From a Social POV: The Impact of Point of View on Player Behavior, Engagement, and Experience in a Serious Social Simulation Game

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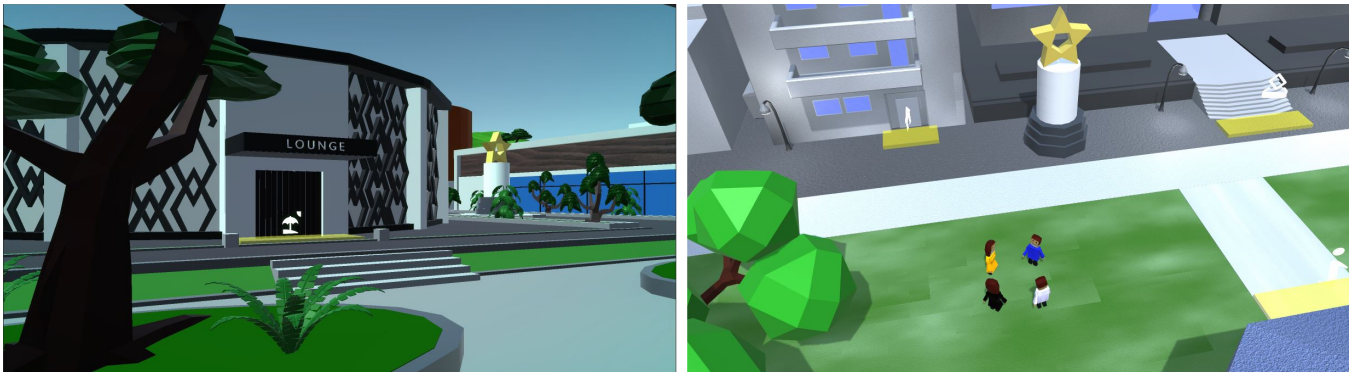

Figure 1: Screenshots of the two clients that we compared in a social simulation game: *FirstPerson* (left) and *TopDown* (right)

ABSTRACT

Multiplayer games with social aspects vary widely regarding client design, e.g., point of view or camera perspective. While design paradigms usually arise from gold standards that are set by previously successful games in the industry, the impact of such paradigms is under-researched for games that serve as scientific instruments, e.g., to research social behavior. Intending to investigate how such games should be designed, we built two multiplayer clients with the same game logic, one using a first-person point of view, while the other includes a top-down camera perspective. Then, we conducted an online user study in which players tested these game clients in extensive multiplayer sessions. Analyzing speech time, in-game logs, questionnaires, and qualitative feedback, we look at the perspectives' impact on player behavior, engagement, and game experience in a scientific or "serious games" context. In addition, we have made our designed game UNISON and both clients available as open source to facilitate future empirical social science research.

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CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**; **Empirical studies in collaborative and social computing**; **Empirical studies in interaction design**.

KEYWORDS

Player-Computer Interaction, Emiprical Sociology, Social Simulation, Gamification, Serious Games, Empirical Studies, Player Perspective, Multiplayer Games, Co-Creativity

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1 INTRODUCTION

While many regard video games as media purely for recreation or entertainment, they can also be used in various serious, pragmatic, or scientific contexts. For instance, in the research fields of serious or transformative games, video games are used for education, business, or health care [46]. In some instances, games are even used to research social behavior and emergent phenomena [20].

However, while designing a commercially successful game might be primarily focused on improving user or game experience by drawing inspiration from previous "genre-defining" titles or game design heuristics, little is known about how to design games that serve as test beds or simulations for social experiments.

In order to create an environment for empirical social sciences and research the impact of design choices on player behavior and experience, we developed a novel online multiplayer game called UNISON over the course of a year with a fluctuating team size of 5-20 developers. UNISON allows players to cooperate to achieve a community goal and improve their economy or individual wealth in a social simulation. The game's critical part is reaching a consensus regarding social measures such as introducing taxes or making education accessible to everyone via voice chat.

Our contributions in this paper are twofold: First, we present and open source the game and all our related code to facilitate future social research in multiplayer digital game environments. Second, we report on our first empirical study (N=39) that we conducted using the game to investigate the impact of point of view (POV, or in-game camera perspective) in a social simulation game context. For this objective, we developed two separate UNISON game clients with the same backend for data storage and processing without altering game mechanics or rules. One client was designed for a first-person point of view (POV), the other for an "isometric" top-down view as it is typically used in real-time strategy games. We conducted a within-subjects experiment to compare both clients, where participants used these clients in separate sessions. Simultaneously, we collected questionnaire data and qualitative (open) feedback. Furthermore, we logged in-game player actions and voice activity.

After related work and presenting the UNISON game and our study methodology in Section 3, we report on the analysis of the gathered data in Section 4. Then, we discuss observed differences between the two game clients' impact on player behavior, engagement, and game experience in Section 5. Our findings include that a top-down POV allowed players to be more efficient regarding the overall game progression toward community goals. Players found organizing, strategizing, and developing distinct social behavior easier. On the other hand, the first-person POV fostered more natural human behavior, resulting in social organization and group behavior that we tend to find in real life. For instance, players showed significantly more political and social participation in the top-down POV client by voting more frequently on petitions. In the first-person client, however, they tended to use voice chat more frequently and developed social strategies that coped with their limited field of view.

2 RELATED WORK

Our research relates to various fields, from game experience research to human-computer interaction and social sciences. In this chapter, we start by taking a glimpse into games beyond entertainment (Subsection 2.1). Then, we first look at games (digital and analog) for social experiments, e.g., in social sciences (Subsection 2.2) and in social multiplayer *video* games research (Subsection 2.3) before delving in creativity-oriented games research (Subsection 2.4). Finally, we look at other work investigating point of view, immersion, and game experience (Subsection 2.5).

