Social Exploration of 1D Games

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Abstract. In this paper the apparently meaningless concept of a 1 dimensional computer game is explored, via netnography. A small number of games was designed and implemented, in close contact with online communities of players and developers, providing evidence that 1 dimension is enough to produce interesting gameplay, to allow for level design and even to leave room for artistic considerations on 1D rendering. General techniques to re-design classic 2D games into 1D are also emerging from this exploration.

Keywords: game design, netnography, new genres, HCI.

1 Introduction

Computer games have been classified in many ways [11], however, most of the games can be divide in 3 dimensional (or 3D) and 2D games. But what about 1D? The inspiration to explore the domain of 1D games came from browsing among several on-line communities, whose members were engaged in a conversation about the topic. Therefore, it was decided to conduct our investigation through the method of netnography, which is a form of ethnography applied to online communities ([1], [2]), and combine it with user centered design (UCD) [10]. Our initial survey suggests that a few 1D games already exist, but most of them were created to prove that 1D games are meaningless or ludicrous. For instance, the author of Tetris 1D[1] seems to make fun of the fact that in 1D no 2D rotations are possible, leaving no room for the typical gameplay of the classic 2D Tetris. Similarly Wolfenstein 1D [2] is not a proper game, but mostly a tribute to Wolfenstein 3D (developed by id Software and published by Apogee Software in 1992). 1D games are somehow recognizable among game designers and developers, but negatively characterized as something to avoid or to laugh about: we propose to consider 1D games a *non-genre*.

[1] http://www.kongregate.com/games/zigah111/tetris-1d-2-0
[2] http://wonder-tonic.com/wolf1d/

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In order to explore the 1D games design space, we re-designed famous 2D games so that they could still be playable and recognizably related to the original games, even with only a single (vertical or horizontal) line of pixels as visualization. We call this re-design process *flattening*. Keeping a game recognizable after flattening it, requires finding out what is the *spirit* or *identity* of that game, in relation to how the players feel, think and interact with the game itself. Our exploration is therefore centered on the players' perception of games, and on the artistic expressivity that 1D games might offer, as a medium for game design.

In the rest of the paper we present our netnographic investigation in the 1D non-genre and the games we designed and implemented (section 2); then (section 3) we analyze online forum discussions, and finally (section 4) we discuss what this exploration of 1D games achieved as well as future work.

2 Exploration of the 1D Non-genre

According to [1] netnography requires four essential steps, which can be reconducted to common ethnographic practice: 1. cultural entrée, 2. gathering and analyzing data, 3. ensuring trustworthy interpretation, 4. conducting ethical research. The first step requires identifying particular online forums, based upon the product or service to investigate, and the "specific research questions". Moreover, in order to gain rich data, the communities of interest should have a high rate of posting, with detailed and descriptive messages (as in [1]). Our study instead started from few negative online comments about the very idea of 1D games; afterwards, we decided to conduct our investigation following other communities (6 in all, including Facebook). Application of netnography is supposed to require a long time commitment ([1], [2]), and at this time our study is being running for five months, starting from May 2012, then in July we designed and implemented circa 15 prototypes of 1D games, of which 6 are currently playable. The games were shared on Facebook during iterative development, as typical in UCD [10], and later on 2 online communities of game developers ([7] and [8]).

With the games available online and publicized on 3 communities, a systematic netnographic analysis was undertaken, the second step in the methodology. The conversation exchanges from the Internet are kept and annotated, with respect to the meaning conveyed among the community members (as suggested in [1]). Regarding achieving trustworthy interpretations (step 3), netnography is based upon textual discourse, which may represent a "controlled self-image" of the community members, so that it may be difficult to reason upon their motives. However, this is a risk also in ethnography (see [1]), which focuses on studying the behavior expressed by a group of people and not on analyzing the individuals expressing it. Moreover, to provide a solid ground to netnographic data, [1] and [2] suggest combining the method with others, such as *in person* interviews. In the present study, netnography is combined with UCD. Moreover, we approached data collection with a "purposive sampling of material" (as stated in [9]), an approach to netnography used in marketing research, according to which noteworthy messages and conversation are selected and interpreted "in terms of a particular sample" (from [9]), hence it is not necessary that

the sample is representative of other populations. Our focus was on people, who are interested in games and in exploring their essence, in terms of visualization and experience. Analysis of row data was based on grounded theory, as suggested by [2], so that we went through the conversations, copied on a separate file and coded them. The aim of this analysis was to identifying emerging themes and possible design inspirations, in relation to how people perceive 1D games. Recurring and interesting utterances were transcribed on post-its, which were pasted on large sheets of papers, so to represent emergent themes into tangible and visual clusters, as it is common practice in design research [10]. Since the conversations we analyzed were concise and straight to the point, and we did not know exactly what to expect, this method revealed to be effective and well suited for the study.

