Learn to Play: lessons learned developing video games for entertainment and education

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Abstract—We report on the development of two video games with educational intent and entertainment ambitions. The first game – "Cash or Card?" – is a cashier simulation focusing on the theme of cash vs electronic payments, a hotly debated topic shrouded in false information and conspiracy theories. The second game – "Untitled Journalist Game" – is an investigative reporting simulation focusing on the analysis and evaluation of information sources, and on how information is presented in the media. We present the design and development process of the two games, and some preliminary usage data of "Cash or Card?." We found that the synergy of game designers, educators, and game researchers is critical in developing and evaluating games to educate and entertain so that all the actors can contribute confidently according to their expertise, and produce games that communicate important content while challenging and entertaining the players.

I. INTRODUCTION

The "EduGames: Play to Learn" research project [1] aims at developing video games with educational intent and entertainment ambitions, firstly supporting the public in acquiring Critical and Computational Thinking skills to tackle the problem of detecting misinformation, and secondly supporting the game development and research communities with a set of guidelines and good practices for creating and evaluating games that are entertaining and educational. We developed two video games, which we describe in the following sections, that tackle different instances and aspects of misinformation. We then present a preliminary analysis of player behaviour for the first game, based on data collected during a trial run involving 21 players who attended an outreach event in which we presented the game. At the time of writing, the second game is in active development, therefore we present a reflection on the design process so far, and the implications for the development of video games with educational intent and entertainment ambitions.

II. GAME DESIGN

A. Cash or Card?

The first game is a cashier simulation that deals with the debate around the use of cash vs electronic payments. In many countries during the past decade, the adoption of electronic payments has increased. This has generated a variety of reactions, from worries about the costs and opportunities of the different payment methods, to concerns surrounding the utility

Figure 1. A customer wishes to pay by card while the player prepares to propose cash instead, implying that cash does not incur in fees, a common misconception often exploited in manufacturing disinformation on the topic.
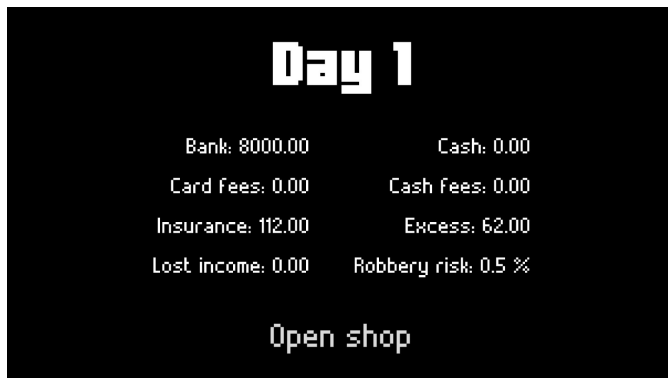

Figure 2. A "day card" is shown at the end of each round to summarize essential information about the game.

of cash for certain demographics, to full-blown conspiracy theories about population control and freedom limitation [2], especially during the COVID-19 pandemic [3].

1) Description: In this game, the player takes the role of a shopkeeper who faces customers waiting to pay for their purchases. Each customer presents a different payment choice and a unique personality that directs their behaviour during the game. By agreeing or disagreeing with the customers through dialogue, the player has to balance income, costs,

and risks, in order to accumulate enough money at the end of the game to pay a sizeable invoice plus any running costs. The information is presented in a neutral way to allow the player to make informed choices without imposing biases (figure 1). At the end of each line of customers, a "day card" is revealed (figure 2) which summarizes the state of the game thus far. If the player accepts the customer's preferred method, the payment is handled accordingly: if payment is in cash, the total is added to the cash register, and the risk of being robbed is updated; if payment is by card, the total is added to the bank account minus a service fee, which is separately accounted for in the interface. The dialogue system goes through several iterations, presenting common objections and responses to either cash or card payments, and can end in one of three ways: payment completed with the customer's preferred method, payment completed with an alternative method, or lost income with the customer leaving in the face of repeated refusals from the player. At the end of each day, if the player has cash in the till, they are asked if they want to bring it to the bank or proceed to the next day. With a bank run, comes the risk of a street robbery, based on how much cash is in the player's possession. If this happens, the player can choose to make an insurance claim which may return part of their stolen cash, minus any excess, and incurs in a higher premium and excess fee for the rest of the game. A robbery can also occur while serving customers, and it is handled in the same way, the only difference being that any remaining customers are skipped. Further details are available in the Game Design Document [4] (GDD).