2.1 Games Beyond Entertainment

Aside from the billion-dollar gaming industry, games have found their way into application fields such as education [12], or economy simulation [8]. Plenty of research can be found for such serious applications in the fields of serious games [53], transformative games [35], or gamification [19]. While gamification aims to use intrinsic and extrinsic motivational factors to increase users' engagement in various activities [54], transformative games are developed to change players in specific ways that persist beyond the game [35]. Example transformative games foster awareness for other cultures [17], or victims of human trafficking [39] or try to educate on sustainable land management [41].

2.2 Games for Social Experiments

Games, be they digital or analog in their implementation, have been used as scientific tools to research human behavior, theorems from game theory, and more. For instance, in social sciences, games can be combined with agent-based modeling (ABM) to research complex social phenomena [48]. Further examples include the investigation of human behavior in social dilemmas [15], the impact of complexity for social decision making [20] or the research of correlations between values, and player behavior in games [8, 34]. For instance, the ultimatum game is often used to research economic behavior. In this game, players compare their own benefit with that of others and try to avoid a situation where others achieve a much higher outcome than their own [2, 16, 34].

2.3 Multiplayer Video Games with Social Aspects

By design, multiplayer games, such as MMORPGs or cooperative video games, have a social component. Hence, they can be used to study social aspects of games, such as design choices that encourage prosocial ingame behavior [7, 29, 36] or social mechanisms in the context of multiplayer games, e.g., regarding generosity [3], social pressure [30], isolation [18], sex differences [13], the production of social capital [22], or well-being [5]. Another aspect of researching social aspects in multiplayer games is the role or necessity of social behavior in specific games [4]. The study of social effects in multiplayer games also includes games that are integrated into social media or social networks, so-called social network games, and their effects [1, 10, 28].

2.4 Creative Player Participation in Games

A natural extension of the social aspects is game mechanics that allow users to participate creatively. In our case, we allowed users to co-create the societal rules of a multiplayer video game, which is a novel approach to the author's knowledge. Previous related work considered e-participation with game-related elements [49], and the interconnection between serious games and participatory design [27]. Stewart et al. explored the biases that act as an obstacle to participation in "citizen participation games" [44].
The blurring of the distinction between players and designers, as described by David Thue [50], suggests a more participatory framework for game design. Similarly, changing game conditions by users for games like "Baba is you," as described by Charity et al. [9], has become a subject of inquiry more recently.

2.5 Point of View, Immersion, and Game Experience

Design choices such as player perspective (or point of view), game mechanics, asset fidelity, or game narrative and storytelling are rarely researched within serious games contexts. However, these are known to correlate heavily with dimensions of player experience [51], such as immersion, flow, involvement, challenge, and competence.
For instance, Denisova et al. found that a first-person point of view increases player immersion, regardless of their preference [14]. Further, a first-person POV was found to increase the feeling of presence or "being there" in an environment [26]. Lim et al. found that player perspective (first vs. third person) did not affect player arousal, while free avatar choice did [33]. Cicchirillo et al. found increased player enjoyment for users using a third-person viewpoint (as opposed to a first-person POV) and a narrative-based task [11]. Further, a distraction from daily worries [21], and the use of in-game narratives [47] can foster player immersion and enjoyment.

3 METHODOLOGY

We developed two multiplayer game clients for our social simulation game UNISON using Unity[1] and the Photon Engine[2]. The Source code, MacOS and Windows builds can be found online on GitHub[3]. To contextualize findings on players' ingame behavior, we describe the rules and game mechanics of the UNISON game in subsection 3.1. Subsequently, in subsections 3.2, 3.3, and 3.4, we explain the within-subjects experiment, during which both game clients were used as conditions.

3.1 Game Design, Mechanics, and Rules

The multiplayer game UNISON models a real-life situation that people have to deal with. Our game design imposed players with two challenges. On the one hand, it confronted the players with a challenge to survive by gathering resources for themselves. On the other hand, the game allows and implicitly incentivizes social behavior in order to achieve community goals. These goals are establishing a functioning society, improving the in-game economy, and, as a final winning condition or goal, community-funding the development of a vaccination that can end a simulated pandemic.

The situation the players had to deal with consisted of maintaining everyday life in a town environment during a pandemic. This everyday life that the players have to cope with breaks down everyday structures in a model-like way: Players can go to work to earn money, replenish their resources in a mall and acquire useful items, increase their educational level in a school and take care of their mental health in a lounge. In addition, the game offers them the opportunity to influence how their ingame actions and the environmental conditions of the game interact through a co-creative petition system. Using the system, players could design petitions in town hall meetings and lay them out so that players could democratically vote on them. If those petitions were voted on successfully, the rules of the ingame society would change, e.g., by introducing a minimum wage, taxes, or social welfare.
These opportunities for player participation are contrasted by the setting of environmental challenges, which present themselves primarily as inequalities. Players begin each game session with random inequalities: some start with more or fewer resources, learn faster or slower in school and are randomly infected with the virus. The core of the challenge is to deal with these inequalities, which can also spread in the form of infection with a virus. More precisely, the game consisted of five primary elements:

(1) Attributes of player characters (see Table 5 in Appendix B)
(2) Actions players can take to affect these attributes (see Table 7 in Appendix B)
(3) Infrastructure to allow a cooperative way of playing, such as a voice chat and a town hall mechanism
(4) A game cycle, consisting of a day phase of fixed duration and an evening phase of variable duration (see Figure 2)
(5) A total of eight stations, that are implemented as buildings and that offer the execution of ingame actions (e.g. office, school and mall, see Table 6 in Appendix B for a description of each building).

