various ways we can mitigate or adapt to the potential threats of global warming in an entertaining way, that involves the player not only intellectually but also on a more emotional level? Put differently, what game elements can we offer to involve the player and still adequately represent the climate issue?

Looking at the games discussed in *Playing Games with the Climate*[1], we see primarily games that either focus on simple climate prediction models (*logos*), or games that challenge the player how to become climate-correct (*ethos*). In our approach, we not only aim to include the *logos* and *ethos* oriented game-playing, but also wish to promote

[1] www.worldchanging.com/archives/003603.html

an understanding of the *pathos* surrounding climate change, where we observe that the models taken as a reference are often gross simplifications and from a scientific perspective not adequate! To this end we will, as an extra ingredient, include interactive video as an essential element in game playing. This approach effectively combines a turn-based gameplay loop, with a simulation-loop based on one or more climate reference models, with in addition exploratory cycles, activated by game events, which allow the player to explore the argumentative issues in the rethorics of climate change, facilitated by a large collection of interactive videos in combination with minigames. As we will discuss later, this approach imposes additional challenges for both the conceptual and technical design of our game, but in this way we can also contribute to the issue of *media literacy*, or "*mediawijsheid*[2]" as the Dutch Council of Culture calls it, that is making students aware of the impact of the media in presenting controversial issues.

The contest, the plan, and the process – building the team

Regional climate change should not be seen only as a threat; changes to weather patterns could generate opportunities for large-scale innovations, say Pavel Kabat, Pier Vellinga and their colleagues.

Kabat et al. (2005)

Developing a climate-proofing strategy now is likely to be more cost effective than taking drastic actions later.

description reglement

Tbv de academische jaarprijs ... indiening 1 mei, presentatie woe 6 juni

- *relevance* – what is our message?
- *identity* – who are we?
- *impact* – why would anybody be interested?

google: climategame / klimaatspel /(climate game VU)

online – the competition

- thinkquest – library.thinkquest.org/5721/climategame.html
- in development – office.ranjnet.nl/climategame
- climate change hero – www.devon.gov.uk/index/environment/climatechange/climateg
- climate simulator – www.deutsches-museum.de/dmznt/climate/climategame/index.html
- not a game – www.climategame.org (but dutch!)
- klimaatspel – www.natuurlijkduurzaam.nl/
-

climate models

CLIMBER 2,0 www.blackwell-synergy.com/links/doi/10.1111/j.1365-2486.2004.00812.x/abs/

> We assess the role of changing natural (volcanic, aerosol, insolation) and anthropogenic (CO2 emissions, land cover) forcings on the global climate system over the last 150 years using an earth system model of intermediate complexity, CLIMBER-2. We apply several datasets of historical land-use reconstructions: the cropland dataset by Ramankutty & Foley (1999) (R&F), the HYDE land cover dataset of Klein Goldewijk (2001), and the land-use emissions data from Houghton & Hackler (2002). Comparison between the simulated and observed temporal evolution of atmospheric CO2 and 13CO2 are used to evaluate these datasets. To check model uncertainty, CLIMBER-2 was coupled to the more complex LundPotsdamJena (LPJ) dynamic global vegetation model.

www.stanford.edu/group/MERGE/GERAD1.pdf
www.stanford.edu/group/MERGE/

MERGE quantifies alternative ways of thinking about climate change. The model is sufficiently flexible to explore views on a wide range of contentious issues: costs of abatement, damages of climate change, valuation and discounting.

MERGE is a model for estimating the regional and global effects of greenhouse gas reductions. It quantifies alternative ways of thinking about climate change. The model is sufficiently to flexible to explore alternative views on a wide range of contentious issues: costs of abatement, damages

[2] www.cultuur.nl/nieuws.html?nieuws_speeches.php?id=184

from climate change, valuation and discounting. MERGE contains submodels governing:

- the domestic and international economy
- energy-related emissions of greenhouse gases
- non-energy emissions of ghg's
- global climate change market and non-market damages

www.climateprediction.net/
en.wikipedia.org/wiki/Climate_model
model evaluation: www.grida.no/climate/ipcc_tar/wg1/308.htm
J. D. Mahlman rethorics of climate change: science versus non-science
www.gfdl.noaa.gov/~gth/web_page/article/aree_page1.html
WHY CLIMATE MODELS ARE IMPERFECT AND WHY THEY ARE CRUCIAL ANYWAY

Final concept – Clima Futura

example(s) – Peacemaker
www.peacemakergame.com / sharkworld.nl

- vertalen van een "serieuze issue" naar een game (in dit geval Midden-Oosten problematiek)
- turnbased
- politiek en sociaal
- aansprekende visuals, zonder af te doen aan het "serieuze"aspect
- presentatie van real-time events mbv video en korte tekst
- het kiezen tussen verschillende betrokken partijen
- alles in de hoop awareness te creeren om daar vervolgens naar te handelen

klimaat @ VU – *klimaat ster*

- klimaatstrategieen, kosten-baten en scenario.s;
- monitoring feedbacks and thresholds;
- energie, bio solar, carbon free (sustainable energies);
- regionale ontwikkeling en integratie;
- ruimtelijke analyse, land gebruik, water en adaptatie;
- governance en entrepreneurschap.

Klimaatstrategien
1. Emissievermindering
2. Aanpassing aan klimaatverandering
Klimaatsysteem
3. Monitoren van feedback
4. Investering in onderzoek
5. Klimaatrespons
Energie en CO2
6. Investering in efficintie
7. Investering in groene technologie
8. Implementering van overheidsbeleid
Regionale ontwikkeling
9. Bewustzijn campagne
10. Voedsel en water zekerheid
Aanpassen aan klimaatverandering
11. Ruimtelijke ordening
12. Waterhuishouding
13. Natuur en landgebruik
Internationale betrekkingen
14. CO2-emissiehandel
15. Europese onderhandelingen
16. Internatonale verdragen
Van bovenstaande punten zijn een aantal (1, 5, 7, 10, 12, 14) direct te gebruiken binnen het simulatiemodel onderliggend

issue(s) – *climate sensitivity*

- climate sensitity – mitigation vs adaptation
- parameters (1) – resources, environment, money, social support
- parameters (2) – money, knowledge, power
- effect(s) – CO2, well-being, ...

article(s)

- IPCC – www.ipcc.ch
- nature – climate proofing the netherlands
- guide – climate challenge
- simulation game(s) – rule-based scenario(s)
- climate games – european forum
- winds of change – instructions
- klimaat @ VU – verslag oprichting klimaat centrum

1. de wetenschappelijke simulatie: het over tijd uitvoeren van het hierboven beschreven model (W);
2. de gamecyclus: opeenvolgende rondes in het spel (G);

3. de exploratie: vergaren van informatie in woord en beeld en het aftasten van de spelwereld (E).

Figuur 2. Interactie gameplay simulatie-klimaatmodel en video-exploratie.

game events. mini-games, advisors

example

De speler start in het jaar 2007, gekozen vanwege het verschijnen van het Intergovernmental Panel on Climate Change (IPCC) rapport. Dit klimaatadviesrapport zal terug te vinden zijn in de extra informatie die te verkrijgen is via de website.

Op basis van eigen inzicht en voorgaande rondes, kiest de speler de te ondernemen acties, zoals hierboven beschreven uit de punten van de Klimaatster. Denkt de speler dat het tijd is voor nationale restricties in CO2-emissie, dan kiest hij Klimaatstrategien en vervolgens Emissie-uitstoot.

Het gevolg hiervan zal in volgende beurten zichtbaar worden: hoe wordt deze beslissing beoordeeld door het volk? (People), heeft het een positieve invloed op de economie? (Profit), en wat doet dit met onze leefomgeving? (Planet).