2) Design process: One of the principles of the EduGames project is the multi-disciplinary collaboration between educators, game designers, and game researchers. As we have previously argued [1], educational video games often fail to capture and engage players in the same way that entertainment video games do. We propose that this might be for several reasons, including that, often times, so-called educational video games are but a faint cartoonish façade for an exercise sheet, developed by, or for, educators, with little, if any, understanding of what makes a game engaging to play. We argue that the synergy of educators, game designers, and game researchers might help in this respect.

In this respect, "Cash or Card?" was developed as a sort of baseline by the first author, wearing all three hats. The game design is based on the fundamental assumption of presenting the information in as fair and balanced a way possible, with every cost, risk, and opportunity clearly laid out. The dialogue is based on some of the most common objections and responses to each payment system, ranging from mild skepticism to hard-core conspiratorial thinking. Such objections are commonly found both online, reported on social media and by news outlets, and offline, among both customers and traders of various persuasions. The type of "work simulation" gameplay is commonly found in video games such as "Papers, Please" [5] and "Not Tonight" [6]: this type of gameplay enables the player to experience a reality, albeit simplified, that they may not be able to experience otherwise, and explore certain aspects of it with due focus, while keeping the experience simple and

enjoyable. We are aware of similar games but, to the best of our knowledge, none focus on the implications of cash vs electronic payments beyond the superficial payment mechanic.

B. Untitled Journalist Game

The second game is an investigative reporting simulation on the theme of source validation. Part of an effective strategy in tackling disinformation is being aware that not all information source are equally reliable. Elements that contribute to make a source unreliable include, for example, the way data is presented in plots, the way correlation and causation are confused, and the more-or-less skillful rhetorical use of logical fallacies to induce the receiver to absorb a distorted version of reality. While some of these are relatively easy to detect, some are more subtle and difficult to defend against.

1) Description: The player takes the role of an investigative journalist who must write three stories on each of ten issues of a weekly magazine, balancing the need for accurate reporting and public appeal in order to keep the publication running, profitable, and reputable. The game aims at educating the player about the evaluation of information sources, and their use in the construction of truth, as well as helping the player to develop their critical thinking skills [7]. The game proposes information to the player through a variety of sources, including interviews, phone calls, e-mails, and archives. The player is tasked with writing news stories picking shards of information from the different sources, evaluating them for biases, logic [8], as well as regarding accuracy of presentation, a common issue with statistics and graphs [9]. The game is in active development and further information is available in the GDD [10].

2) Design process: In keeping with the principles of the EduGames project [1], we formed a team comprising a professional game designer with experience in the field of disinformation, a STEM teacher with experience in public outreach and education on the theme of evaluating information sources and data, a video game developer, and a game researcher.

In two sessions,[1] we worked to (1) identify issues of accuracy and validity of information sources and their impact on mis/disinformation, (2) identify practical skills that, if acquired and refined over time, contribute to mitigating the mis/disinformation effects, (3) identify the pedagogical best practices to enable learners to acquire and practice these skills, (4) map skills and practices to video game mechanics, narrative, setting, style, genre, and so on.

We identified relevant issues and practical skills to include in the game, such as (i) the interpretation of numeric data, especially of proportions, and the issue of misleading data presentation, especially regarding data plots, (ii) issues of reliability, reputation, and provenance of information and information sources, and (iii) aspects of critical thinking such as logical fallacies and causal relations. From these, we quickly converged on the type and setting of the game: an investigative journalism scenario offers an easy way to acquire and test the

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[1]https://edugames.andreafranceschini.org/open-call-videogame/

	Fair	Bias Cash	Electronic
Q5: choice of strategy	**9**	2	5
Q6: presentation of arguments	6	3	**7**
Q7: balance of costs and risks	**8**	7	1
Q8: overall fairness	6	3	**7**

skills and notions identified. In addition, a "work simulation" gameplay enables a certain amount of role-play within a plausibly realistic scenario, so that the player can experiment with different choices and observe the consequences, which is arguably important for learning [11]. We also decided to keep the tone light and humorous to have a broad appeal and maximise the reach of our educational content.