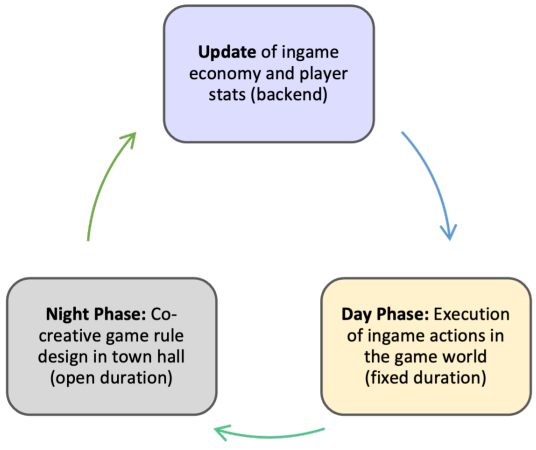

Figure 2: The game loop. One iteration resembles one round.

[1]https://unity.com
[2]https://www.photonengine.com
[3]https://github.com/hcmlab/UNISON

The elements above interact through game rules that we implemented into the game via background scales and fixed calculations. For instance, the action "work" that was available in the office affected player attributes by increasing the money units by $2 \times ED \times OF$, where the office factor OF is a background scale that represents the strength of the game economy and is determined by the overall investments into stocks and a fixed minimum, and ED representing an education level that can be increased by learning in school. "Work" also increases the stress level by a fixed value which may cause health points to deteriorate faster. Tables that list all game actions with their respective ingame locations (Table 7) and the player attributes that they influence (Table 5) can be found in Appendix B. The game mechanics also include an in-game economy, the pandemic mechanism (spreading of the virus infection state), and opportunities to establish various forms of welfare structures through the petition system. Between rounds, the different scales that managed the coupling of actions, player attributes, and environmental conditions, as well as the player attributes, were updated.
In contrast to the night phases, the day phases (see Figure 2) were temporally limited. The game allowed most actions that affect individual wealth and economy only to be conducted during the day phase (see Table 7 in Appendix B). Evening phases were reserved for either recreational actions or for discussing and designing petitions in the town hall. This separated the more "individual" day phases from the more "social" evening phases and thus gave more incentives to socialize during the evening phases.

Figure 3: Players gathering in the town hall at night to discuss petitions for future game rule changes (TopDown Client)

Most players established a routine during the day phases that consisted of working or learning, purchasing items in the mall, and potentially voting. During the evening phases, the players had to choose whether to participate in the town hall meeting. In this case, they had to spend the evening phase in the town hall (see Figure 3 for a screenshot of a town hall meeting). If they chose not to participate, they could not enter the town hall afterward but could freely enter the lounge, home, the market square, or the open spaces between buildings.
The town hall process was multi-parted. During the evening phase, players could deliberate about a petition and close older petitions, while during the day phase, opened petitions were available for voting. Part of this town hall mechanism was the opportunity to create taxation and welfare measures to aid the players and formalize redistribution. However, players were not forced to install these measures or choose some over others.
A more detailed description of the rules and game mechanics can be found on our online Wiki[4].

3.2 Dependent and Independent Variables

In our experiment we altered the independent variable *Game Client Design* in two conditions/steps:

- *FirstPerson:* In this condition, participants used a game client that made use of the first person perspective (see left image in Figure 1).
- *TopDown:* Within the *TopDown* condition, participants used a Game Client that used an "isometric" top-down camera perspective (see right image in Figure 1).

For the *TopDown* client, level layout and game assets were adjusted to work properly from a third-person or "isometric" POV (e.g., roofless building models). In Appendix A, a variety of screenshots are shown to illustrate these differences.
As we conducted a within-subjects experiment, each participant went through both conditions/clients, participating in two game sessions of approximately three hours per client. The order in which participants used the clients in those two game sessions was randomized. During these game sessions, we stored game logs to measure the dependent variables *Single Action Frequencies* (SAF), *Total Action Frequency* (TAF), and *Voice Activity Duration* (VAD). Please refer to Table 1 for more details on these dependent variables. After each game session in condition *FirstPerson* or *TopDown*, participants filled out the core module of Ijsselsteijn's Game Experience Questionnaire (GEQ) [23], which was validated by Johnson et al. [25] and Law et al. [31]. Following their suggestions, we only considered the scales *Competence*, *Sensory and Imaginative Immersion*, *Flow* and *Positive Affect* of the core module. Furthermore, we excluded the question "It was aesthetically pleasing" from calculation of the immersion scale.

3.3 Participants

We acquired 39 participants from Germany through social media, mailing lists, and poster announcements. Twenty of them identified as male, and 16 as female. Participants ranged in age from 19 to 29 (M: 23.3, SD: 2.6). We lost demographic data for three participants. Each participant had access to a Windows or MacOS PC, a stable internet connection, and communication hardware for voice chat. We paid each participant a compensation of 75 Euros for their efforts.

3.4 Study Procedure

To participate, participants had to register to our study online system (a webpage and database), agree to the data privacy form, and leave demographic data (see Figure 4). During this registration, each

[4]https://github.com/hcmlab/UNISON/wiki

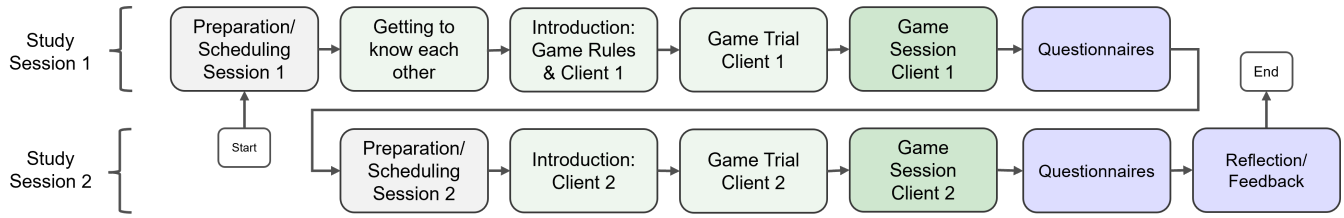

Figure 4: A visualization of the study procedure.

