Reward-Mediated Individual and Altruistic Behavior

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Abstract. Recent research has taken a particular interest in observing the dynamics between individual and altruistic behavior. This is a commonly approached problem when reasoning about social dilemmas, which have a plethora of real-world counterparts in the fields of education, health, and economics. Weighing how incentives influence in-game behavior, our study examines individual and altruistic interactions in the context of a game task, by analyzing the players' strategies and interaction motives when facing different reward attribution functions. Consequently, a model for interaction motives is proposed, with the premise that the motives for interactions can be defined as a continuous space, ranging from self-oriented (associated with individual behaviors) to others-oriented (associated with altruistic behaviors). To evaluate the promotion of individual and altruistic behavior, we leverage Message Across, an *in-loco* two-player videogame with adaptable score attribution systems. We conducted a user testing phase (N = 66) to verify to what extent individual and altruistic score functions led players to vary their strategies and interaction motives orientations. Our results indicate that both of these metrics varied significantly and according to our expectations, leading us to believe in the suitability of applying an incentive-based strategy to moderate the emergence of in-game behavior perceivable as individual or altruistic.

Keywords: Interaction style · Reward system · Message Across · Serious games · Behavior promotion

1 Introduction

Since the last century, researchers have studied the dynamics between individual and altruistic behavior [10, 14]. This aspect is an important target of analysis in social dilemma implementations, such as the prisoner's dilemma [16, 22] or the public goods game [6, 12, 20]. In these scenarios, subjects have to decide between acting with self or collective interest, thus focusing or not in the development of others' welfare. Along social dilemmas, this *self and others* paradigm is also predominant in education. Namely, the theory of Self-determination [4, 21, 23] distinguishes between several levels of motivation, such as intrinsic motivation - related to self definition of goals and satisfaction from self development, and extrinsic motivation – influenced by external factors like rewards, approval or competition.

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Over the years, research on behavior promotion has taken particular interest in the use of games to change players' long-term commitments [3, 24, 27], for instance, to develop environment sustainability awareness [15, 19] or non-sedentary behaviors [1, 9]. As an interactive medium, games allow the promotion of feelings of competence through feedback and rewards, and support relatedness through social interactions such as competition and cooperation [21]. Therefore, we credit that promoting in-game behavior can be a useful path to approach aspects of attitude change such as the motives which drive interactions, given the growing impact of games in players' lives [2]. This line of research can help to inspire the parameterization of systems aiming to balance or enhance individual and altruistic facets of behavior among people with different individual or cultural backgrounds, as these intrinsic characteristics might be able to drive distinct game strategies [20]. Researchers have focused on studying how the attribution of different rewards (ranging from simple scores to collectibles, resources, item granting systems, achievement systems, feedback messages, etc.) [4, 11] affect player experience. In fact, although some studies embraced reward-based behavior promotion, there is the consensus that further research in the motives upon interpersonal choice behavior is still needed [16, 28]. Altogether, this work contemplates the following research question:

How can rewards be used to mediate individual and altruistic in-game behavior?

In particular, our hypothesis is that, by changing in-game rewards, we can alter the behaviors of players at an in-game task level. The rewards are, in our case, simply an instrument used to guide players towards an individual or altruistic behavior, as perceived in the context of a task. In other words, they act as incentives for players to engage in certain in-game behaviors.

To answer this problem, we define a model for interaction motives orientation and implemented it in Message Across, an *in-loco* two-player word matching game, with two versions of the score attribution system, aimed at orienting the players' interactions to either themselves or others. In the particular example of Message Across, the task is the completion of a word. Using this game, we conducted user tests where pairs of participants played the different versions without knowing what score systems were being deployed at each moment. We extracted the players' strategies and scores, as well as their self-reported orientation of interaction motives (between self-oriented and others-oriented) to find answers to our research question.

The remaining of the paper is organized as follows: in the next sections, we explore several interaction styles, as well as techniques to promote in-game behavior; then, we describe how we implemented individual and altruistic Message Across versions; afterwards, we include the evaluation process, and present and discuss the empirical results; finally, we summarize the work and finish with future directions.