Finally, inadequately reporting messages and utterances from conversations in online communities, might result in psychological arm to community members (as explained in [1]), therefore, a researcher is supposed to act correctly with respect to privacy, confidentiality, and informed consent. It is recommended that researchers reveal their identities and purposes, to the members of the communities they follow, and that they are careful when reporting literal quotes, which online represent the individual identity of the members. Taking these recommendations into account, the communities that were followed through participant observations, were informed of this study and affiliation of the researchers. Moreover, in respect of the members' privacy, literal quotes from individual members will not be reported, both in the case of the communities we joined as well as the ones we only observed. Data are only reported in relation to the emerging themes we identified from the observed conversations and used for the design of our games.

2.1 Our 1D Games

The games were created following a user-centered iterative development approach, in line with agile development. The main goal was to transpose famous 2D games in 1D, possibly in multiple ways, and keep in contact with players, to validate the design as quickly as possible (with new versions created in few hours). All the games are written in Javascript, they all use HTML5 canvas for graphics, and the code is willingly simple and portable, so that the games can run on most browsers and on most Wi-Fi enabled mobile devices. Dropbox was used to distribute our 1D games[3].

The classic and popular games we decided to *flatten* were: Tetris[4], pinball-style games, Bloxorz[5], Sokoban[6] and Rogue[7]. For each of these games we designed different flattenings, i.e. different 1D games have been derived from the same classic 2D game, and for each 1D game prototype many version have been developed, usually between 3 and 5.

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[3] All our games are available at `https://dl.dropbox.com/u/1518199/1D%20games/index.html`

[4] `http://www.tetris.com/`

[5] `http://www.bloxorzgame.com/`

[6] `http://www.sokoban.jp/`

[7] `http://www.gamasutra.com/view/feature/4013/the_history_of_rogue_have__you_.php`

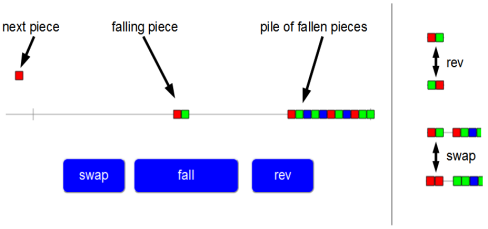

Fig. 1. 1Dminos, our transposition of tetris onto 1D. As in the classic tetris, a piece is falling (from left to right) and will join the pile of fallen pieces. The game also shows the next piece that will fall, to help the player better plan a strategy.

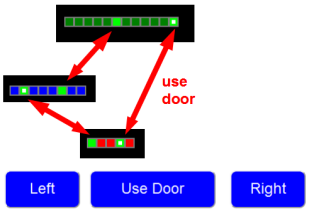

Fig. 3. Rogue1D is the flattening of the classic Rogue. The user interface allows to move left and right, and to go through a door. These 1D doors are like portals, connecting different linear rooms, and allowing for exploration of a graph-like 1D maze.

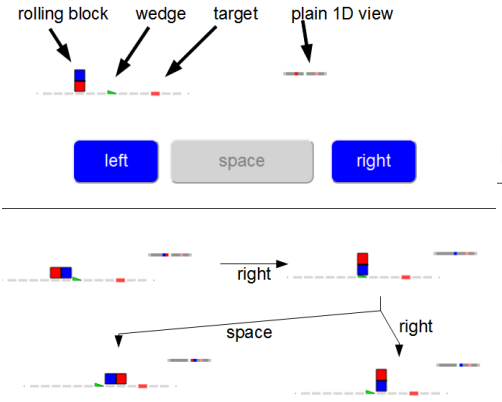

Fig. 2. Blox1D. The top part of the figure shows the game as it appears to the player, with 3 buttons and both an artistic and a plain 1D views. The bottom part of the figure instead shows some steps of the possible interactions between player and this game.

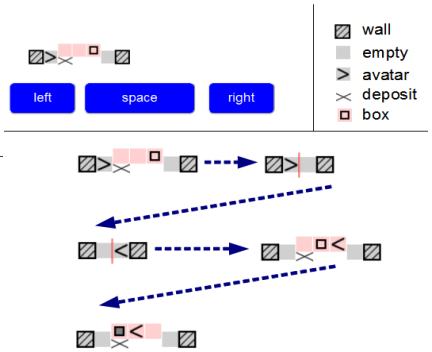

Fig. 4. Soko1D, a 1D version of Sokoban. The lower half of the figure shows the player solving a level, by way of folding and unfolding a section of the level.