No.	Name/Reference	Abbr.	Measure/Description/Subscales	Range
1	Voice Activity Duration	VAD	Total amount of seconds a player talked on game-related aspects such as game strategy or petitions per round	0-inf. [s]
2	Single Action Frequencies	SAF	Amount of times that players conducted a specific in-game action (see Table 7) in one game round (compare Figure 2)	0-inf.
3	Total Action Frequency	TAF	Total amount of in-game actions that players executed per round (sum of SAF)	0-inf.
4	Scores of the Game Experience Questionnaire [23]	GEQ	We used the validated scales *Competence, Immersion, Flow* and *Positive Affect* of the core module.	1-5

Table 1: Groups of dependent variables that were measured during the experiment.

participant chose a pseudonym that we used in databases and during the study to enable a clean separation between study data and personal information. Before the study, we arranged participants into four groups. Although we planned for similar group sizes, we had group sizes of 7 twice, 12 once, and 13 once (some participants canceled at short notice). For each group, two study sessions (first and second column in Figure 4) were scheduled on two separate days. In order to ensure high measurement sensitivity, the group constellations remained unchanged between both study sessions so that only the game client changed to move between conditions *FirstPerson* and *TopDown* in a randomized order.

In preparation for each study session (lasting about 4 hours each), participants received a mail containing download links to MacOS and Windows builds for the client belonging to their next condition (either *FirstPerson* or *TopDown*) besides installation instructions. Furthermore, they were provided a Link to a Zoom-Meeting room[5] that served as a virtual initial meeting space, from which participants later moved on to the in-game voice chat system of the game clients. Furthermore, before every session, the participants received help to solve technical issues with the help of the study supervisors. Participants were introduced to the game mechanics and rules during both study sessions. Then, they tried out the respective game client in a game trial session before entering the game sessions, during which they played the social simulation game for three hours. Participants concluded each study session by filling out a game experience questionnaire (GEQ) [23]. Additionally to this standard procedure, the first study session started with a "getting to know each other" game, during which the players introduced each other, such that initial social barriers were reduced. The second study session finished with an additional round of reflection and feedback.

[5]https://zoom.us

4 RESULTS

We first report qualitative results for the dependent variables listed in table 1 in subsection 4.1. Then, we report the qualitative feedback in subsection 4.2. Finally, we investigate implications by varying map layouts (subsection 4.3) and analyze differences in player behavior 4.4.1.

4.1 Dependent Variables

We statistically examined all scores and frequencies that were considered as dependent variables (see Table 1) for differences between the *FirstPerson* and *TopDown* clients. Table 2 lists the results for all comparisons, including GEQ. The means and standard deviations for voice activity duration (VAD), total action frequency (TAF) and single action frequencies (SAF) are additionally plotted in Figures 6, 7 and 5 respectively.

All values were tested for normal distribution using the Shapiro-Wilk test [42] and for equal variances using Levene's test [32]. If the sample data examined turned out to be parametric, a paired-sample t-test [45] was used. If either test failed, the Wilcoxon signed-rank test [52] was used. The significance level was set at $alpha = 0.05$. Because we compared the scores in an exploratory manner and without hypotheses, we did not apply a p-value correction as suggested by Rothman [37], and Rubin [38].

The results of the t-tests and Wilcoxon tests are shown in Table 2. As can be seen, we found statistically significant differences in *Total Action Frequency* (M=2.62, SD=0.62 for condition *FirstPerson*, and M=2.93, SD=1.11 for condition *TopDown* with Z=-1.97 and p=0.0491) and the single action frequencies *Learned* (M=1.15, SD=1.0 for condition *FirstPerson*, and M=1.69, SD=0.94 for condition *TopDown* with $t(38)$=-2.88 and p=0.01) and *Voted* (M=5.921, SD=3.06 for condition *FirstPerson*, and M=7.38, SD=5.19 for condition *TopDown* with Z=-2.47 and p=0.01).

Condition	**FirstPerson**	**TopDown**			
Variable	*M(SD)*	*M(SD)*	*t*(df)/*Z*†	*r*	*p*
VAD: Voice Activity Per Round in Seconds†	72.22(82.65)	55.71(56.1)	*Z*=-1.55	-.25	.12
SAF (Office): Work	4.28(1.87)	4.05(1.83)	*t*(38) = 0.6	.09	.6
SAF (School): Learn	**1.15(1.0)**	**1.69(0.94)**	***t*(38) = -2.88**	**.42**	**.01***
SAF (Lounge): Relax†	1.82(1.13)	2.31(1.99)	*Z* = -1.16	-.13	.25
SAF (Mall): Investment in Vaccination Fund†	1.31(1.79)	1.87(2.13)	*Z* = -1.84	-.3	.07
SAF (Mall): Investment in Stocks†	1.69(1.6)	1.64(2.02)	*Z*=-0.34	-.05	.74
SAF (Mall): Gift to other Player†	0.26(0.44)	0.38(0.84)	*Z*=-0.71	-.11	.47
SAF (Town Hall): Vote on Petition†	**5.92(3.06)**	**7.38(5.19)**	***Z*=-2.47**	**-.4**	**.01***
SAF (Mall): Buy Health Check†	0.46(0.67)	0.77(1.21)	*Z*=-1.55	-.25	.12
SAF (Mall): Buy Disinfectant†	0.77(1.1)	0.51(0.96)	*Z*=-1.28	-.21	.2
SAF (Mall): Buy Health Points†	3.77(2.49)	3.15(1.98)	*Z*=-1.14	-.18	.26
TAF: Ingame Actions Per Round†	**2.62(0.62)**	**2.93(1.11)**	***Z*=-1.97**	**-.32**	**.05***
GEQ: Competence	2.77(0.71)	2.9(0.9)	*t*(38) = -0.73	.12	.47
GEQ: Sensory and Imaginative Immersion	3.10(0.80)	3.17(0.75)	*t*(38) = -0.75	.12	.46
GEQ: Flow	3.32(0.88)	3.36(0.92)	*t*(38) = -0.32	.05	.75
GEQ: Positive Affect	2.61(0.79)	2.59(0.77)	*t*(38) = 0.16	.03	.87

† Wilcoxon test applied *p<0.05

Table 2: Results of the two-tailed statistical comparisons. For abbreviations, see Table 1.