1) Klimaatmodel
2) Basis spelstructuur en interactie met (1)
3) MediaContent (video-, beeldmateriaal en tekst)
4) Minigames
5) Clima Futura
6) Uitbreiding Clima Futura

o onderwijs
o entertainment

7) Multiplayer Clima Futura

trailer

1. descriptive – luxury, but
2. can we ... – look around us
3. political – opposition (star) -
4. explanation – scientific insight (star) +
5. propaganda – clima futura, play it

The game event description format – scenario(s)

www.cs.vu.nl/∼eliens/projects/form-game.html

slide id=pr-w-iss-topics¿

scenario(s) – encounter(s) & challenge(s)

- narrative(s) – de verhaallijn
- perspective(s) – (first person) actor(s)
- challenge(s) – problem(s) to solve
- resource(s) – (capital) to spend
- reward(s) – fame or shame
- visual(s) – setting(s) and effect(s)

game event description format

game event description – format

- name of event – give a meaningful name
- event-id – for administrators only
- type – (generic/specific) game/model/video
- cause – game play/simulation/exploration
- feedback/information – give a logical description
- player actions – indicate all (logical) player options
- description of visuals – for both feedback/information and player options
- additional information – give a url with references to additional informatin and visuals
- relates to event(s) – give id's or descriptions of related events
- remarks – anything

storyboard – narrative(s)

- context – general setting, situation
- problem – event(s) to occur, problem to solve
- S-R sitiation(s) – stimulus/response
- climax – action must be taken
- resolution – find solution or result

Towards a modular architecture – participatory deployment

Bij de ontwikkeling van Clima Futura gaan we uit van de volgende (standaard) ontwikkelingsfases:

1. initiatie - uitwerking game scenario
2. definitie - uitwerking game scenario en klimaatmodel

3. ontwerp - software architectuur, interactie en visueel design
4. voorbereiding - verzameling van materiaal
5. realisatie - software modules en interfaces
6. functionele tests - integratie in Clima Futura spel
7. ingebruikname - oplevering en uitbreiding minigames

Zoals aangegeven in de eerdere beschrijving van Clima Futura streven we, met het oog op mogelijke uitbreidingen, een modulaire opzet na. We onderkennen hierbij de volgende architectuur in componenten (M1-M5):

1. klimaatmodel - action script module
2. game play interaction - event-handler per game event
3. video content module - a) aanlevering videofragmenten b) alfa-overlays voor interactie
4. minigame(s) - flash module met actionscript interface
5. Clima Futura - integratie module 1-4, plus server-side ranking

technology

- flex – www.adobe.com/products/flex/sdk/
- flash – www.adobe.com/devnet/flash/3d_animation.html

Vox Populi homepages.cwi.nl/∼media/demo/IWA/ ... note(s) vox

Looking back – an evaluation of our approach

presenatation 3 anchor + (multi-person) expert choir

1. philosophy – pathos, ethos, logos (multi-disciplinary)
2. trailer – drama
3. climate star – items & game play
4. game development – architecture and project plan

ontology of humour Dormann et al. (2007)

- humour as a process initiated by a stimulus such as a joke or a cartoon which results with a response indicative of experiencing pleasure and joy such as laughter.
- humour has cognitive (i.e. mental processes involved in the appreciation of humour), emotional (i.e. pleasurable feelings), behavioural (e.g. laughter), social (e.g. interpersonal) and psychophysiological (i.e. involving autonomic nervous system changes) components
- There are three theories of humour: relief, superiority and incongruity theory [Morreall 1983].

According to relief theory, humour results from the release of nervous energy. People experience humour and laugh, because a sense of stress has been reduced. In this view humour can reveal suppressed desires and socio-cultural inhibitions. Humour is seen as a pleasurable mechanism. It has also been associated to well-being and healthy adaptive behaviour

superiority theory asserts that people laugh because they feel some kind of triumph over others or feel superior to them. Making fun of those who are less fortunate or who deviate from a particular set of norms are typical kinds of humour addressed by superiority theory. This kind of humour has a social function like criticism, censure or control, in enforcing the norm of a group or culture.

incongruity theory argues that people laugh at things that are unexpected or surprising . The cause of laughter in this case is the sudden perception of the incongruity or ambiguity, for humour depends on the teller playing with hidden meanings that are suddenly revealed in unexpected ways.

use While existing theories of humour appear partial, they remain invaluable for framing our understanding of humours use, function and effect.

Conclusions

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