GameDNA: Towards Game Notation for Discourse and Player Actions

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Abstract

In the current game practice there is a need for richer game grammars or ways of notation. Existing methods are not sufficiently able to accommodate the players' mental states and actions during the game; we need better ways to visualize cognitive aspects within the player and the game events. In this project a Serious Game Studio, a Computer Science department and an HRD consultancy firm cooperate on a living case-study, a serious game to measure "Compliance" for job assessment in order to uncover individual traits (here: Compliance) in a structural manner. This paper describes the first concepts and progress of GameDNA (Game Discourse Notation and Analysis), a method to notate, analyze and visualize cognitive actions of players and interactive aspects during play.

1 Introduction

Well designed serious games captivate and engage players for a specific purpose, e.g. learning material or training on specific situations. They provide engaging environments despite their non-entertainment purpose. Players endeavor in higher order cognitive skills such as decision making, information-handling, acting in organizational problems, and can take risks, explore options, learn from their actions, and receive feedback. A trend today is the use of serious games to uncover individual personality traits of people, for example in job assessments. A game with the goal of assessment involves uncovering personal traits, skills and capabilities (or deficiencies) present in people. Personality tests have been in use for a long time for employee selection, team building or training, such as paper tests, interviews, or computerized versions of these, but there are disadvantages, e.g. the fact that it is often too easy to give socially desirable answers. Accommodating assessment in a game could provide a richer, less predictable and more immersive context. Players might act more natural and intuitive than when holding a pen and, thus contributing to the validity of measurements.

In the design and development of games, be it in the creative process, development phase or in communication between teams, the notation, visualization, analysis and description of the game and its structure is important. There are many ways to describe games, some more formal than others, such as structure diagrams, rule sets, state transition diagrams, storyboards, game mechanics visualizations, flowcharts, or Use Case diagrams. However, during the last years, from various sources the need for richer and more formalized game grammars or notations becomes prevalent. One well known advocate for a better design vocabulary for games is Church (1999), who mentioned the need for "Formal Abstract Design Tools". He promotes a vocabulary that could “dissect a game into its components, and attempt to understand how these parts balance and fit together”. This then could improve our understanding of and proficiency with game creation. Also from the industry, Kreimeier (2002) stated that “Game design, like any other profession, requires a formal means to document, discuss, and plan”. This should facilitate understanding within development teams, communication between developers and stakeholders. Likewise, Cook (2006) acknowledged “the primitive state of game design notation” and stated that “the lack of a well defined language of game design is crippling”. He mentions that in order to create a more advanced system of game play notation it could be beneficial to look at other disciplines such as musical notation. As an anology, he stated ”How would you create a symphony if written music did not exist? Game design exists in a similar state”. In order to develop serious games, the multidisciplinary aspect and the inevitable presence of several domain experts call for one shared language, with which the game can be properly mapped. Regarding the desirability of a player’s representation, also Taylor (2006) recognizes that “despite the immense activity within the player community their invisibility or omission from the structural and organizational aspects of games is one of the more distressing things we often see within design talk”. Taylor comments that symbolic notations games, including turn taking and other mechanics, generally lack a representation of the player. This fits with the raison d’être of this project: the observation that game analysis methods, design tools, grammars, notations and visualizations are not sufficiently able to accommodate the mental actions that such games should provoke. A major deficit is that although the methods as they exist and are used are often extremely rich and detailed, a clear division between the type of player actions and what instigates them is lacking, too implicit or unclear. In the case of serious games for assessment, a story can be at the core, and the player has to act in it, decide on actions, and show his insight and the way he would act or react. Players have to make choices, based on the information in the game. The content and information flow have to be carefully weighted, set up and designed in order to measure what one wants to measure. We are in need of an adequate view on global, but also on more specific levels to see which information is provided, where and how discourse takes place between system and player, and how the discourse is developing. From the above, we identify two main important levels which are needed to accommodate features for the type of serious games we focus on:

1. The story line showing at which points discourse and mental actions take place
2. A detailed level visualizing local loops of discourse and mental actions precisely

The current project involves the development of a notation and grammar aiming at exactly these mental issues in serious games. Game designers could benefit from a set of components and information elements as a "toolbox" to create interventions in the game at specific events and indicate what this mentally means for the player. Important at this moment is to put the player, and the mental process he/she endeavors central along with the flow of information, and to not focus only on the underlying game logic and rules. Earlier in this project first steps were taken by Wouters et. Al. (2009), who coined it "Game Discourse Analysis" (GDA). They describe the game story in terms of discourse components (e.g. actions, events, internal elements), the relations between components and how components may trigger schemas of action in specific situations. In this follow-up project, Ranj, a serious game studio, a university computer science department and GITP, an HRD consultancy firm team up in a living case-study. From here on, we refer to our method as "GameDNA" (Game Discourse Notation and Analysis). GDA as it once started will be further elaborated in parallel with the development of a serious game to assess "Compliance"; in how far do people act in accordance with established guidelines or legislation.