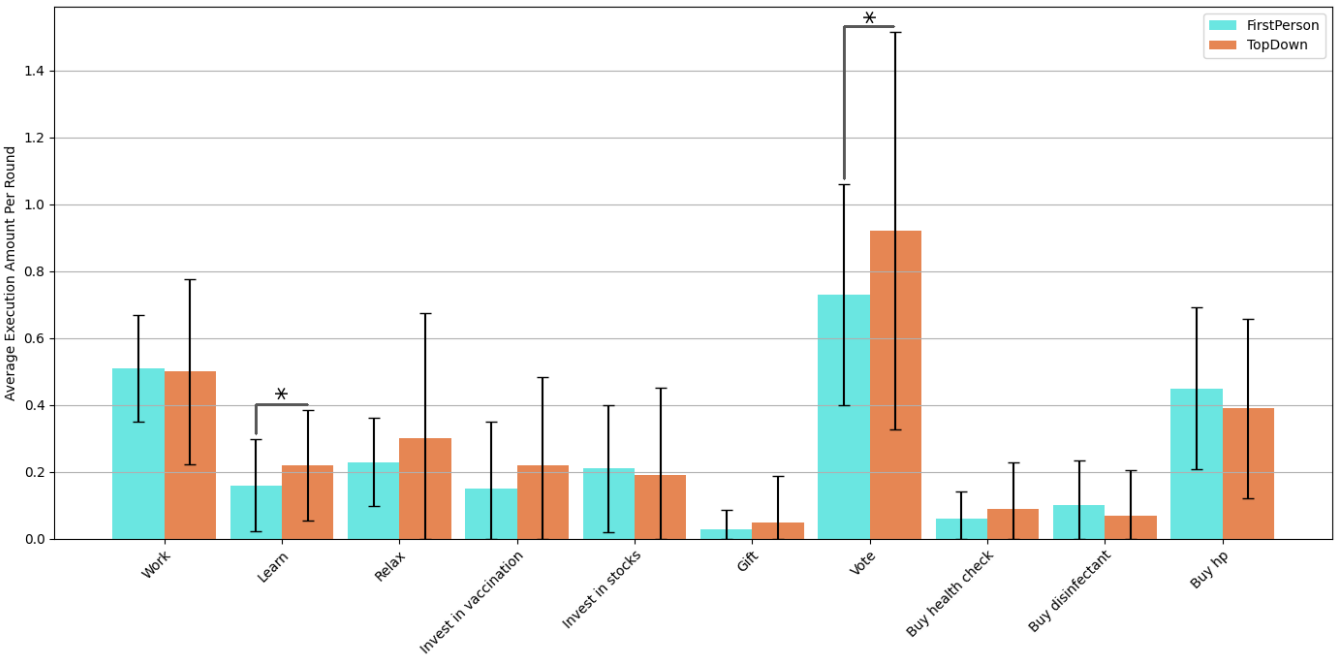

Figure 5: Single Action Frequencies (SAF)

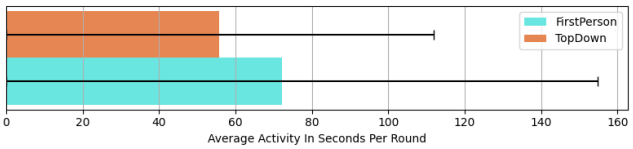

Figure 6: Average Voice Activity Duration (VAD) per round

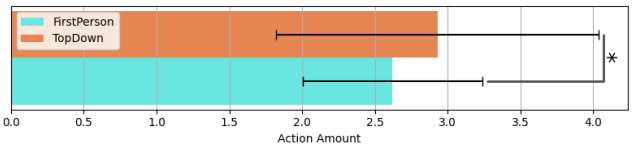

Figure 7: Average Total Action Frequency (TAF) per round

4.2 Qualitative Feedback on the Game Clients

The players were given the opportunity to comment on the differences between the two clients after having played both. To analyze the feedback that participants provided after both game sessions, we conducted an inductive thematic analysis [6] using the MaxQDA software[6]. Codes (i.e., category labels) were derived by highlighting important phrases in the participants' answers and summarizing their semantic content in a short descriptive text. We determined the frequency of code mentions and created word clouds/code clouds depicting opinions of the two clients voiced by participants. Figures 8 and 9 show the most frequently mentioned lemmata, such that their size corresponds to the frequency of mentioning the lemma. Please note that the feedback was about the differences between the two clients and the game itself.

Figure 8: Positive aspects mentioned by the participants regarding the *TopDown* client.

Participants expressed a general preference for the *TopDown* client. Seven participants justified this preference by praising its better overview (see Figure 8), and two participants said it was easier to coordinate in the client. Frequently, this expression of preference was also associated with the characterization of the client as "more intuitive", "more convenient", or "easier". Five participants expressed this opinion.

No player expressed a preference for the first-person perspective. Two players described an increased presence in the game playing the *FirstPerson* client. They also spoke of playing the game from a first-person perspective as a more "private" or "intimate" experience. Yet, one player especially characterized the *FirstPerson* client with a limited field of view (fov) - contrasting the expressed better overview in the *TopDown* client. Two players liked the "map" more by which they primarily meant the overall game world that was optimized for a first person POV.