2 From Theory to a Model of Interaction Motives

We started our analysis by observing which behavior mediation techniques were identified in social dilemmas scenarios. A significant amount of research deploying social dilemmas focuses on collaborative interactions, studying how can higher levels of cooperation and altruism be fostered. Hilbe et al. [12] theoretically examined several strategies to sustain cooperation in the public goods game and volunteers social dilemma, including generalized variants of Tit-for-Tat and Win-Stay Lose-Shift. More importantly, to

define such strategies, the authors identified three particular sub-classes of strategies: (i) the fair-neutral strategy which ensures individual payoff is aligned with the average payoff of the other group members; (ii) the extortionate strategy which, in scenarios where mutual defection leads to the lowest group payoff, is based on ensuring that individual payoffs are above average (related to free-riding and individual focus, not concerning for the others); and (iii) the generous strategy which, in scenarios where mutual cooperation is the social optimum, consists in letting co-players gain higher payoffs. We find extortionate and generous strategies inspiring in mixed interactions, as they reflect two opposite poles. In one pole, there is an individual motive for interaction, devaluing attention for others, and in the other pole there is an others-oriented motive for interaction, devaluing self consequences. Following this line of thought, we further analyzed theories regarding these two opposite ideas.

Hoping to exclusively study individual motives for interaction, we analyzed several work regarding self-improvement. Self-Improvement can be defined as a conscious desire to improve self ability [25], a result of self evaluation. Numerous research focused on what can influence this behavior, and how it emerges [5, 14, 18, 25]. Task-based scenarios as games may ease the emergence of self-improvement, as task-related self-enhancement – the tendency to maintain positive self-regard – seems to effectively facilitate action taking and overall task performance, as opposed to non task-related self-enhancement [14, 18]. Following this line of thought, we believe that multiplayer games might foster self-improvement through their actions, by rewarding players when embracing choices which individually improve themselves, without directly taking into consideration the actions of other players.

In order to study others-oriented motives for interaction, we examined multiple theories related to altruism. Seelig and Rosof present several categorizations and review several research regarding altruism [26], from which we highlight Kitayama's scale of altruism as masochism [13]. On a study related to the dual nature of the feminine ideal in Japanese culture, the author defines altruism as a continuum between two facets. While the first facet can be interpreted as an interaction consisting of mutual help between peers, the second facet happens when people feel that it is important to do good for others, even if it means the process will not be pleasant for them. In other words, people engaging in the second type of altruism are *exclusively* motivated by others, without even trying to minimize the negative consequences that helping others might bring to themselves. Although some research, such as the works just presented, also associate this effect to *Pathological Altruism*, we will refer to this interaction style as *Extreme Altruism*. We believe that multiplayer games might reflect this interaction style through their actions as well, by rewarding players when embracing choices which exclusively improve others.

2.1 Model of Interaction Motives

Related research allowed us to extract two extreme behaviors: *Self-Improvement* and *Extreme Altruism*. In this work we deploy both these ends of the spectrum, placing them as opposite poles of a continuous interactions motive space (Fig. 1). This space allows us to examine to what extent players interactions are individually or altruistically motivated. In one pole, we have a **Self-oriented** motive for interaction, devaluing attention for

others, and in the other pole there is an **Others-oriented** motive for interaction, without valuing self consequences. Based on this interaction motives model, we deemed that an adequate indicator of the emergence of individual and altruistic behavior (besides verifying players' game strategies and final scores) was to acquire self-reported motives for interaction, comprehended between **Self-oriented** and **Others-oriented.**

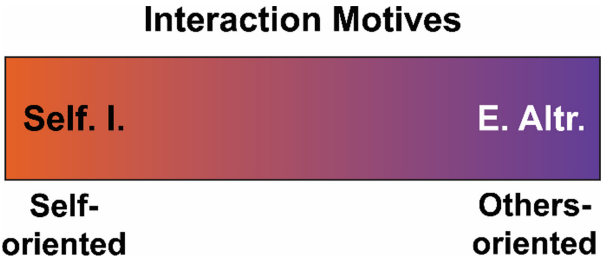

Fig. 1. Continuous space organizing interaction motives, between Self-oriented and Others-oriented. Self-oriented motives can be associated to the *Self-Improvement* behavior, and Others-oriented motives can be associated to *Extreme Altruism.*