2 Existing Methods for Game Notation

Game designers can have their own preferences in flowcharts (Figure 2), diagrams, notations and visualizations, and sometimes do a lot by "gut feeling". For example, an intuitive way of depicting that "something yet unknown must happen" by a player who must make a choice can be seen in Figure 1. This specific designer added a "cloud" (as part of a drafty doodle). It is a fragment from documentation of an actual project at Ranj showing branching between scenes. The thought-cloud is not a "choice" in a game rule system, but a point in the game where the player has to think and decide. Here it is shown, but often this is not done, omitted because it is either seen as not necessary or just implicitly assumed.

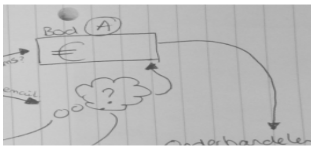

Figure 1: Thinking cloud indicating "decision"

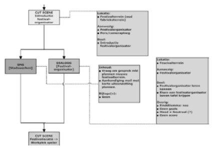

Figure 2: Fragment of story flowchart from Ranj

In various many domains such as architecture, human computer interaction, E-learning and software engineering, design patterns can be used as a tool to transfer knowledge. Also for computer games design patterns, descriptions of relevant recurring interactions have been developed. Pioneers from the field such as the earlier mentioned Church (1999) and Kreimeier (2002) proposed to adopt pattern formalism for game design. These patterns are reusable solutions to solve recurring problems. Much cited work has been carried out by Björk and Holopainen (2005). They identified and described a large number of patterns in game design, meant to help game designers to analyze games, understand games, and the patterns could also serve as inspiration for yet to be developed games. At a higher level, MDA (Mechanics, Dynamics & Aesthetics) has been influential (Hunicke et. al, 2004). It breaks down the design process and connects higher goals of the game with low-level components. But just as with game design patterns, it does not provide the detail we require to identify where and how mental activities in a game take place. Koster (2005) elaborated on the concept of “ludemes” proposed a visual notation to diagram the way a game functions using ludemes on an atomic level in order to be able to analyze what makes a game “fun”. Other attempts attend to game mechanics and their corresponding feedback mechanisms, such as Cook (2007). His diagrams indeed *do* reflect the player and the information in the game. Grünvogel (2005) proposed the use of a mathematical model (Abstract State Machines) to precisely describe games as systems of objects whose state is changed by the players and other game objects. The problem with this is that game designers without deep knowledge of this notation have problems expressing their designs. It is important, therefore, to provide a designer-friendly representation of the game specification concepts. The mentioned methods are all valuable in their own right, however, regarding their scope they are (rightfully of course) geared at “fun”. They do not adhere to our issue: clearly and correctly identify, accommodate and visualize *mental* actions a player is facing, in an explicit way. In the next section we present the test case we are working around.

3 The Test Case: Compliance

GITP, the domain expert in this project is a consultancy firm in the area of Human Resource Management and Development with the goal of enhancing individual and organizational effectiveness by assessing people and organizations. GITP is already active with novel ways to measure individual differences with games, and a new area they explore is “compliance”, the tendency of an individual to agree with a proposal/instruction from another person (in an organization), even if this individual does not believe it, only to satisfy the other person or to avoid conflicts (Gudjonsson, 1989). The potential of narratives in interactive games and immediate feedback on actions make computer games promising for assessing compliance, which is a hot topic after global crises in financial services.

4 Methodology

Way of Working in the Project

This project, starting from the need for adequate notation echoed in industry and literature benefits from the fact that it is multidisciplinary and that we work around a real case (an assessment game for compliance). It poses an excellent opportunity; domain experts provide input regarding measuring psychological constructs, and GameDNA provides input for the translation from domain expertise driven requirements and what the game designer in turn does with it. Several psychological constructs are operationalized into a robust content model. Next to literature research, the computer science department has a researcher working physically in the game studio. On a regular base there are workshop-like sessions to uncover how game designers conceptualize, describe, and visualize the games they design and build.