Figure 9: Positive aspects mentioned by the participants regarding the *FirstPerson* client.

Notably, almost all players expressed their preference for the *TopDown* client, independently of the order in which they played the clients. While the general tendency of players expressed the feeling of being more competent in the second game session due to more experience with the game, we did not observe an effect on their evaluation of the associated clients.

4.3 Building Visit Counts

The two clients used different map layouts to accommodate their respective POV. This could potentially influence the behaviour of the players since some buildings might be located more convenient in one client compared to the other. Therefore, we checked how often the participants visited each building. The results are shown in Table 3. Participants in the *TopDown* client visited more buildings in general which might be because the buildings were closer to each other in this version. The biggest differences are for Home, the Market Square, the Lounge and the Mall. Interestingly, the Lounge was visited way more in the *TopDown* client even though it is the only building that is closer in the *FirstPerson* client. The school is visited slightly more often and is closer to Home in the *TopDown* client. This shorter distance could be part of the reason for the significant difference in the *learn* action. However, the significant difference in the *vote* action does not seem to be affected by the map layout since the Town Hall was visited equally often in both clients.

[6]https://maxqda.com/

Building	Home	Town Hall	Market Square	Lounge	Mall	Office	School
Visit Count (M(SD)), *TopDown*	1.39 (0.41)	0.72 (0.45)	0.69 (0.47)	0.36 (0.28)	0.85 (0.28)	0.56 (0.22)	0.25 (0.13)
Visit Count (M(SD)), *FirstPerson*	1.12 (0.33)	0.71 (0.4)	0.41 (0.29)	0.25 (0.14)	0.77 (0.24)	0.53 (0.18)	0.2 (0.18)
Distance to Home (s), *TopDown*	0	2.5	3	4	2	8	6.5
Distance to Home (s), *FirstPerson*	0	10.5	6	3	9	13	12.5

Table 3: Mean and standard deviations of building visits in both clients per game round and player (rows 1&2), and the walking distance/duration in seconds from home to the buildings (rows 3&4)

Name of Behavior	Short Description	*FirstPerson*	*TopDown*
Assembling	The players of a group or a sizeable subset assemble in front of the town hall or the market square to coordinate and discuss.	13	19
Queuing	Players form a queue in front of buildings they want to enter to avoid infections	9	6
Bouncing	Bouncers are established by the group to ensure that buildings are entered one player at a time	4	1
Dividing the group	The players decide to divide the group into subgroups or coordinate orders by which to enter buildings	1	3
Reporting	One or more individuals are sent into the market square to gather information about the game statistics and report to the assembled group	2	2

Table 4: Ethogram featuring the (total) frequencies of of observed group/social behaviors.

4.4 Behavioural Differences from Observation Protocols

We derived qualitative differences in individual player and social behavior using observation protocols that test supervisors kept during gaming sessions. The findings from analyzing these protocols are discussed in this subsection.

4.4.1 Social behavior differences. To analyze differences and similarities in social behavior between clients, we classified and counted social behaviors, which resulted in an ethogram [24], which can be found in Table 4. Since players did not communicate across groups (or teams), the four groups developed their distinct behavioral patterns individually. There were notable parallels between social behaviors. In principle, all groups that coordinated chose distinct gathering places on the map (compare Figure 10). In the *TopDown* client, this was predominantly the space between market square, town hall, and the mall. Alternatively, they assembled in front of the lounge during the evening phase. In the *FirstPerson* client, players preferred a place close to the market square. Further, in both clients, players coordinated queues in front of buildings to avoid spreading the virus (which was only possible inside buildings). These queues also served as a place for communication via voice chat. Not all groups coordinated their efforts equally. Particularly the fourth group did not coordinate their efforts, which resulted in this group not undertaking collective actions and displaying social behavioral patterns.

The behavioral pattern of "bouncing" was a behavioral innovation shown exclusively in one group and tied to the *FirstPerson* perspective. It is noteworthy that that this group played the *FirstPerson* client first. In its second session playing the *TopDown* client, the same group tried to revive this behavior but did not maintain it. The "assembling" and the "queuing" behaviors were alternatives. When groups queued in front of buildings, they tended to coordinate while standing in the queue and showed no attempt to assemble before or after (again) deliberately. However, in individual cases, the queues disintegrated to mere assemblies - particularly during the evening phase, once all players had entered the lounge.

Figure 10: Players gathering on a popular meeting point in the *TopDown* client

4.4.2 Behavioural differences of individual players. The most apparent difference in individual player behavior was their style of movement. For instance, substantially more players were observed in remote locations of the map and trying to "break the map" by

looking for gaps or cracks in the game world in the *FirstPerson* client. The behavior of looking for ways to climb onto buildings and climbing on buildings occurred in the *FirstPerson* client more often than in the *TopDown* client. This behavior also coincided with significantly more comments on the game world and the map in the context of the *FirstPerson* client than in the context of the *TopDown* client via voice chat. Players, e.g., commented on "the beauty of the ocean" or the architecture. This environmental focus was contrasted by "circling" behavior, which we predominantly observed in *TopDown* client: While assembling or standing in line, players often did not stand still but ran around other players' avatars. These observations indicate that behaviors that do not serve ingame objectives seemed to be aimed at other players' avatars in the *TopDown* client while aimed at the game world in the *FirstPerson* client.