2.2 Mediating Individual and Altruistic In-Game Behavior

After constructing our interaction motives model, we examined work specifically devoted to behavior promotion. For instance, Vegt et al. [28] showed that, while subjects played a multiplayer game in separate rooms, different game rules could generate distinct reported player experiences and observable distinct player behaviors, further discriminated into four patterns: expected patterns of helping and ignoring, and unexpected patterns of agreeing and obstructing. Returning to social dilemma scenarios, Rosen and Haaga [22] managed to induce higher levels of cooperation in small groups of four to eight subjects playing a prisoner's dilemma (higher number of cooperative game actions, and higher altruistic attitudes toward a specific dilemma story), by applying message-based persuasion methods. To facilitate cooperation, instead of neutrally defining the nature of the dilemma, two explanations were applied: either the positive effects of collaboration and negative effects of free-riding were directly exposed for the considered social dilemma problem; or subjects were told that the same task was presented to various professionals at a conflict-resolution conference, who agreed that *cooperation was the only appropriate response to the conflict and was necessary for societal harmony in general*. Galbiati and Vertova on the other hand, studied the promotion of cooperation in a repeated public goods game through contribution obligations - the minimum each player had to contribute to the public good to have a chance of being rewarded [6]. The authors concluded that although obligations *per se* could not sustain cooperation over time, higher obligations led players, in average, to focus more in cooperating, while not reducing as much their cooperative contributions through the course of the game. Also, unexpected obligation increases meant cooperation levels increases. Following our research question, we also analyzed several game-oriented reward attribution approaches which we believe to be suitable for in-game behavior promotion, ranging from simple scores to collectibles,

resources, item granting systems, achievement systems, player dossiers, and feedback messages [4, 11, 17, 21]. In particular, rewards in the form of scores awaken interest, as they are simple to deploy and allow easy comparisons between players [11, 16, 21]. For instance, McClintock et al. showed that players choices (and possibly the dominance of motives behind such choices) could be manipulated in a modified prisoner's dilemma game, by varying the score display methodology (display of own outcome or both own and other player's outcome) and monetary reward parameters [16]. Notably, more competitive behavior was observed when players were able to compare their and others' scores and in a low – as opposed to a high-reward condition, even though players were separated via a visual barrier and disallowed to communicate. Besides their simple deployment, scores also provide flexibility when parameterizing behavior, as they may not directly influence the way game actions and mechanics operate for a player to progress in a task. Thus, we chose this route for behavior promotion.

3 Solution Description

As previously commented, we used a game called Message Across[1] (Fig. 2) to examine the dynamics of players' interactions. In the course of the game, players try to complete words as they advance through the levels. Each level presents two words on the top of the screen, one for each player. Because we wanted words which were easily understood and completed, only four letter words with two letters in common were considered in our experiments. In the middle of the screen, the game presents a track containing three lanes where letters move towards players. The track also contains two markers, one for each player, arranged at the bottom.

Fig. 2. Screenshot of the game message across.

In order to select a letter, a player has to move his/her marker to the lane where the letter is sliding, and select an action. When the letter collides with the marker, the

[1] The implementation of the game is available online, hosted in the platform *GitHub*: https://github.com/SamGomes/message-across.

selected action is performed. If two players are in the same lane, only the first player that selects an action is able to perform it. Players can perform one of two possible actions at each moment. They can either **take the letter** or **give the letter** to the other player. The objective of each player is to **obtain the highest score**. In our experiments, each player could perform a maximum of four actions per level, and a level finished whenever both players had no actions left to perform. We believe that a limit of four possible actions exacerbated the players' need to search for meaningful strategies.

