PLAY ME! Influencing Game Decisions through Suggestions made by Augmented Characters

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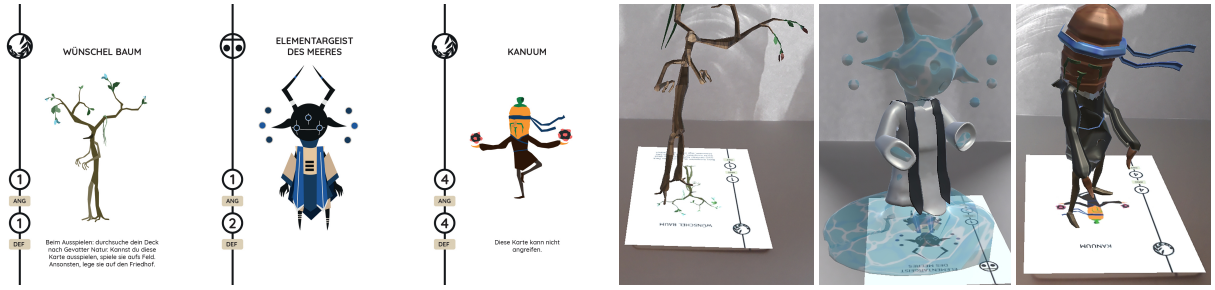

Figure 1: Three physical Trading Game Cards on the left, same cards augmented with encouraging AR characters on the right.

ABSTRACT

During physical games, we love to socially interact with other players through bluffing or giving them hits. This work aims to enrich AR characters by adding a suggestive behavior to them intended to playfully influence game decisions. In a user study, we evaluated such behaviors presented as body postures by animated card characters using an AR trading card game. Our results indicate that AR characters can indeed influence the player's game decisions through postures that encourage or discourage to play a certain card. Our approach enriches the game design space, can make the game more interesting, and finally adds a social component to the game.

CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)**; **Mixed / augmented reality**; **Empirical studies in HCI**.

KEYWORDS

Augmented Games, Augmented Reality, Behavior change

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1 INTRODUCTION

Making suggestions, like bluffing in a Poker game, does not only add excitement and fun to a game; it can also be an essential strategic game element, for example, when players hide their intention or suggest to have another one to fool the other players. Recognizing bluffs and misleading game suggestions to make the right game decision can be challenging, which can add to the game flow [11, 12] and can keep the player interested and entertained [6, 7, 32, 45]. While suggestions are a known game component to add fun and complexity to traditional games, they are missing in current AR games.

In this paper, we are introducing suggestive characters as AR game components that are intended to influence game decisions.

However, we are not the first to bring AR card character to life, existing AR characters are mainly pure 3D visualizations of game characters, sometimes with a spatial location, but always without an own behavior that serves as a game element. Nintendo, for example,

introduced AR applications with their first Nintendo 3DS [1]. They delivered AR cards together with their console which could be used to create Nintendo characters and to take photos together with them in the players' personal environment. Furthermore, Nintendo allowed users to integrated their selfies into the AR game Face Raiders [2]. Here, the picture of the user's face was put on flying drones, augmented models in your room, that were attacking the user from every side of their room. Within the growing field of AR applications [3], the most popular one is Pokemon GO [4]. The successful game principle of Pokemon GO has also been adapted by other manufacturers, for example to shoot zombies [5] or hunt dinosaurs [6]. Moreover, Microsoft and Mojang released mobile AR games [7]. As being said, the characters of existing AR games, even though being animated, are neither interacting with the player nor changing their animation according to the game situation. The characters have rather aesthetic and joy-of-play functions, but they are not intended to be part of the game, for example, through influencing the game by suggesting a specific game decision.

Previous research on games was done to explore the effect of the character design on UX [18, 26, 47]. Moreover, the value of visualized gaze and gestures representing the user in the digital world was investigated [1, 27, 37, 43]. Adding a social component as part of the game (beyond the visualization of the counter player) is a novel approach.

Here, we propose animated AR card game characters that behave in various ways: encouraging and discouraging to play a card and neutral. The suggestions were made by poses and gestures. In an experiment, we show that the suggestive animations are noticed, recognized, and successfully influence the players' game actions. We specifically show that encouraging characters potentially influence to play a card while discouraging characters make players not playing a card, which in both cases works best if the character design aligns with the behavior (strong character or warrior encourage, weak character discourages).

The contribution of this paper is (1) the introduction of a novel AR game design component of behavioral game characters and (2) game design recommendations on how to design suggestive game characters.

2 RELATED WORK

While suggestive characters seem to be under-explored, we identified three related research topics: (1) social aspects in games, (2) game character design, and (3) influencing virtual agents.