5 DISCUSSION

5.1 The Top-Down POV Benefited Social Organization and Participation

For the *TopDown* Client, we observed a significant increase in total action frequency (TAF) compared to the *FirstPerson* client. Hence, players were more active in executing actions that affected the game state and served the in-game economy and the overall community goal. When looking at the single action frequencies (see Figure 5), the most considerable differences can be observed for the actions *learn* and *vote*. The increased learning frequency can partially be explained by the altered map layout, which resulted in a shorter path from home (the spawning location) to school in the *TopDown* client (see Table 3). However, since the town hall was visited almost identically as often within both game clients, this effect cannot explain the significantly increased voting behavior. Instead, we attribute this increased social participation and co-creativity to an increased focus on community-oriented and -driven behavior, also reflected in an intensified group formation behavior (see the ethogram in Table 4). Since the primary goals of the UNISON game are community-oriented, this faster progression was also positively reflected by players, who expressed their preferences for the *TopDown* client and described it as "more convenient" and "more intuitive" (see Figure 8) while also providing a "better overview". The first-person perspective, on the other hand, was considered to be an obstacle in the realization of the game objectives by the participants.

Furthermore, we think that the choice of POV might have communicated affordances. While games primarily focused on strategy are usually played from a top-down POV, games focused on immersive experiences (e.g., horror games) are usually played in a first-person POV. Hence, users that were confronted with the top-down POV might have had strategy-related associations and started to strategize earlier. However, verifying this would require further testing.

5.2 The First-Person POV Fostered Authentic Human Behavior

In some scenarios, e.g., game theory-related empirical social research, maximizing efficiency for achieving community goals, such as observed in our *TopDown* client, might be of primary value. However, other research endeavors might instead focus on observing natural human behavior and how it may, for instance, invoke emergent social implications. Our observations show that a *FirstPerson* POV can be an adequate perspective in such projects, focusing more on individual perception.

This condition more closely resembles how humans perceive the real world and shows behaviors that emerge as a result of limitation that would occur in natural human interactions. For instance, the "Bouncing" behavioral pattern (see Table 4) was a reaction to a problem that occurred only in the *FirstPerson* client with its limited view: Individual players took over the duty to check if someone had entered a building to prevent spreading of the virus. This was only in *FirstPerson* client, where turning the perspective would lead to an interruption in monitoring the entry of a building. This is similar to the real world, where we also saw the introduction of bouncers during the COVID-19 pandemic. In the *TopDown* client on the other hand - due to the perspective and the section of the game that could be perceived - it was possible to monitor the entry of buildings, even though attention was primarily occupied with a different aspect. Such behavioral innovations are prototypical; other differences in the player's behavior can be explained similarly. The increased amount of voice activation and decreased number of actions in the *FirstPerson* client can also be attributed to the smaller section of visual information perceived in the *FirstPerson* client, as it meant that players did not see other players and thus grouped in smaller groups and thus individually talked more - in contrast to larger gatherings, where the individual players would talk less.

5.3 Game Experience Remained Largely Unaffected

In the qualitative Feedback, players reported an increased feeling of privacy and presence (see Figure 9) in the *FirstPerson* client, which is in line with the findings of Kallinen et al. [26]. This feeling of "being there" in the environment might have increased the participants' willingness to communicate with players as they also felt an increased sensation of "being there with" other players. This feeling of co-presence or social presence was found to correlate with overall presence in virtual environments in other studies [40, 43]. However, we did not observe any significant differences between the conditions in the validated scores of the Game Experience Questionnaire core module, including *Sensory and Imaginative Immersion*. This circumstance surprised us, as we expected increased immersion ratings for the *FirstPerson* condition, based on findings by Denisova et al. [14]. Game Experience scores overall showed a low level for *Positive Affect* and *Competence*, which is expected in a complex (serious) game that is likely demanding to learn within two gaming sessions and that was not designed for entertainment purposes. As one client did not fall off significantly in any GEQ-score compared to the other, we regard these results as an indicator for comparability between the two clients from a user perspective, which makes Game Experience-related confounding variables for our significant observations more unlikely. However, we note our relatively small sample size as a limitation.

5.4 UNISON has Proven to be a Useful Tool for Empirical Studies

With approximately 270 hours of total playing time within our first study, UNISON, and the two clients we developed proved to be practicable tools for internet-based empirical social or HCI-related experiments. However, the road to this point was extensive, including pilot studies, play tests, and design iterations. Over the development period, we added quality-of-life features such as consoles, live error reports, a "spectator" and administration view for test supervisors, and global and local voice chat rooms. Still, sole reliance on the in-game voice chat remained unpractical, as we needed to assist players with installing clients for their respective operating systems (Windows and MacOS) besides introducing them to the overall game mechanics, incentives, and controls. Hence, we used an online conferencing tool as a meeting hub and a fallback for communication.

By sharing our game with the community we hope that researchers will help to improve it further and use it for their research, be it for empirical social sciences, human-game interaction studies, or human-computer interaction research.

6 CONCLUSION

In this paper, we reported on a study investigating the impact of the point of view in a serious social simulation game on player behavior, engagement, and game experience. Our findings indicate that using a top-down POV is more suitable for studies that aim to enhance player efficiency in pursuing community-oriented objectives. This POV promotes strategic gameplay and incentivizes social organization and participation. In contrast, our results suggest that a first-person perspective is more suitable for researching natural human behavior as it reflects how individuals perceive the world and generates behaviors that arise from limitations found in natural human interactions.

The study was conducted using the online multiplayer game UNISON that we created as an environment for empirical social sciences research. The fact that we were able to conduct a large-scale online user study within this game and our consequent findings demonstrate the potential usefulness of UNISON for other researchers.

In future studies, we plan to explore correlations between player values and behavior and analyze group dynamics and strategies during gameplay. By doing so, we aim to further assess the potential of online multiplayer games as a tool for empirical studies investigating social phenomena, individual behavior, and emergent social behaviors for value constellations that represent different societies from around the globe.

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A GAME CLIENT SCREENSHOTS

Figure 11 shows some screenshots of the two clients.