III. ANALYSIS

A. Cash or Card?

We presented the video game to the public during the 202x edition of Science4All,[2] an annual outreach event organized by the University of Padova (Italy) running alongside the European Researchers' Night. During the day, we invited members of the public to play the game for as long as they liked, while the game recorded their actions anonymously. We also asked the players to fill an anonymous questionnaire to record their experience and opinions. In total, we collected valid data from 16 questionnaires and 21 games. Despite the limited numbers, we gathered some useful insight on the players' experience.
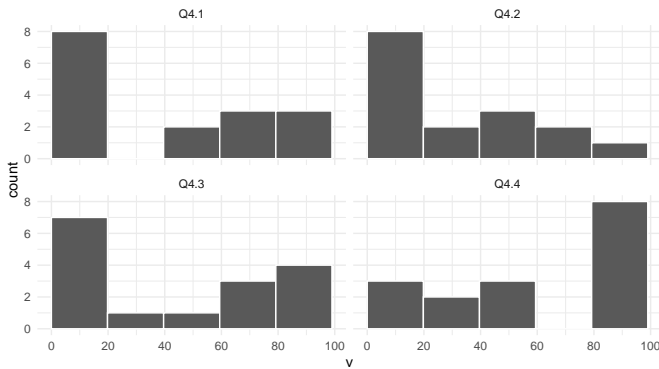

Figure 3. Players' real-life experience with cash and electronic payments. Q4.1: I prefer to pay with cash. Q4.2: Shopkeepers ask me to pay with cash. Q4.3 I push back on cash payment requests. Q4.4: I am satisfied if I ask to pay electronically.

The questionnaire focused on three broad areas: real-life experience with payment methods, pre- and post-game opinions on payment methods, and gameplay experience, including questions based on the Systems Usability Scale [12] (SUS). We first asked the respondents how familiar they were with the differences between various payment methods, and 11 out of

[2]https://science4all.it/

16 declared knowing more than "a fair amount." Recounting their real-life experience with payment methods (figure 3), we found that 10 out of 16 prefer to pay with an electronic method (Q4.1), and 13 reported having being seldom asked to pay with cash by shopkeepers (Q4.2). If they are asked to pay with cash, half of the respondents would not push back (Q4.3). However, if the respondents ask shopkeepers to pay by card, or push back to a cash request, they are generally satisfied (Q4.4).

We inquired about pre- and post-game opinions on different payment methods using open-ended questions, and in informal conversations on the spot. The opinions of the respondents did not change significantly – i.e., if they preferred a certain method before playing the game, they still preferred the same method afterwards. However, several respondents noted that they very seldom thought about the other side, and playing the game made them realize that issues such as payment fees, as well as risks and opportunities, may play a significant role in a shopkeeper's day-to-day. One respondent noted that, despite their preference for card payments, the constant complaints from shopkeepers about high fees eventually made them prefer cash for small purchases. However, it should be noted that many new payment providers may offer extremely low, or even zero fees on small purchases. This is something that the public may not be aware of, and that can be taken advantage of by shopkeepers, as it is a very easy bit of misinformation to pass as true on pretence of authority – e.g., *trust me, what do you know about my job anyway?*" Overall, the respondents appreciated the game, with some remarking positively on the dialogue choices and the variety of arguments discussed, and suggesting possible improvements to the customers' behaviour, such as leaving with the goods but without paying when tired of arguing – i.e., stealing. It should be noted that sometimes customers do leave without paying, but they leave the goods behind – i.e., they do not steal.

Not all the players were affected by robberies, although those who did seemed to enjoy the challenge that this posed, and always reflected before choosing to make an insurance claim, a sign that the contextual information provided was useful and used. Sadly, as it emerged during the day, being robbed twice during a game meant almost guaranteed defeat. On the positive side, while the information panel was not always clear from the beginning to all the players, it invariably became their best aid when assessing their strategy throughout a game. An interesting occurrence, albeit anecdotal, was one young player who approached the game with an all-cash strategy *because I don't want the bank to rob me!*" – something that perhaps they picked up from family or friends, given their young age. However, after the second day, the player decided to bring their cash to the bank, which triggered the "cash fees" indicator, reporting zero until then, to rise accordingly, to their utter surprise. After a quick exchange with their parents, the player changed their strategy to be more accommodating in order to balance the perceived loss, and went on to win the game. Although this case was quite extreme, we have observed changes in strategy during several games. Changes were triggered by a variety of conditions, including robberies,

unexpected fees, and excessive numbers of customers leaving without paying. Robberies were also the most important reason for a player interrupting their game, according to the application logs. Most other recorded games were completed, to either success or failure, but we could not determine clear reasons for those that were not completed and not interrupted by a robbery, based on the application logs.