2.1 Social Aspects in Games

A large body of research in board as well as in digital games is investigating how social aspects and interactions differ in analog versus in digital games [14, 25, 34], how the user experience changes depending on the social and virtual environment [4, 29, 39] as well as where the enjoyment of playing games comes from [38]. While playing against a computer is in general less fun, less engaging, creates a lower experience, and more boring than playing against humans [25, 34], the setting of the game impacts the experience. For example, Gajadhar et al. [14] and de Kort et al. [9] showed that social setting influence player experience positively by letting a human play a game against a computer and against a mediated human. Moreover, Gajadhar et al. [15] found that the social context when playing a game against a machine can be important. Having a co-located co-player increases fun, challenge, and perceived competence [16]. Acknowledging that the social component in games is important, researchers explored how to create a social experience through computers. Lankes et al. and Maurer et al. were focusing on the improvement and positive impact of shared gaze on collaboration and perceived social presence [20, 21, 27]. Hybrid games, which combine elements of digital and analog gaming, already contain social aspects and thus, in comparison with purely digital games, enhance the natural and enjoyable interaction between friends when gaming [26] and combine the benefits of both, analog and digital games [18].

Hybrid game research has been conducted to explore embodied experience used as information between players in the game. Baudisch and Lopes found that muscle-propelled force feedback given when a player was hit by the other one is preferred over vibrotactile feedback [23]. Maurer et al. let in an art exhibition blood drop on the player's tablet when being hit so that the touchscreen would work worse as an analogy when have been hurt, which led to a stronger feeling of realism and a higher level of empathy [28].

In summary, we can conclude that while it has been shown that social aspects are positively influencing user experience, immersion, engagement, and empathy in a game, the possibility to use social interaction as a game component has not been explored yet. As characters are predestined for such social interaction, we take a deeper look into according research.

2.2 Game Characters Design

It has been shown that the visual appearance of game characters significantly influences how viewers and players accept and perceive the characters. Schwind et al., for example, showed that at a high level of realism, small atypical features can cause the uncanny valley, unrealistic characters are accepted when they stay consistently unrealistic, and childish features increase affinity [41]. Tychsen et al. found that also other attributes than visual appearance influence the player's engagement with the character, such as personality, demographical background, and shown stats, e.g. about health, endurance, and strength [46]. For the design of non-humanoid characters of a game, it was also found that gender does not have any effect on male or female players. They are all accepted in the same way [37]. Research on the visual appearance of AR avatars showed that a higher realistic level of an avatar is favored over an abstract one [35].

Game card characters are non-player characters (NPCs) as they do not represent a player. You and Katchabaw, investigating the

[1] https://www.nintendo.co.uk/Nintendo-3DS-Family/Nintendo-3DS-Family-94560.html
[2] https://www.nintendo.co.uk/Nintendo-3DS-Family/Instant-Software/Face-Raiders/Face-Raiders-115459.html
[3] https://www.statista.com/statistics/591181/global-augmented-virtual-reality-market-size/, https://www.emarketer.com/content/virtual-and-augmented-reality-users-2019#page-report
[4] https://www.pokemongo.com/en-us/
[5] https://www.thewalkingdeadourworld.com/
[6] https://www.ludia.com/en/games/jurassic-world-alive
[7] https://www.minecraft.net/en-us/earth

impact of NPCs on players, found that psycho-social models (characters with cultural aspects, psychological traits, or improved socialization) are more believable and lead to more immersive experience [48]. Ferstl et al. showed that the facial features of NPCs can influence moral decisions of the players and their trust in the digital characters [13]. In contrast to our research, the faces of the characters were static and did not change during the game to fit with the situations. Moreover, the characters of Ferstl did not try to influence players, for example in their decisions. Merrick found that NPCs that evolve with the players and their decisions, which means that they fit their behavior to players' decisions, lead to a more immersive game experience [30]. While here the player was able to influence the NPCs, our research aims at exploring if the *behavior* of NPCs can influence players' decisions. Lankoski found that goals are the very basis of character immersion and emotional experience. When players evaluate the characters' goals and take them as their own, i.e. the NPC and player both want to attack an enemy, and not one wants to attack and the other to defend, shared emotions occur [22].

2.3 Influencing Virtual Agents

Previous research on virtual agents showed that agents can influence user's behavioral motivation or even their behavior.

It is commonly accepted that virtual agents can influence users. Lucas et al. [24] showed virtual agents are more persuading than human agents in informal social influence (the desire to evaluate ambiguous situations correctly). They furthermore found that informal social influence is stronger than normative (the desire to be liked and gain social acceptance from another person). Ruijten et al. [40] showed that social exclusion leads to stronger changes in human behavior than social inclusion. People who feel socially excluded are more sensitive to social influence.

The influence of users can have several reasons, e.g., the agents appearance or behavior. The look of agents can influence user's interest and performance [42]. While a young and attractive rated female agent has a positive impact on the interest, an old and less attractive male agent has no positive influence at all. Important to note is that the stronger interest does not automatically lead to better performance. Moreover, task motivation and performance have been shown to increase when agents had the opposite gender than users [19]. Gestures of virtual agents can attract attention of users, but identical gestures may convey very different meanings depending on the gesture expressiveness [33]. Kinateder et al. showed that virtual agents can change users' behavior (navigation choice) when acting as guides in emergency situations [17]. Users followed here the virtual agent to escape from fire and took exactly the path proposed by the agent. The most related work to ours explored agent's shown emotions, e.g., happiness or anger, which can indeed affect behaviors as users make greater concessions in negotiation to an opponent that expresses anger and they make fewer concessions to an opponent that expresses happiness [10].