5 GameDNA: The Requirements

5.1 2-level Approach

GameDNA should accommodate different, but corresponding levels. One first and higher level is the one that is close to the broad “story line” and identifies the major points in the game where mental dilemmas or problems occur for the player, and the second level is more detailed and exactly describes at which points mental activity from the player is desired.

5.2 The First GameDNA Level

This level refers to the narrative level with its main story elements. From film and drama analysis, there are many examples of story plots, often of them inspired by the now ancient Freytag Pyramid, a diagram with 5 parts (exposition, rising action, climax, falling action, and dénouement). Stein and Glen (1979) mention story elements, such as Setting, Initiating Event, Internal Response, Attempt, Consequence and Reaction. Story events of a rather linear game could be accommodated in a Freytag Pyramid (see Figure 4). It gives an overview of the very elements that define the story. In our game context, we are looking for the points in the game that define the story, narrowed down to the most crucial points where important mental action occur (often situations in which the player faces a conflict).

5.3 Our Example: De Nacht van….

As an example we will look at a game by Ranj called “De nacht van…” (in English; “The night of) to provide insight in working at the local government for higher educated staff. The player has to organize a cultural festival, faces decisions and must provide input by choosing predefined answers regarding what he/she would you do or say (see Figure 3).

Figure 3: Screenshots from "De Nacht van..." (in the 2nd image showing three clickable answer options). http://www.denachtvan.nl.

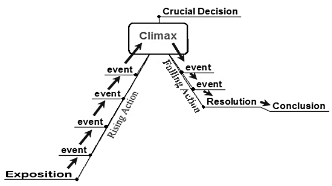

Figure 4: Game events in Freytag Pyramid

This game engine will also be used in this project. “De nacht van…” has a bold storyline, in which mental action from the player is desired. This is a simplified description of the course of events in the game (story-components that one way or the other will always feature):

1. General Introduction (audio-video) introducing the game, explanation that YOU are the person responsible for organizing a cultural event in the certain city
2. Staging of characters: The mayor, city council, building department, festival organizer and the neighborhood committee. All stakeholders have to be taken into account

No matter how the game is played, the following crises will emerge:

3. There is a problem with the terrain on which the festival is meant to take place
4. The current city council is replaced by a new one (less friendly)
5. At another festival a stage collapsed, assurance is needed that this will not happen here
6. The neighborhood committee's problem: worry that neighborhood life will be disturbed

The player has to act, take decisions on the above issues. After this the game reaches its end

7. Based on the player's choices and actions a verdict is made about the performance

Roughly diagrammed, the first (story) level could look like Figure 5 (the rising line indicating accumulating complexity of the problems): Much more branching and detail is possible, but we do *not* want a rule or state diagram here, the relevant bold story elements.

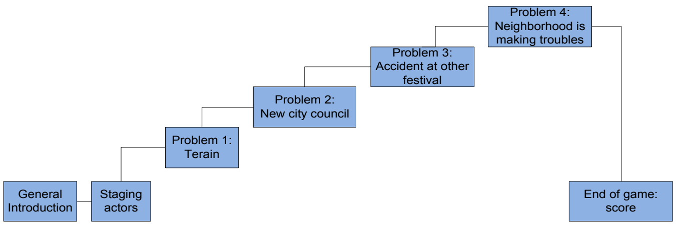

Figure 5: GameDNA Level 1 components

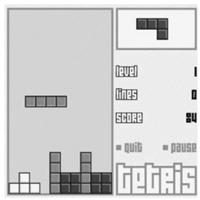

Figure 6: Screenshot from Tetris

5.4 The Second GameDNA Level

The second level contains more specific information about the discourse taking place between the system and the player and the corresponding mental actions. To come up with adequate components, and inspired by what we saw in the game design practice at the participating game studio so far, we decided to take a step back and start with the intuitive notions of what it is that happens in a game by firstly distinguishing between actions by the *system* and actions by the *player.* As an example, we will take the classical game of Tetris (Figure 6). What is it that actually happens in Tetris distinguishing different types of actions?