After reviewing related research, we built a model for interaction motives bounded between *Self-Improvement* and *Extreme Altruism*. To foster these two extreme behaviors in-game, we developed two divergent scoring versions:

- The **Self-Improvement** version exclusively rewarded 10 points to players who took letters that were useful for them;
- The **Extremely Altruistic** version exclusively rewarded 10 points to players who gave letters needed by the other players.

The duality between these strategies is apparent, as the first rewards players which act for their own task completion, disregarding the actions of other players, while the second one rewards players who exclusively help in others' task completion. Given that these reward versions were developed to allow players to understand the game in different manners, we predicted two distinct trends, which we translated to two hypotheses. Firstly, the players would embrace different, opposite strategies. These strategies would then allow the game to orient the players' interactions towards the opposite poles defined in our interaction motives model:

H1: The Self-Improvement version will implicitly drive players to perform a high number of takes and the Extremely Altruistic version will drive players to perform a high number of gives.

H2: The Self-Improvement version will implicitly drive players to report self-oriented interaction motives, and the Extremely Altruistic version will implicitly drive players to report others-oriented interaction motives.

4 Experimental Setup

In order to evaluate the effectiveness of our approach, we performed several experiments, approved by the Ethics committee of our institute, where pairs of participants played through the different versions of Message Across. In each test, the game versions were obfuscated by using letters to represent them, and the order of presentation of the game versions was uniformly randomized between groups to avoid any potential learning effects. **Therefore, throughout the session, the participants did not know how the game was being scored and had to figure that out by themselves.**

A touch screen was included in the experiment room for players to interact with the game. Two computers were used for our experiments: one computer executed the game and other computer allowed players to self-report their interaction motives orientation through a questionnaire. A Go-Pro video camera[2] was also included for observing player movements and in-game activity and to help remedy some possible inconsistencies in

[2] https://gopro.com/en/us/

automatic data collection. The camera was attached to a tripod and positioned approximately 50 cm in front of the touch screen. The camera view of our setup can be observed in Fig. 3.

4.1 Sample

Participants were recruited through standard convenience sampling procedures including direct contact and word of mouth. Subjects included anyone interested in participating if they were at least 18 years old. There were no potential risks and no anticipated benefits to individual participants. We conducted a total of 37 tests in a college laboratory. Participation was open to outside visitors, which meant that not all participants were college students. After data analysis, four tests did not meet quality criteria, e.g. in-game data not recorded or questionnaires with missing answers. Thus, our final data set comprised 33 tests, a total of 66 participants (37 males, 29 females) between 18 and 40 years old ($M = 23.12$; $SD = 4.09$).

4.2 Procedure

The experiment operated as follows: (i) Firstly, participants were informed about the experiment and invited to sign a mandatory consent form. They were also informed that they could stop the experiment at any time; (ii) After signing the consent form, both participants were asked to move next to the touchscreen (as seen in Fig. 3) and received a tutorial regarding in-game mechanics and possible actions to perform. Additionally, participants were allowed to play up to seven levels without being rewarded for any *give* or *take* action, in order to support the development of fluent playing skills; (iii) When both participants felt comfortable with the game mechanics, they played the two game versions in random order with each gaming session requiring the completion of seven levels. After each gaming session, participants were asked to complete questionnaires measuring their interaction motives orientation regarding that session. At the end of the experiment, participants received a candy bar as a compensation for their time.

Fig. 3. Camera view of a group playing Message Across during our experiments.

4.3 Variables

One independent variable was considered, **Score Attribution System** with two possible values: {*Self.I., E.Altr.*}. Three dependent (within-subjects) variables were considered:

- **Mean number of takes**, the mean number of letters a player acquired for himself/herself in each level. The value space is [0, 4], as each player could perform at most four actions (gives or takes) per level. This variable was measured by analyzing game logs;
- **Final game score**, the score a player obtained at the end of playing each version of the game. This variable was acknowledged to support the differences observed by the mean number of takes, and was obtained through the game logs as well;
- **Interaction motives orientation**, which measured the orientation of motives behind a player's interactions, between self-oriented and others-oriented. This measure was obtained at the end of each played version, through a question "Who did I focus while playing this version?", answered using a seven-point Likert scale ranging from "Me" to "The other player". In our data analysis, we considered a value range between [-3,3], in which -3 symbolized full self-oriented, and 3 symbolized full others-oriented interaction motives.