In summary, much prior work found that virtual agents' visual appearance can have an effect on task motivation and performance. Further previous work showed that virtual agents that serve as guides (in emergency situations) can influence locomotion. Moreover, In contrast to previous research on agents influencing user's behavior (through guidance or shown emotion), we want to explore if decision making can be influenced by subtle behavior using body postures.

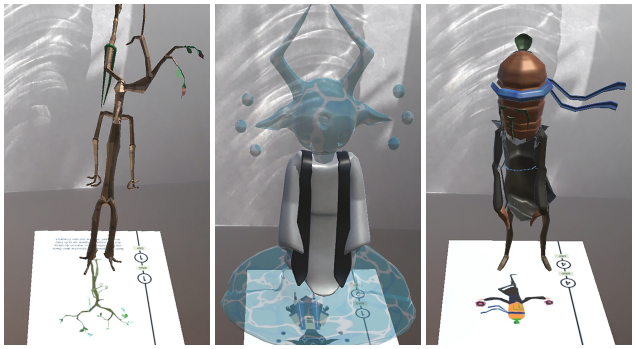

Figure 2: All three *characters* in the not-suggestive position. Weak looking "Wünschelbaum" (left), strong looking "Water Ghost" (middle) and the warrior-looking "Kanuum" (right).

3 SUGGESTIVE CHARACTER DESIGN

In real life, human postures and gestures can – through being interpreted as emotional expression – influence others, e.g. invite to talk through a smile or make people feel uncomfortable and quiet through crossing arms and making an angry face. In games, such as Poker, bluffs – done through spoken but also through non-verbal suggestions – can influence game decisions of counter players.

With this work, we aim at embedding suggestive behavior in character design to influence the players' game actions as we believe this will enrich games and add a novel game element to them. As suggestive behavior, we designed postures that are meant to be encouraging (to play a certain card) and discouraging (to play a certain card). As baseline, we used a neutral (idle) posture. We also designed a game to evaluate the suggestive characters. The following paragraphs explain our game and our suggestive behavior design.

3.1 Game Design

We chose a Trading Card Game as research apparatus as (1) such a game usually has characters visualized on their cards, and (2) more importantly, it is not 100% clear what card is the right one to play in most situations. Hence, we have many game situations where suggestions to play a card or not can be applied. The decision to play a card is always dependent on a game situation and on the player's game type. Trading Card Games support situations in which an attack, a defense, or a neutral action are often possible at the same time, and none of them would be a totally wrong turn.

As current (Trading Card) Games not allow to add behavior to characters as we propose to do, we designed a Trading Card Game including game cards, character models with animations as well as game rules, which is following the common principle of Trading Card Games by ourselves. Please see details about the game and the rules in the appendix.

The character design was chosen in a way that the characters represent different levels of strengths, a fragile and rather weak one, a more warrior-looking like one, and a strong looking one, see Figure 2.

As suggestive behavior, we designed the kinds of body language supposed to suggest a certain game strategy to the player (encouraging and discouraging to play a certain card) for each character as well as the neutral (non-suggestive) idle behavior.

3.2 Encouraging behavior

To encourage a player to play a card, the behavior of the characters displayed on a card has a self-confident body posture as such makes the player more willing to play offensive and to attack [2, 5, 31].

In detail, the encouraging behavior is represented through a self-confident posture while directly facing the counter player's characters and gesticulating hands. That animation aims to communicate that the character is not scared of the counter player's character and willing to attack them, see Figure 3, left column.

3.3 Discouraging behavior

For influencing the players to not play the card we animated the character showing fear assuming when the players recognize that their character is frightened, the player may not send them into a fight, but develop empathy and the wish potentially make them want to protect the scared character so that nothing bad can happen to them [3, 8].

As sign of fear and weakness, we let the character turn away from the enemy and look down as a kind of discomfort and hiding their face behind their hands, see Figure 3, right column.

This behavior lets assume that the character is scared and not willing to fight. Therefore, the players may either feel sorry for their character or just not believe the character might win the attack, and hence, the character card might not be played.

3.4 Not-suggestive behavior

A neutral behavior, realized as idle animation, that is neither encouraging nor discouraging serves as base-line animation, see Figure 2. Such animation might still make a player play that character when only cards with non-animated characters are the alternative as motion automatically grabs our attention, which could be explained by the orientational reflex [44]. We also are questioning if a certain animated behavior is more convincing to, for example, be chosen in an attack situation than another. Consequently, we will test what animation for what character in which situation is played, which we explain in the following section in more detail.

4 METHOD

To evaluate our approach we investigated in an experiment if animated characters can influence the players' game decisions through suggestive behavior. Thus, in the experiment, participants played our AR card game in exemplary game situations in which they were challenged to decide what card to play in an attack, defense, and neutral situation.

