

A Four-Dimensional Maxwell Equation for Social Processes in Web-Based Learning and Teaching: Windrose Dynamics as GIS (Games' Intrinsic Spaces)

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ABSTRACT

This paper describes how the principal structure of a system of equations fundamental to science, namely the Maxwell equations governing electromagnetism, could be analogously applied to social procedures among humans who start to create emerging networks through gaming. Inspired by a cartographic windrose, a new type of notation for social procedures is introduced that allows to graphically depict "information", "team", "debate", "integration" as four basic dimensions; symbolically called soprano, alto, tenor and bass. Experiences with a web-based role-play ("Surfing Global Change") show that these four basic dimensions tend to peak one after the other along a suitably designed gaming procedure. The resulting sequence of the "voices" S, T, A, B gives rise to hypothesizing a general pattern of social behavior that qualitatively could formally be described by a four-dimensional Maxwell type set of equations of these four variables. It is hypothesized that in analogy to an electromagnetic wave also a social process of harmonious flow in S, T, A, B might emerge that describes suitable and successful conditions for game play and game-based learning.

Keywords: Four-Based Dimensions, Games' Intrinsic Spaces, Maxwell Equation, Strategic Agent Personality (SAP), Surfing Global Change (SGC)

1. INTRODUCTION: THE MOTIVATION

The objective of this paper is how to understand, visualize and model human social and especially gaming behavior. Findings could be applied also

to climate protection which is understood as a long-term collective global learning procedure.

Such a modeling strategy, namely to view the gaming aspect (Ahamer, 2013a) of life and of learning, seeks to improve game based learning design, while it is also used for gaming as

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such, e.g. for multi-agent systems (MAS) as common to online games.

The motivation of this paper is to understand and visualize important traits of both e-learning and online gaming, more specifically how *fundamental dimensions* of social behavior are intertwined, interdependent and interacting.

For the purpose of studying real behavior of humans, this paper uses the case of a web-supported university lecture structured along the role-game “Surfing Global Change” (SGC) that was designed, implemented and copyrighted by the author earlier (Ahamer, 2004a; 2004b; 2005; 2006) and might offer some generalized insights for game developers. Some readers might wish to apply the findings later on also to multi-agent system research (Dignum et al., 2009) as well as to situations similar to the ones occurring in MMOGs (Massively Multiplayer Online Games). Typically, multi-agent platforms assume autonomy of the agents (Baumgarten et al., 2009), similar to students who also behave autonomously in a classroom lecture during game-based learning. In MAS, the communication facilities play a crucial role (Dignum et al., 2009, p. 3).

According to earlier experience, important *criteria for successful learning* and gaming can be (1) self-adaptivity of (learning and gaming) processes, (2) suitable fluctuation of framework conditions and (3) the underdetermined (learning and gaming) paths along which participants move through the “space of possibilities and options”. The above quality criteria will be briefly discussed below and add to the three characteristics that make learning fun cited by Wang & Wu (2009), taken from Malone (1980), namely (i) an appropriate level of challenge, (ii) using imagination and abstractions and (iii) tickling the player’s curiosity. A classical in-depth book in the field is Mark Prensky’s (2001) “Digital Game-Based Learning”, which is still worth reading.

1. The quality criterion of *self-adaptivity* means that the level of difficulty of the gaming procedure adapts itself automatically according to the profile of the participant.

SGC chooses to achieve this goal by means of a structured dialogue between the participants that causes the level of difficulty and degree of differentiation to converge (through the procedure of conversation) to a level suitable for all participants. Dignum et al. (2009) stated that “the gaming industry has been challenged recently (...) by a realistic cognitive behavior of the characters and realistic reaction and interaction with other characters over extended episodes. (...) We need more cognitive believable behavior of the characters. (...) In MAS, *communication* is one of the pillars of the whole system.”

2. The “science of design” (mostly promoted by the “Journal of Design Research” and “Design Studies”) posits a *toggling between* “problem space” and “solution space” in which actors would move (Cross, 2011, p. 129; 2007, p. 80). Both learners and gamers encounter such an experience as do soccer players who generate new framework conditions on the field for the other players as a result of their own moves. In order to meet quality criteria for gaming design, a suitable path and a suitable rhythm for such fluctuating framework conditions should be provided by a (learning or gaming) environment. In MAS, one gamer typically provides the framework conditions for the other by his or her own moves, and vice versa.
3. As expressed in design science, the participants move along principally *under-determined* (learning and gaming) paths through the “space of possibilities and options”. Such *constructability* provides more degrees of freedom and more right for creativity than habitually in scientific technological environments where “truth” is rather pre-fixed and only *discoverable*. Lindley & Sennersten (2008) say that “players eventually learn sufficient patterns of interaction to make progress. Game play is therefore fundamentally a process of players learning, adapting and improving play skills.”

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