5 Results

5.1 Mean Number of Takes and Final Score

The distribution of mean number of takes is plotted in Fig. 4. Shapiro-Wilk tests reported a non-normal distribution regarding the mean number of takes values. Therefore, a Wilcoxon paired signed-rank test was performed to compare the two score systems, at the level of significance $p = 0.05$. The number of performed take actions changed highly significantly between the two score strategies, with a large effect size ($Z = 7.06$, $p < < 0.001$, $r = 0.87$). Furthermore, if we analyze the distribution of the data, we can observe that players of *Self-Improvement* score systems performed, on average, a high (near maximum) number of takes ($M \approx 3.64$, $Mdn \approx 3.86$, $SD \approx 0.37$), while oppositely, players of the *Extremely Altruistic* score system performed a low number of takes ($M \approx 0.58$, $Mdn \approx 0.57$, $SD \approx 0.42$). Even though the differences are clearly noticeable, we can also observe that the *Self-Improvement* data is closer to the maximum number of takes, than the altruistic version is to the minimum. Based on our experiments' observations, we argue that this effect was possibly caused by the fact that while searching for the most rewarding strategies, players found easier or more natural to start by taking letters for themselves, which resulted in differences in the final scores, notably slightly higher *Self-Improvement* values (Fig. 5). This tendency may also relate to the assumptions which players initially make of the game (in this game, they might initially be compelled to compete). This trend should be more extensively explored in future studies. *In summary, these results support that players implicitly understood that the optimal strategy while playing the Self-Improvement version was to take letters, and the optimal strategy while playing the Extremely Altruistic version was to give letters, even though these strategies were unknown throughout the game execution. However, while playing the game, the players seemed compelled to take letters for themselves in both conditions, which may relate to their initial assumptions.*

5.2 Interaction Motives Orientation

The distribution of the interaction motive orientation values is plotted in Fig. 6. Shapiro-Wilk tests reported a non-normal distribution regarding the motives orientation values. Therefore, a Wilcoxon paired signed-rank test was conducted, at the level of significance $p = 0.05$. The motive orientation values also varied highly significantly between the two score attribution strategies, with a large effect size (Z = -5.73, $p <$ < 0.001, r = 0.71). By observing the distribution of the data, we can conclude that *Self-Improvement* responses were driven towards "Self-oriented" ($M \approx$ -1.76, Mdn = -2, $SD \approx$ 1.43), opposite to *Extreme Altruism* responses, which were approximated towards "Others-oriented" ($M \approx$ 1.12, Mdn = 2, $SD \approx$ 2.30). However, similar to the aforementioned results, there was a natural tendency for the players of *Extreme Altruism* to deviate from the expected value range, in this case the full "Others-oriented" motives, which may also have been an effect of the players' initial assumptions. *Summing up, these results indicate that, as expected, the Self-Improvement version was perceived as allowing players to improve their gameplay, and the Extremely Altruistic score system was perceived as a helping scenario implying that players' interactions were motivated by other players. However, these results reflected a natural tendency for Extreme Altruism players to deviate from the expected, full "Others-oriented" motives, which may also relate to their initial assumptions.*

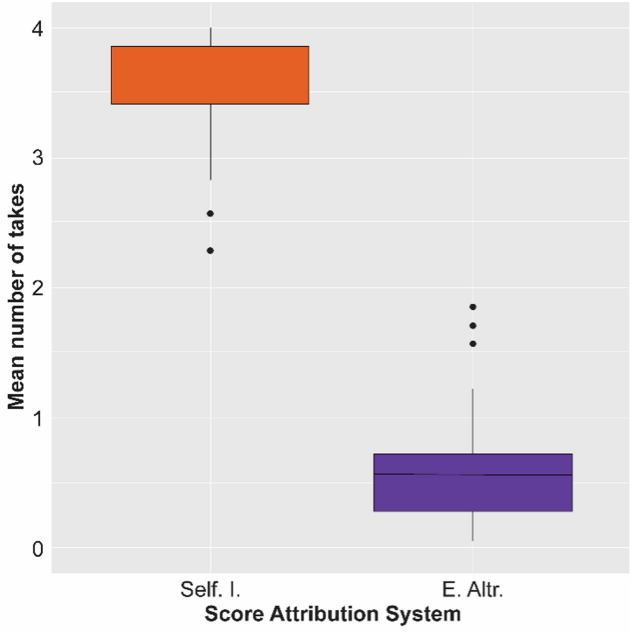

Fig. 4. Distribution of mean number of takes by score system.