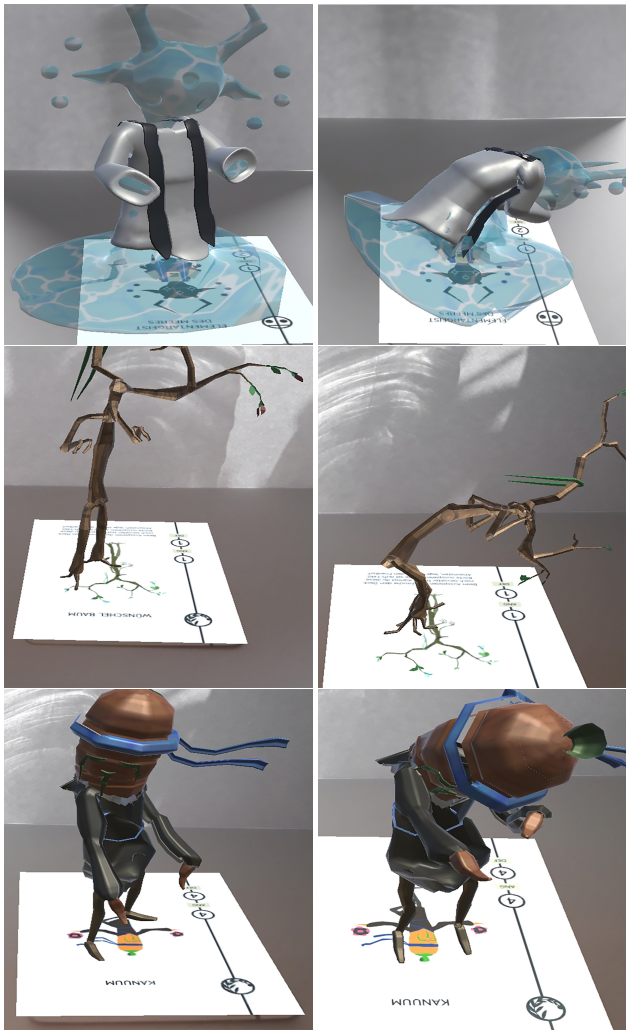

Figure 3: Encouraging (left) and discouraging (right) *behavior* of the three *characters*.

4.1 Experiment Design

The experiment was based on a 3x3 within-subject design with the two independent variables *game situation* (attack, defense, neutral) and *suggestive behavior* (encouraging, discouraging, not suggestive) of the animated characters. The characters that the participants were playing with were available in every game situation (see Figure 1). Each character could have each behavior. The one animated was chosen randomly. Hence, the character was not a variable but served to ensure that our results would not be biased through character design. In particular, we wanted to ensure to find results for a successful suggestive behaviors, for example to attack, no matter how strong or weak the potentially attacking character looks like.

To suggest in a specific game situation a certain game action intending to make a player play a certain character (1) the player's attention has to be drawn to the character, (2) the animation has to be understood, and (3) the animation intend, if being understood, has to result in the corresponding game decision, which is in our

case playing a card whose character suggests a game action. Hence, we measured (1) if the animation has been perceived through questionnaire with a binary choice (2) if the intended message of the animation has been understood providing a selection out of the three possible behaviors, and (3) if the character's suggestion (play a card or not) was in line with the player's action, which was recorded by the participants in a questionnaire.

To better understand the quantitative results, in particular why our suggestive design succeeded or failed, we use a mixed-method approach and asked in a semi-structured interview what aspects had influenced the decision towards as well as against playing a card.

4.2 Participants

We recruited 18 participants (14 male, 4 female) with an age range from 22 to 50 years and an average of 28 years (SD = 7,38). Half of the participants had experience with Trading Card Games. 10 participants rated themselves as offensive players and 8 as defensive ones.

4.3 Apparatus

The apparatus consisted out of a physical Trading Card Game and a Samsung Gear Head-Mounted Display (HMD) using a Samsung A6.

In the study, four game cards were used by the participants (three characters which were the same in each *game situation* (attack, defense, neutral) and the Action-Points (AP) card (which could be chosen in the neutral situation to win by strategy). To vary the independent variable *suggestive behavior*, in each *game situation* one of the participants' characters was animated to behave *encouraging*, *discouraging*, or not suggestive through an idle animation, corresponding to our *not-suggestive* behavior.

Six different cards, see Figure 4, were used to symbolize the opponent's (represented by the experimenter) card, two different characters for every *game situation*. The cards of the opponent represented the *game situation*, see Figure 4, left representing an *attack*, Figure 4, center a *defense*, and Figure 4, right representing a *neutral* situation. During the, *attack*, the opponent had the small mushroom and the harmless wooden ghost (see Figure 4, left). Both were not able to defend, no matter with which character the participant would attack. Every character would lead to success (which was also told to the participants) so the choice of the character was not driven by losing or winning points. In the *defense* situation, a defending character had to be chosen. The attacking opponent always had the angry golem and the intimidating elemental ghost on his side and was attacking with the golem (see Figure 4, center). The golem was chosen as attacking character because this card could be successfully defended by each of the participants' cards. In the *neutral* situation, the participants could either choose a character to attack the opponent or they could play the AP-card to win by strategy. The characters was chosen in a way that both would have the same game outcome. In this situation, the friendly fire ghost and the giant tree were representing the opponents hand (see Figure 4, right).