Fig. 1 shows the game 1Dminos, one of our 1D remakes of Tetris. To decide how to reduce Tetris pieces and operations from 2D to 1D, we followed a structuralist approach [3]. First we considered all Tetris pieces and the actions available to the user: horizontal translation, and clockwise and counter-clockwise 90 degrees rotation. According to our analysis, key factors are: shape (distribution of squares in 2D to form connected figures), horizontal and vertical position, and orientation of shapes.

The goal of a game can then be expressed in relation to pieces and operations, the artificial conflict and the rules [11]: in Tetris, connecting shapes in particular ways, a kind of *fitting*. Rotation and horizontal translation affect shapes, since their fitting might change. The player has to find strategies to control the one falling shape with respect to the shapes that already fell. This structuralist analysis helps when defining a flattening of Tetris. We proceeded considering: how shapes would be in 1D, and which operations can be defined that "remind of" the 2D translation and 2D rotation. We decided to flatten shapes into color patterns: a 1D shape is simply a sequence of a few colored squares. As operations we chose **reverse** and **swapping** of the right-most square of the falling piece and the top square on the top of the pile (see Fig. 1). Now we can rephrase Tetris main goal in 1D, as fitting of colored sequences. Fig. 1 also shows the user interface of the 1Dminos game: composed of 3 large buttons, it is usable both on a computer and on mobile devices.

The same structural analysis that was conducted in the case of Tetris, was applied also to other famous games, such as Pinball, Space Invaders, Bloxorz, Rogue and Sokoban. The 1D Pinball and 1D Space invaders were just considered to expand the range of games that could be flattened, and their design is still very incomplete. Bloxorz is about *rolling* a three-dimensional block on a 2D surface, until it falls down a square hole. The block measures 1 by 1 by 2 units, and the player can roll it in 2 different directions (vertical and horizontal, with respect to the floor). Flattening this game, which is 2.5 D was challenging, and we concentrated on the asymmetry that the 3D block induces with respect to the 2D floor. The resulting design (after a few partial prototypes) is visible in Fig. 2. Given the *artistic* visualization that we implemented for blox1D, the game might look more 2D than 1D, therefore we added a *plain 1D* view to show that blox1D is still perfectly playable with a strictly mono-dimensional visualization.

Rogue1D is an attempt at flattening a 2D adventure game. The original game Rogue, is a classic that started a genre, and its gameplay has to do with exploration of a 2D maze composed of rooms and corridors, populated with monsters and filled with items. The main challenge in flattening this kind of games is in rendering the idea of free exploration, but with only 1 dimension. Few prototypes were designed and implemented; the latest is the one shown in Fig. 3. In 1D the maze is replaced by linear rooms (i.e. corridors) connected by portal-like doors. A door is a bi-directional gate that connects a tile in one room with a tile in another room, so the entire maze is just a graph. The player can see only the current 1D room: we have sliced a 2D maze, and present a single horizontal slice at any given time, therefore time acts as second dimension during the exploration of the maze (a general technique inspired by the discussion about 2, 3 and 4 dimensions in [4]).

Finally, Sokoban is a classic *transport puzzle* from the 1980s. The player has to push boxes around in a warehouse, trying to get them to storage locations. Boxes cannot be pulled, and are blocked by walls and other boxes, hence the complexity of the game.

Flattening Sokoban proved more complex than with the other games: it required almost 1 week and produced many very different prototypes. The final one, called soko1D, is depicted in Fig. 4. The inspiration for the flattening came from trains and

the way railroad switches work, by enabling or excluding entire sections of tracks. In Soko1D (as shown in the lower part of Fig. 4) the level is linear, and can contain boxes, deposits and walls. The level itself is composed of sections, some of which can be folded, i.e. excluded; boxes contained within a folded section still exist, but are inaccessible as long as the section stays folded. Fig. 4 (lower half) shows how the player can fold, move around the section containing a box and a deposit, then unfold and push the box left-to-right, eventually winning. The latest soko1D prototype has 9 levels of increasing complexity, an indication in our opinion that level design can actually be meaningful within the 1D genre.

3 Themes in Players' Feedback

Initial analysis of online conversations about the dimensionality of existing games (like Super Mario Bros [3] or 1D Tetris) suggested 4 main themes: non-genre, essence of what is a 1D game, experience, design. The same 4 themes also emerged later in analyzing the feedback we received for our 1D games.

The first theme emerged from comments about the impossibility of having 1D games; and inspired us to take up the challenge and explore the 1D non-genre. These comments are of three kinds: direct critics of the concept of 1D games, ironic celebrations of a 1D game and its author, or positive comments about an engaging 1D game. This last kind of comments express surprise: a person would initially state that 1D games are nonsensical, then change opinion, after playing a particular game.