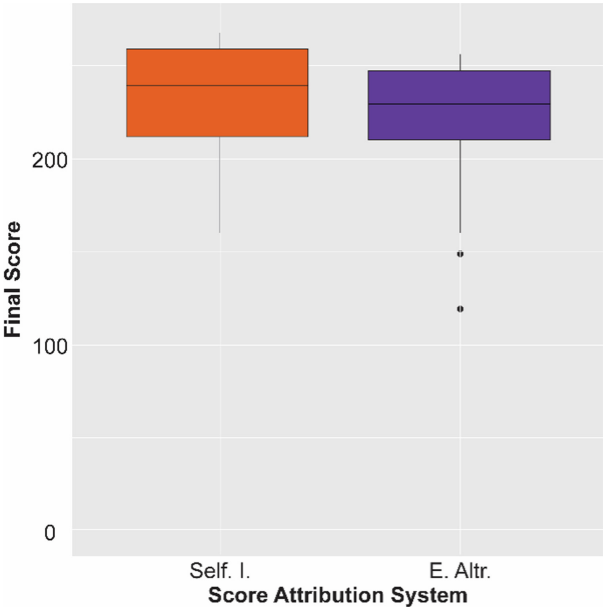

Fig. 5. Distribution of final scores by score system.

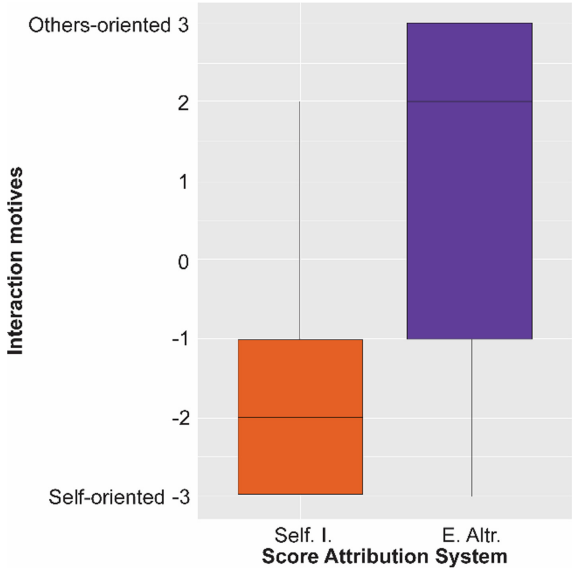

Fig. 6. Distribution of interaction motives orientation values by score system.