The digitally augmented card characters were displayed on the HMD. The Android AR application was developed in Unity3D version 2018.2.16f1. Vuforia served for recognizing the game cards as markers to place the digital characters developed in Blender 2.79 above them.

The randomly selected animated characters as well as the independent variables were saved in a CSV file on the phone. Another CSV file was saved on a laptop to store questionnaire and interview answers, as well as the chosen card.

4.4 Task

The tasks the participants had to solve was to decide which card they would play in the three *game situations* represented by the Trading Card Game, but also told the participant.

4.5 Procedure

After participants signed a consent form and filled in a demographic questionnaire, we explained the game rules to them using our game situations as examples. Participants sat on a table opposite from the experimenter and were equipped with the AR glasses. The three *game situations* were counter-balanced. In each *game situation*, each of the three suggestive behaviors occurred in randomized order, resulting in nine *game situation* per participant. The character animated was chosen randomly. Before each *game situation*, the participants were informed which *game situation* was presented. For the task being a decision making, no time limit was given.

After solving a task through choosing a card, participant filled in three questionnaires and answered the two questions of the semi-structured interview. The participants also filled in which card they have chosen.

5 RESULTS

For animation perception, we counted the correctly recognized animations. Moreover, we calculated the correctly understood behavior as well as the played cards labeled with success when in line with the suggested behavior. For animation understanding and suggestive behavior success, independent Friedman tests were used to indicate significant effects for the independent variables. Post-hoc analysis with Wilcoxon Signed-Rank tests were conducted with a Bonferroni correction applied, resulting in a significance level set at .017.

Furthermore, an additional Friedman test were used to identify significant successful suggestion effects between each of our nine conditions to identify possible interaction effects. Post-hoc analysis with Wilcoxon Signed-Rank tests were conducted with a Bonferroni correction applied, resulting in a significance level set at .0056.

Qualitative feedback on choices made was analyzed through an oping coding approach.

5.1 Quantitative Results

5.1.1 Animation Perception. In each of the nine conditions, one of the cards that the participants had to choose from was animated. Asking what card had been animated shows that in 97.5% of the cases participants recognized the animated card, while this was not the case for 2.5%. These 2.5% were animated with not-suggestive behavior. Consequently, an animation was perceived in 93 % of the

Figure 4: Left: encouraging behavior of the strong looking character(bottom, right) in the attack situation; center: discouraging behavior of the strong looking character in the defense situation; right: not-suggestive behavior of the strong looking character in the neutral situation.

cases when only taking a look at the not-suggestive animations, while encouraging and discouraging animations were always recognized (as animation without distinguishing if the animation type was guessed correctly, which the following section is focusing on). This question serves as basic check if the following results allow for being interpreted.

In four of the 162 study rounds it was stated that the animation was not perceived. These data sets are not considered in the following analyses.

5.1.2 Suggestive Behavior Understanding. To ensure that our animations were able to work as intended suggestions, we also tested if they were designed correctly through testing if the animation behavior has been understood.

The animated character behaviors were mostly correctly recognized, see Figure 5. The encouraging behavior was understood in 85% of the cases, while that behavior was misunderstood as not-suggestive in 13% and as discouraging in 2% of the cases. The discouraging behavior was recognized in 89% of the cases, while being understood as encouraging in 7% and as not-suggestive in 4% of the cases. The not-suggestive behavior was recognized in 78% of the cases, but misunderstood as encouraging in 9% and as discouraging in 6% of the cases. Please note that not-suggestive here does not add up to 100% due to the fact that sometimes not-suggestive behavior was not even perceived.

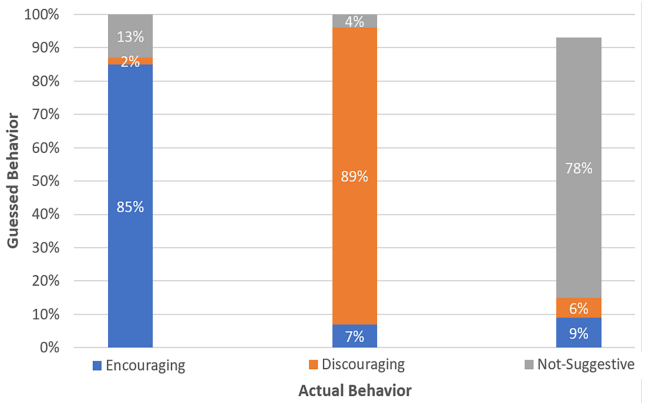

Figure 5: *Behavior* guessed by participants for each *behavior* animation.

We calculated the correctly understood animations by counting them for each of the independent variables *situation* and *behaviour*. An animated behavior counted as correctly understood when the shown behavior of the animated card matched the behavior guessed by the participant. Due to our study design, a minimum of zero and maximum of three animations could be correctly noticed by each participant and each of our independent variables.