We asked the respondents how fair or biased they felt the game was, in various respects (see table I). Overall, only 6 out of 16 respondents felt that the game was fair, 7 felt it favoured electronic payments, and 3 felt a bias towards cash, and the same numbers emerge when the question focused on the arguments presented through dialogue. With respect to the balance of costs and risks, 8 respondents thought the game was fair, and only 1 felt a bias towards cash. Interestingly, 9 out of 16 respondents thought the game was fair in how it let them choose their strategy, whereas 5 felt a bias towards electronic payments. Considering that the game was designed with neutrality and fairness in mind, and for lack of further comments from the respondents, we can only speculate as to why the perception of fairness was not higher. First, we cannot exclude that any designer's bias infiltrated the writing and the balancing. Given that the game was designed by one person alone, this is likely, and only confirms that game design is an inherently team-based and multi-disciplinary effort, and this is of critical importance when designing games with educational intent. Second, it may be that the players conflated the presentation with their playing experience, and drew an unfairness conclusion based on the outcome of their games.

Lastly, in 11 out of 16 responses, the SUS score was 72.5 or more, which is above the "passing" score of 68. The lowest score was 50 and the highest was 85, with a median of 72.5, a mean of 70.16 and a standard deviation of 11.67. This is a decent result, but leaves a large margin for improvement, especially when taking into account the respondents' comments and the conversations and observations made during the day.

B. Untitled Journalist Game

As the development of the game is ongoing, we reflect on the process so far. We formed a team as described in section II-B2, and set to work as planned. In the first session, we discussed and agreed on the specific aspects of disinformation that the game would tackle. As both the game designer and the educator had previous experience with issues surrounding information reliability, we quickly converged on the investigative theme. Further discussion on the reliability of information sources, and how such reliability is constructed, destructed, and evaluated, helped us identify investigative journalism as a good scenario in which to explore not only the evaluation of information and sources, but also how reliability is established and manipulated to communicate according to an agenda. In the second session, we focused on practical skills that would help players learn and practice how to evaluate information reliability, and we explored potential game design ideas to embed these skills into the investigative journalism theme already identified. As a result of these two sessions, we produced a preliminary

checklist for the evaluation of the reliability of information and information sources to guide the story and content writing, and drafted a GDD [10].

In retrospect, the composition of the team encompassing the different relevant skill sets (§ II-B2) made for a relatively smooth analysis and design process, where the team felt confidently in control of the project, and able to contribute to it to the best of their capabilities. In particular, the domain expertise provided by the educator, their experience in designing educational activities suitable for the general public, and their experience as a gamer, proved instrumental in navigating such a complex theme and guiding the team to incorporate complex skills into the game design. The presence of a professional game designer with previous experience in the field of information reliability also helped to identify the right game design elements to enable the optimal experience of such a complex skill set. We feel that both the educational intent and the entertainment ambition were equally well represented, in keeping with the principles of the EduGames project. The next step, which is already under way at the time of writing, will be content creation, including plot(s), in-game textual and multimedia content, and a scoring scheme to evaluate the players' choices and determine the outcomes. Following the implementation and playtesting, the game will be rigorously evaluated to establish its efficacy in communicating the educational content, as well as its entertainment and replay values to the players.

IV. CONCLUSION

The fact that specialist expertise and practice can bring more focus and value to a multi-disciplinary design process such as that of a video game should not be a surprise. In fact, this is a foundational principle of the EduGames project. The games we presented in this article show, in their distinct ways, strengths and weaknesses of different approaches to the development of such products. We feel [1] that the reputation of educational video games has been damaged by some products designed and used without due consideration of all the aspects involved in the development of games. Play is fundamentally voluntary, and carries certain expectations regarding the challenge and enjoyment of the experience. If these are disattended, the only way to retain players is to require that they play, which contributes to worsen the experience. With this project, we hope to contribute to spread better practices and, ultimately, to produce "better" educational games.

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