5.3 Discussion

In this study we deployed and compared the effects of two score systems, representing two extreme behavior styles: *Self-Improvement* and *Extreme Altruism*, in the players strategies and self-reported interaction motives. Notably, the players played through several game levels, without knowing how the game was scored. Results indicated that the *Self-Improvement* version led players to perform a high (near maximum) number of takes and report self-oriented interaction motives, while the *Extreme Altruism* version led players to perform a low (near minimum) number of takes and report others-oriented interaction motives. Thus, our expectations were corroborated. Moreover, the tendencies revealed high effect sizes, which means strong differences were mediated by the two score functions. It is important to note that rich and dynamic interactions were promoted, even though there was the concern that players could possibly deviate their focus to the game tasks alone, without acknowledging their rewards (in this case, their scores). Still, in both conditions, a predominance of the *Self-Improvement* version was observed over all measures. This may indicate a natural tendency for players to start exploring the effects of their own actions, before exploring others-oriented actions. Also, in this game, players might be initially compelled to compete, a possible reason being that all scores were concurrently displayed in the game interface [16]. As commented before, this trend requires future analysis, notably by deploying new versions of our game. Nevertheless, the aforementioned results reflect an important finding, which answers our hypotheses and research question: *our score attribution strategies led all players to implicitly adopt significantly different in-game strategies (mean number of takes) and to report different interaction motive orientations for the two game versions, aligned to each behavior pole. Thus, evidence was obtained for individual and altruistic reward mediated in-game behavior.* In other words, without using different game items or mechanics, players still managed to learn meaningful strategies, which motivated them to interact in different ways, thus proving the effectiveness of our approach. Even though this may not necessarily indicate that, while performing our experiments, players were intrinsically less selfish in the altruistic condition, results do indicate that in this condition, they were more focused on the other player from a task completion perspective. Taking that into account, we still believe that this research may shed light in applying individual or altruistic-oriented rewards to facilitate attitude change via in-game behavior promotion, or to regulate and balance dilemmas in which the players' decisions can be influenced by individual differences or cultural backgrounds [8, 20].

5.4 Limitations

The further consideration of a similar strategy must, however, be treated with care, as in order to apply our strategy, our game presented tasks that could be completed by different means, but using the same player actions. This may not be the case of the tasks present in all games. In more complex scenarios, instead of using a reward-based approach *per se*, rewards can be used to complement rules or mechanics in ways that might be further investigated in different serious games and social dilemmas scenarios, while trying to avoid player assumption biases. Finally, for experiment ease, we acknowledged just two types of actions, contrasting with most modern games that include a wider range of

action possibilities. The fact that only four actions were allowed at each level may have limited the emergence of interactions as well.

6 Conclusions

In this work we approached the promotion of behaviors perceivable as individual or altruistic, exclusively through the use of rewards as scores. Our premise was that an individual behavior, modeled by a full self-directed interaction motive orientation, could be implicitly incentivized by rewarding players who contributed to the completion of their own tasks, while, oppositely, an altruistic behavior, modeled by a full others-directed interaction motive orientation, could be implicitly incentivized by rewarding players who contributed to the completion of other players' tasks.

To test the validity of these assumptions, we deployed two different score attribution systems in a word-matching game named Message Across, and conducted several user tests, where participants did not know how the games were scored. The evaluation comprehended two main aspects: the first was to verify if there was an actual change in the players' task completion strategies, and the second was to acquire and compare the players' perception of who they were focusing on while playing the game.

The results indicated accentuated tendencies for the promotion of both individual and altruistic in-game behavior, as highly significant differences, aligned to our expectations, were observed for the players' strategies and self-reported interaction motive orientations. In particular, an individual score function drove players to perform a high number of takes and an altruistic function drove players to perform a low number of takes. Besides, these diverging players' strategies allowed the individual version to motivate players to focus on themselves, and the altruistic version to motivate players to focus on other players. While this does not necessarily indicate that players were less selfish in the altruistic condition, results indicate that in this condition, players were more focused on the other player from a task completion perspective.

Future research includes the investigation of whether individual differences such as personality have an effect on how people vary their playing strategies and interaction motives when a game targets to mediate individual or altruistic behavior. We also believe that varying the number of actions per level, words size and using different numbers of shared letters is worthwhile to verify how the length and type of the task can have an impact on interactions and playing styles. A cross cultural study would also be interesting, given the already presented tendency for culture to influence players' strategies and behavior evaluations [8, 20]. Besides, we can verify what differences may emerge when separating players, restricting their interactions [16, 28], or extend our analysis by contemplating interactions styles beyond the ones considered in the present study, such as mutual help or competition. Finally, our findings also contribute to the field of automatic education and training, due to the importance of behavior promotion for this research topic. Models such as GIMME [7], that aim to optimize the collective ability of groups interacting with one another, may use scores to mediate students' interactions, thus empowering collective teaching in multiplayer game settings. Furthermore, promoting interactions using rewards allows researchers to take a more human approach to the integration of agents that simulate people in serious games, besides adding expressiveness to their simulation models.

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