Descriptive statistics led to following median values for *situation*: $Mdn_{\text{attack}} = 2.0$ ($n = 18$), $Mdn_{\text{defense}} = 3.0$ ($n = 16$), and $Mdn_{\text{neutral}} = 3.0$ ($n = 16$), and for *behaviour*: $Mdn_{\text{encouraging}} = 3.0$ ($n = 18$), $Mdn_{\text{discouraging}} = 3.0$ ($n = 18$), and $Mdn_{\text{not suggestive}} = 3.0$ ($n = 15$).

While the Friedman test indicated that there were significant differences between suggestive behavior understanding for the different *situations*, ($\chi^2(2) = 6.333$, $p = .042$), the Friedman test did not show a statistically significant difference between the number of correctly understood *behaviours* ($\chi^2(2) = 1.310$, $p = .519$).

However, the Friedman test let us assume a significant difference, Wilcoxon Signed-Rank tests did not show a statistically significant difference in the number of correctly understood *behaviors* between the different situations, neither between *defense* and *attack* ($Z = -1.725$, $p = 0.084$) nor between *neutral* and *attack* ($Z = -2.121$, $p = 0.034$), and also not between *neutral* and *defense* ($Z = -1,414$, $p = 0.157$).

5.1.3 Suggestive Behavior Success. Aiming at influencing game decisions through suggestions, we analyzed the suggestion success. The suggestion of an animation would be successful if (a) the encouraging card is played (when it occurs) as it suggests to be the right one in the game situation, (b) the discouraging played card is NOT played as it suggests to NOT be a good choice in the game situation. During the third possible situation, when (c) the animation shows a not-suggestive, neither en- nor discouraging behavior) we do not actively suggest a game action, but we make the participant paying attention to that card through the animation as humans tend to draw attention to moving things which is explained as orienting response or reflex [44].

We calculated the success of the suggestive behavior by counting the successful suggestion for each of the independent variables *situation* and *behavior*. The beforehand mentioned four of the 162 cases where the animation was not perceived was not considered in the analysis.

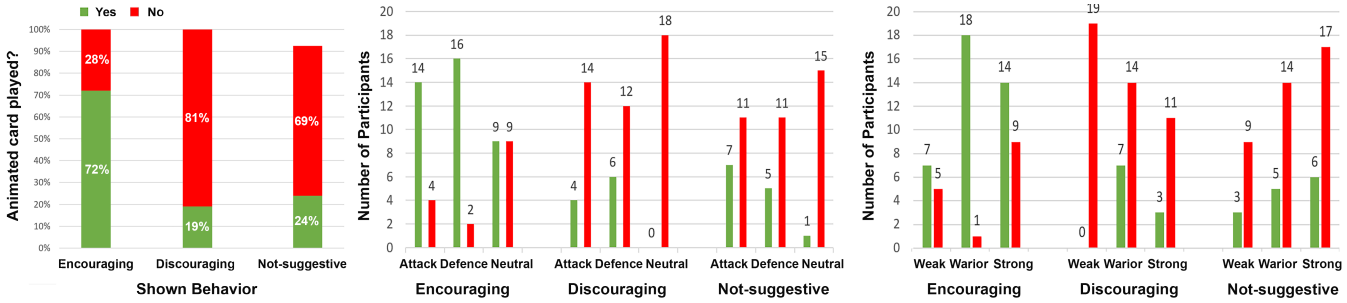

Figure 6: Left: Decision made to play a card (Yes) or not (No) for each suggestive behavior; Animated card played by the participants per suggestive behavior and game situation; right: Animated card played by the participants per suggestive behavior and animated character.

Overall, the encouraging as well as the discouraging suggested game actions were in line with the actually cards played. For the encouraging behavior, in 72% of the cases participants played the card the characters were encouraging them to select, while in 28% they did not (of which 27% were not understood to be encouraging). For the discouraging behavior, in 81% of the cases participants did not play the card, while they did in the remaining 19% (of which 30% were not understood as discouraging behavior), see Figure 6, left. When a not-suggestive behaving character was animated, the animated card was not played in 68.5% of the cases and played in 24% (of which 29% was misunderstood as another behavior). For the not-suggestive behavior we (again) just considered the cases where an animation was perceived by the participants.

Descriptive statistics led to following median values for the successful animations sorted by by *behaviour*: $Mdn_{\text{discouraging}} = 3.0$ ($n = 18$), and $Mdn_{\text{not suggestive}} = 1.0$ ($n = 15$), and by *situation*: $Mdn_{\text{attack}} = 2.0$ ($n = 18$), $Mdn_{\text{defense}} = 2.0$ ($n = 16$), and $Mdn_{\text{neutral}} = 1.5$ ($n = 16$).

While a Friedman test indicated a significant difference in success between the suggestive *behaviors* ($\chi^2(2) = 15.731$, $p < .001$), no significant difference between the number of successful suggestive behaviour was found for the different *situations* ($\chi^2(2) = 1.302$, $p = .521$).