Player

- <u>Perceptual action:</u> see blocks appear (the system feeds this), see outcome of actions and score after completed lines or at level-end, or game over
- <u>Mental action:</u> Think and decide, where should *this* block go? Rotate, and if so, how?
- <u>Physical Action:</u> Physically perform the action(s) decided on with keyboard or joystick

System

- <u>System action:</u> React according to rules, show action result/feedback of player actions

If we would diagram Tetris using these components, using a legend corresponding with the above categories, it would come down to what can be seen in Figure 7.

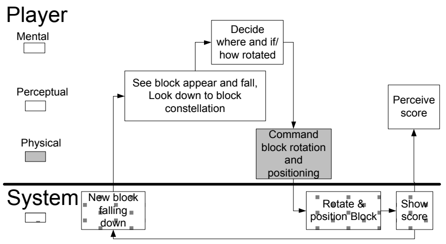

Figure 7: Tetris modeled in second level GameDNA

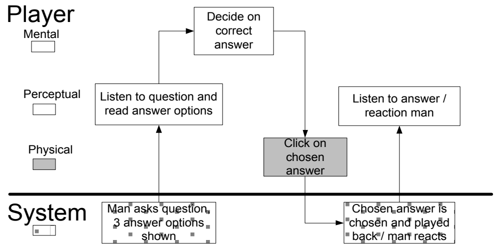

Figure 8: Scene from "De Nacht van" in GameDNA

We divided the actions in Tetris in smaller parts to pinpoint *where* mental action takes place (white block, Figure 7), and where perception action is required. These are the components we start from, the "mental actions" being the most important ones, the focus is not on the underlying rules. By no means we claim exhaustiveness here, there are other micro loops at play, e.g. during reading, a mental action in itself. But here the division is drawn differently; an action is regarded as purely "perceptual" if it consists of absorbing information by the system. A players' action is labeled "mental" from the moment on that contemplation is required, and when a decision has to be made actively. Tetris has no rich narrative, it is a repetition of problem solving loops. "De nacht van…" *does* have a clear narrative. The game has seen several conceptual rounds in its development, including post-it's on walls, pencil-doodles, flowcharts etc.. However, the mental actions of players have not been explicitly accommodated anywhere. Let us attempt to see if the components so far can accommodate the flow in the game. We take a small sequence, in the first level it takes place at the third block from the 7 blocks shown in Figure 5: "*There is a problem with the terrain on which the festival is meant to take place"*. On the second level the following happens:

1. System: plays video of construction supervisor explaining problems, ends with question
2. Player perceptual: takes in this info, ending with question and display of 3 answers
3. Player Mental : ponders question, decides his answer
4. Player physical : clicks his chosen answer
5. System : play (audio) the chosen answer
6. Player perceptual : listen to system

This is diagrammed in Figure 8. Here, there is a clear story moment, a point where the player has to perform a mental action instigated by the system, in other words: to provide input to the game. We decompose nodes in flowcharts in smaller components, and the following components are used for the second layer, a looped model to describe the events. We use the 3 types of player actions and system actions under the following assumptions:

1. SYSTEM ACTION >> PERCEPTUAL ACTION. System actions must be perceived. System events therefore ***always trigger*** perceptual action. System actions and perceptual actions follow each other *immediately* or are *parallel* (e.g. a player listening to audio).
2. PERCEPTUAL ACTION >> MENTAL ACTION. A perceptual action (taking in information) ***always triggers*** a mental action regarding the information, the player's contemplation on the action. This mental action is initiated by the system.
3. MENTAL ACTION >> PHYSICAL ACTION. A mental action can trigger another perceptual action (e.g. deciding to re-read the question) but is meant to, and will ***always trigger*** a physical action at some point.
4. PHYSICAL ACTION >> SYSTEM ACTION. Closing the loop again, a physical action from a player ***always triggers*** a system action (system shows answer, next video, etc.)

We looped these actions in Figure 9. We added two extra components at the bottom in grey. The left one, "system internal action", refers to for example a running time clock causing a system event to occur (e.g. "game over"). The right one refers to an issue that will receive attention further on: a voluntary mental action resulting in a physical action (in turn triggering a system event). In "De nacht van…" this could be deciding to grab the Smartphone when *not* instigated by the system, but from the player's own instigation. Combined, the two-level notation should accommodate the higher order storyline elements (level 1, Figure 10) and the local flow of discourse and mental actions (level 2, Figure 10).