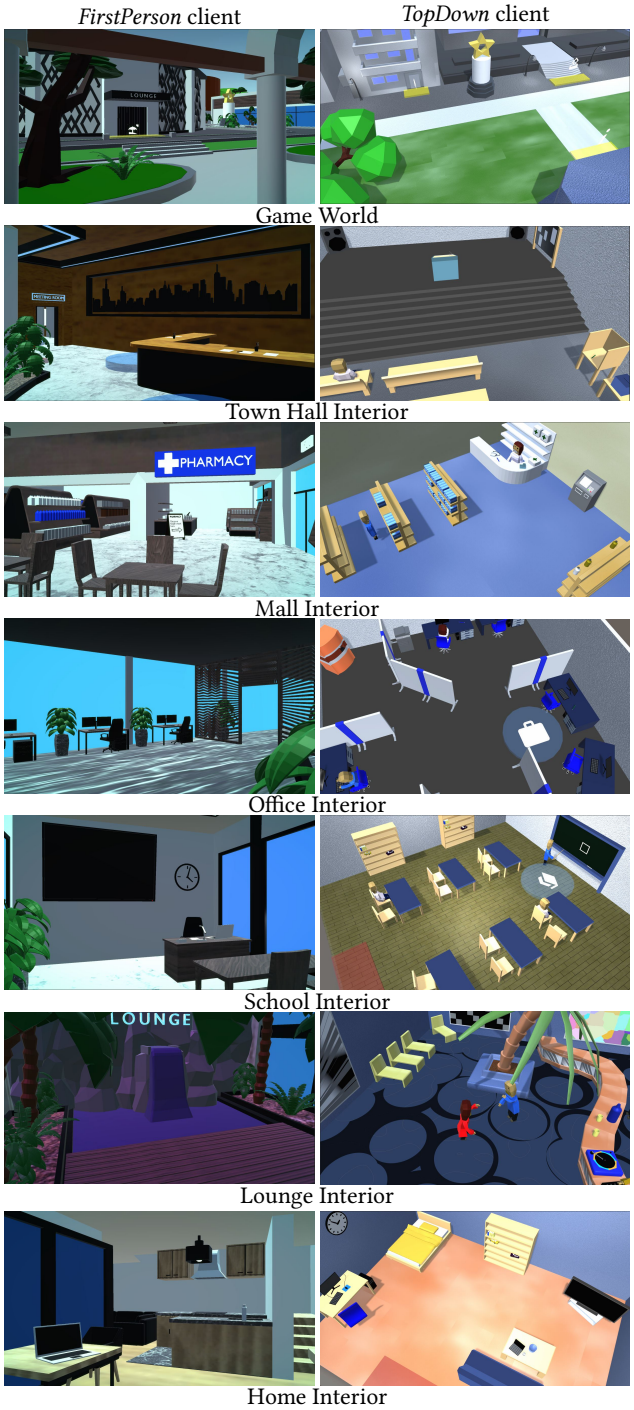

Figure 11: Screenshots of the two clients.

Name	Initial Setup	Note
Money Units (MU)	Random (normal distribution)	Player wealth, can be increased through working (int)
Health Points (HP)	Random (normal distribution)	Represents player health and reflects cost of living (int)
Infection Status	Random (Bernoulli)	Player virus infection state (boolean)
Learning Speed	Random (normal distribution)	Determines how much education level increases on learning (int)
Stress Level	0	Adds an additional penalty on health point loss, increases through working (int)
Eduation Level (EL)	1	Affects the income (int)

Table 5: Player attributes

Name	Available Actions	Description
Home	-	Each round, all players spawn at home. Home offers access to a manual on game rules and the buildings/stations through an integrated web browser. Home can also be used for isolation to prevent the spreading of the virus.
Office	Work	Each day phase, players can either work at the office to gain money based on their education level or go to school to increase their education level.
School	Learn	If players want to invest in better future income, they can increase their education level once per day by learning in school.
Lounge	Relax	The lounge can be accessed day and night. It serves as a social hub in the evening phases if no petitions need to be created or discussed. Furthermore, the "relax" action can be used to reduce one's stress level.
Town Hall	Create Petition, Vote on Petition	The town hall is the space for social participation. Game rule changes can be discussed, formulated as a petition through specific UI, and then opened for voting. Votes can then be placed starting from the next day phase.
Mall	Buy HP, Buy Disinfectant, Buy Health Check, Gift, Invest in Stocks, Invest in Vaccination Fund	The mall aggregates in-game actions that are associated with a bank (money investment and transfer), a grocery store (buy HP) and a pharmacy (buy disinfectant and health checks).
Market Square	–	The market square acts as a social hub during the day and provides information on the in-game economy and infection numbers through graphs that are displayed through an in-game browser.
Hospital	–	The hospital is a special building that can only be entered when a player's HP reaches zero. They then spend two rounds (day/night phases) in the hospital until they are recovered.

Table 6: Buildings (Stations)

Action	Location	Phase	Effect
Work	Office	Day	Increases the money units and the stress level
Learn	School	Day	Increases the education and stress level, but costs money units
Buy Health Points	Mall	Day	Increases health points, but costs money units
Buy Disinfectant	Mall	Day	Grants immunity to infection for the round, but costs money units
Buy Health Check	Mall	Day	Grants details on health status, including stress level, infection status and HP
Gift to other Player	Mall	Day	Transfers Money Units (MU) to another player as a gift
Invest in stocks	Mall	Day	Grants a dividend in money units, boosts the economy, but costs money units
Invest in Vaccination Fund	Mall	Day	Increases the chance to find a vaccine, but costs money units
Vote on Petition	Town hall	Day	Decision comes into effect or not
Relax	Lounge	Evening	Decreases the stress level, but costs money
Create Petition	Town Hall	Evening	Making a petition available for voting

Table 7: Selected game actions

B ADDITIONAL GAME RULE TABLES

Table 5 lists player attributes, Table 6 lists the stations that are implemented as buildings in the clients and Table 7 shows the actions that players could use to influence attributes in the respective buildings.