Regarding the second theme, essence of 1D game, two main subthemes emerged, called: geometry and view. Geometry comments claim that 1D games should respect the basic geometrical principle that a 1D space has only one axis (vertical or horizontal). Hence, the games should all be represented on one line of pixels. Other comments reflect a different understanding of 1D games, related to the visualization and movement of the character. According to this interpretation, even Super Mario Bros can be arguably seen as 1D, as the character moves mainly in one direction. Moreover, some individuals claimed that a 1D game could be the 1D view of a 2D world, some comments mentioned as an example the book Flatland [5]. The game Z-rox[8] seem to match this definition of 1D, as it visualizes a bi-dimensional shape (a character in this game) crossing a line, and the player has to guess which character it was, just by observing its 1D projection. Other comments focus on usability, and maintain that a designer can take the freedom to scale a line of pixels to a line of colored squares.

Finally, few comments fall in between the geometry and view themes, so that a game can be acknowledged as 1D, and yet its visualization considered as 2D. In the design of our games we adopted the view theme, which emphasizes gameplay and user experience (defined as the main goal of game design also in [12]).

Two main sub-themes emerged regarding the theme of experience: appreciation and critics, reflecting positive and negative judgments. Positive comments overlap with the non-genre theme, as they express players' surprise in finding an engaging 1D

[8] Freely available at: `http://www.kongregate.com/games/EvilDog/z-rox`

game, often praising the authors for being a creative, original thinker. In some cases, the authors of such comments said that they have thought or tried, to design a 1D game before[9], showing that 1D games can also be engaging from a developer's perspective. However, negative comments claimed that 1D games are "not so fun" or that the game play is "vague". Hence, a sub-theme related to understanding seemed to emerge, in which 1D games are said to be confusing or difficult, so that it takes a while before a player can enjoy them. The same comments appeared also in a positive light, as some individuals enjoyed these challenges, as part of the gameplay.

Finally some individuals provided interesting design suggestions, such as adding tutorials or menus to clarify the goal of a 1D game and how to play. In one case it was suggested to add a button that allows players to re-start from the level where they were playing, and not from beginning. Given the small size of these games, it was suggested that they could be interesting apps for mobile devices, such as smart phones and Nintendo DS. Some of these comments even suggested specific 1D games as a possible source of inspiration, such as: line[10] and gauge[11] for iPhone. The authors of the game line explored the possibility of a one-dimensional shooter game; they developed their game as a collection of mini-games, with minimalistic graphics and gray colors. The forum comments that followed the post about line were generally positive. Gauge is a commercial game for iPhone, where the player taps on a single button (i.e. the entire screen) to control a size-changing horizontal gauge; the closer the gauge gets to the edge of the screen, the more points the player gets, but if the gauge exceeds the screen the player loses. While this game is clearly of the 1D kind, nothing about one dimensional gameplay is explicitly written in its description, strengthening our concept that 1D is a non-genre.

4 Reflections and Conclusion

After creating few 1D games and reflecting on online feedback, we can formulate a more precise and inclusive definition of this non-genre. A 1D game is:

a game that can be rendered and played, at least in principle, with a single line of pixels, either vertical or horizontal

From a visualization point of view, this definition allows for quite sophisticated renderings, provided it is always possible (at least in principle) to simplify the graphics into a single line of (colored) pixels without affecting playability.

In our games we use 3 kinds of 1D visualizations: black and white pixels, colored pixels (or squares, as in 1Dminos Fig. 1), and *artistic rendering* (e.g. in soko1D, Fig. 4). So far we have flattened 2D adventure and 2D puzzle games; a reusable technique that emerged involves slicing of a 2D space in horizontal strips, with a single strip perceived while playing. Both Rogue1D and Soko1D follow this approach, while the *folding feature* of Soko1D show that 1D games can stretch towards 1.5D.

[9] Similar comments were posted also for our games.

[10] `http://forums.tigsource.com/index.php?topic=17734.0`

[11] `http://www.148apps.com/reviews/gauge-review/`

Another reusable technique is to perform a structural analysis before designing the flattening of a 2D game. The results of the analysis suggest, but do not dictate, what the flattening should focus on, still leaving plenty of artistic freedom to the 1D game designer.

In conclusion we believe that 1D games possess a minimalistic quality that can be useful when reflecting on game identity, and we would like to use participatory design to gain more insights on whether 1D games could become a viable tool when teaching game design and game programming. For instance 1D games could be used in conjunction with paper Turing Machines [6].

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