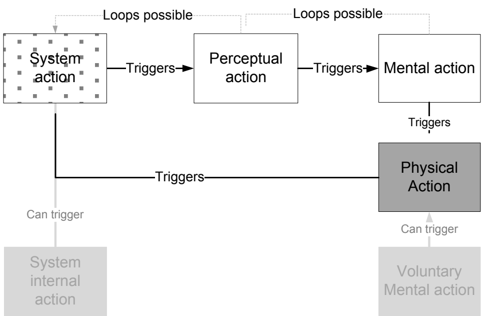

Figure 9: GameDNA Level 2 components model so far

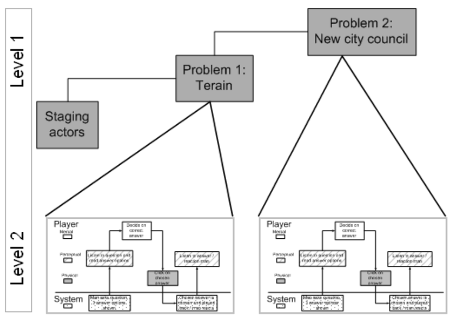

Figure 10: Combining two GameDNA levels

5.5 Visualization

Besides further elaboration on the "atoms" of mental/discourse activity and their relations, considerable effort must be dedicated to the issue of visualization of GameDNA. It should provide a means of clearly showing what happens in the flow of a game, and a clear overview in a language that communicates structural features comprehensively. The key might be providing the options to "show" or "hide" complexity. It might be that a view on game flow for a creative director does not suffice for the development team which has to think in rules, decision trees and software components needed. Hence, the message is: design for flexibility. One can think of layered views, collapsible structures, detail that is modifiable as in a Google map, 3D visualizations, and others. Dormans (2008) regards games as complex state machines: interactive devices that can be in many different states. He developed "Machinations" to model and "run" a dynamical visualization of a game, to "provide the game designer with a gestalt of his design", making the descriptions less abstract and textual. Although difficult to concretize at this point, a notation that is "runnable" is an issue we will look at to make GameDNA extremely rich to express game aspects. We need a way to show the two levels we identify (Figure 12), and a way to connect them. How this will be done, in levels, (3D) layers, expandable views, and other choices one could think of will be elaborated on further on in the project.

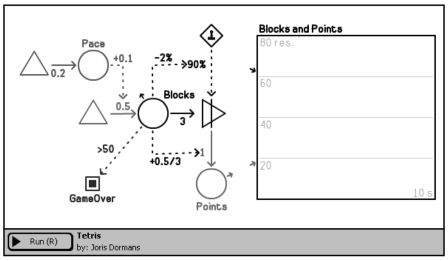

Figure 11: Dorman's Machinations tool (www. jorisdormans.nl/machinations/wiki/index.php?title=Tetris)

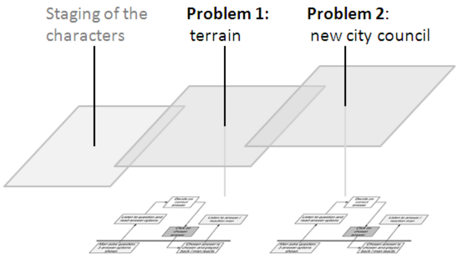

Figure 12: Two layered 3D visualization of GameDNA

6 Conclusions and Future Work

GameDNA's components and concepts to model mental actions and discourse so far seem adequate and solid as building blocks to start with. Both game designers in the project and the HRD consultancy firm agree that it can accommodate mental actions and discourse for the type of game we envision. In further development, an issue to take in account is "meta processes". The mental action components on the levels we identify here encompass rather "local" game events. 1st level events in the game story as in Figure 10 are often connected and influence each other. By doing a mental action at point "x", and then at point "y" a player might formulate a "meta strategy" of how is act throughout the game. Regarding the exhaustiveness required, besides the basic components we identify there might be extensions and/or annotations that are important enough to be accommodated. For example, if a piece of discourse is being shown, e.g. a player that has to take a decision, it might be interesting to also be able to specify *on the basis of which kind* of information this should happen (specific information the player has just learned, or common sense knowledge)? One could also think in distinguishing moral decisions from organizational or managerial decisions. Then the question is whether these distinctions deserve only an annotation or whether they must be separate components in their own right. We will investigate these issues with both GameDNA and the compliance game as providers of input. Regarding the multidisciplinary purpose of GameDNA the "usability" of the notation including the exact labeling, details of the graphics must be such that they are easy to grasp across disciplines. This requires co-design from different disciplines and validation inside, *and* outside the project.

Acknowledgments

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