Post-hoc analyzes performed with Wilcoxon Signed-Rank tests showed that the median count of successful suggestive behaviour was statistically significantly higher for the *encouraging* than for the *not suggestive* behaviour ($Z = -2.901$, $p > 0.004$), and it was also significantly higher for the *discouraging* than for the *not suggestive* behaviour ($Z = -3.308$, $p < 0.001$). No significant difference in median counts of successful suggestive behaviour could be found between *encouraging* and *discouraging* behaviour ($Z = -1.232$, $p = 0.218$).

An independent Friedman test were used to identify interaction effects between our nine conditions. This test indicated that there were significant differences in the success of the suggestion between all nine conditions ($\chi^2(8) = 52.171$, $p < .001$).

Post-hoc analysis with Wilcoxon Signed-Rank tests were conducted with a Bonferroni correction applied, resulting in a significance level set at .0056, see Table 1.

A Wilcoxon Signed-Rank test showed a significant more successful suggestions for the *attack situation* when the *behaviour* of the animated character is *discouraging* compared to the *neutral situation* when the *behaviour* of the animated card was *not suggestive*. Moreover, Wilcoxon Signed-Rank tests indicated a significant more successful suggestions for the *defense situation* when the *behaviour* of the animated character was *discouraging* compared to the *neutral situation* when the *behaviour* of the animated card was *not suggestive*. Wilcoxon Signed-Rank tests showed a higher statistically significant successful suggestion for the *discouraging behavior* of the *neutral situation* compared to the *encouraging situation* of the *neutral behavior*, and compared to the *attack situation*, *defense situation*, and *neutral situation* of the *not suggestive behavior*. Furthermore, Wilcoxon Signed-Rank tests indicated that the *encouraging behavior* in the *attack situation* is suggestively more successful than the *not suggestive behavior* in the *neutral situation*. Moreover, the *encouraging behavior* in the *defense situation* had a higher suggestion success compared with the *neutral situation* of the *not suggestive* behavior. All other Wilcoxon Signed-Rank tests did not show significant differences in comparisons of successful suggestions.

To better understand the significant effects shown in Table 1, we took a closer look at the *behaviors* in the different *game situations*, see Figure 6, center. If we consider just the two *game situations* where a character has to be chosen (attack and defense) by the participants we can see that the encouraging behaving character was played in 30 out of 36 cases (83%) and the discouraging behaving character in 10 times out of 36 cases (28%). In the *game situation* where the participants also could play another card than a character the encouraging animated characters was played in 9 out of 18 cases (50%) and the discouraging animated characters in none of the cases. Here it becomes even more obvious that if the participants have to choose a character they will take the encouraging one in first place. If the behavior is discouraging they will take another card and if they do not have to take one character the discouraging behaving character is completely not selected. The not-suggestive behaving character is less often played in every *game situation*. Results also indicate an influence of the animated characters to the player is even stronger if *behavior* and look of the characters fit together, see Figure 6, right. There we can see that the warrior is the most played character when looking at the encouraging *behavior*. At the opposite the weak character is played less due to the discouraging *behavior*.

Sample 1 (S1)	Sample 2 (S2)	*Mdn* (S1)	*Mdn* (S2)	Z	p-value
Discouraging_Attack	Discouraging_Defense	1.00	1.00	−.816	.414
Discouraging_Attack	Discouraging_Neutral	1.00	1.00	−2.000	.046
Discouraging_Attack	Encouraging_Attack	1.00	1.00	.000	1.000
Discouraging_Attack	Encouraging_Defense	1.00	1.00	−1.000	.317
Discouraging_Attack	Encouraging_Neutral	1.00	.50	−1.890	.059
Discouraging_Attack	Not Suggestive_Attack	1.00	1.00	−2.333	.020
Discouraging_Attack	Not_Suggestive_Defense	1.00	.00	−2.333	.020
Discouraging_Attack	**Not_Suggestive_Neutral**	1.00	.00	−3.317	**.001**
Discouraging_Defense	Discouraging_Neutral	1.00	1.00	−2.449	.014
Discouraging_Defense	Encouraging_Attack	1.00	1.00	−.707	.480
Discouraging_Defense	Encouraging_Defense	1.00	1.00	−1.633	.102
Discouraging_Defense	Encouraging_Neutral	1.00	.50	−1.134	.257
Discouraging_Defense	Not_Suggestive_Attack	1.00	.00	−1.890	.059
Discouraging_Defense	Not_Suggestive_Defense	1.00	.00	−1, 897	.058
Discouraging_Defense	**Not_Suggestive_Neutral**	1.00	.00	−3.300	**.003**
Discouraging_Neutral	Encouraging_Attack	1.00	1.00	−2.000	.046
Discouraging_Neutral	Encouraging_Defense	1.00	1.00	−1.414	.157
Discouraging_Neutral	**Encouraging_Neutral**	1.00	.50	−3.000	**.003**
Discouraging_Neutral	**Not_Suggestive_Attack**	1.00	.00	−3.317	**.001**
Discouraging_Neutral	**Not_Suggestive_Defense**	1.00	.00	−3.317	**.001**
Discouraging_Neutral	**Not_Suggestive_Neutral**	1.00	.00	−3.873	**<.001**
Encouraging_Attack	Encouraging_Defense	1.00	1.00	−.816	.414
Encouraging_Attack	Encouraging_Neutral	1.00	.50	−1.667	.096
Encouraging_Attack	Not_Suggestive_Attack	1.00	.00	−2.111	.035
Encouraging_Attack	Not_Suggestive_Defense	1.00	.00	−2.333	.020
Encouraging_Attack	**Not_Suggestive_Neutral**	1.00	.00	−3.317	**.001**
Encouraging_Defense	Encouraging_Neutral	1.00	.50	−2.646	.008
Encouraging_Defense	Not_Suggestive_Attack	1.00	.00	−2.714	.007
Encouraging_Defense	Not_Suggestive_Defense	1.00	.00	−2.714	.007
Encouraging_Defense	**Not_Suggestive_Neutral**	1.00	.00	−3.873	**<.001**
Encouraging_Neutral	Not_Suggestive_Attack	.50	.00	−.707	.480
Encouraging_Neutral	Not_Suggestive_Defense	.50	.00	−1.265	.206
Encouraging_Neutral	Not_Suggestive_Neutral	.50	.00	−2.646	.008
Not_Suggestive_Attack	Not_Suggestive_Defense	.00	.00	−1.000	.317
Not_Suggestive_Attack	Not_Suggestive_Neutral	.00	.00	−1.890	.059
Not_Suggestive_Defense	Not_Suggestive_Neutral	.00	.00	−1.342	.180

Table 1: Statistical values of Wilcoxon Signed Rank tests (no Bonferroni correction applied for p-values). Sample 1 and Sample 2 are possible combinations of *behavior* and *situation*. All possible combinations are checked against each other to see if there are significant differences between them. Significant results are highlighted.

5.1.4 Summary. The quantitative results show that encouraging and discouraging *behaviors* are significantly more often influence game decisions than a not-suggestive *behavior*. As shown in Figure 6, left, the most played animated card was a card with encourage behaving characters, while the least played card was the discouraging, which both is in line with the suggestions made. While animation has the strongest influence on decision, situation (see Figure 6, center) and the character itself (see Figure 6, right) also impact game decisions. The highest success do suggestive animations have when the look of the character and the suggestive *behavior* fits.

5.2 Qualitative Results

We analyzed the qualitative results to better understand the three major findings our quantitative results indicated: (1) suggestive behavior influences game decisions, (2) animation only is not enough to make players play a card, and (3) suggestive behavior and look of the character have to fit.

5.2.1 Suggestive behavior influences game decisions. Our qualitative data confirms that the reason for playing the card was the animation of the character. Participants names, for example, reasons for playing a card:

- The inviting gestures of the character (P.1)
- The animation: character wants to attack (P.15)

In particular, the encourage behaving characters look motivating and confident (e.g. P.9, P.10), which can even make some participants play the weak character, see Figure 6, right. In that regard, 5 out of this 7 participants directly mentioned the animation as reason (e.g. P.18):

- The character looks motivated to fight (P.9)
- The character looks brave. Made a very confident impression (P.10)
- The weakest character seems stronger through the animation (P.18)

We had also asked for reasons to eventually not play the animated card. Here, for the encourage behavior nearly every participant answered "*nothing*", which additionally confirms the successful suggestion.

Reasons to not play a card showing a discouraging character were their frightened look (mention for example by P.4 and P.7), which, for example, can even make the player develop empathy with the weak character (mentioned for example by P.5 and P.13):

- The character looked anxious and duck its head. The character did not look ready (P.4)
- The character was frightened and the other strategy was worth it (P.7)
- I felt it was mean to play the card even though the character was afraid (P.5)
- The character was frightened. Bad things could happen to it if I play that card (P.13)

5.2.2 Animation only is not enough to make a card played. If a character is animated, it grabs attention, but if the animation is not suggestive, the noticed character will not be played only because its animation, as shown in Figure 6, left, which is the case across all character designs, see Figure 6, right.

Only a minor part (4) of the not-suggestive animations was not recognized as such, for example:

- I was not able to recognize which character was animated (P.3)

If noticed, the not-suggestive animation was not proposing to act in a certain way, which led our participants rather not play the card, for example as:

- The character looked undecided (P.10)
- The animation suggests a kind of exhaustion (P.11)
- The character looked unmotivated to attack (P.17)

Because it was hard for the participants to figure out what the behavior of the character suggested, they often (87 times out of the entire 162 answers) made their decisions based on the look of the characters, for example as:

- Another character looked more like an attack-character (P.3)
- The character seemed to be spiritless so I took another card (P.5)
- The character looked weak and another card looked stronger (P.8)

5.2.3 Suggestive behavior and look of the character have to fit. Even though the suggestive behavior was in general successful in influencing game decisions, the most successful suggestions we observed when the behavior of the character fitted to its look. For example, the suggestion to play a card worked best for the encouraging warrior, see Figure 6, right:

- Through the headband, the character looked like a warrior. So I played the card (P.9)
- His look. And as game character it should obey (P.1)

When the weak character discourages to play its card, participants always played another one, for example as:

- Other characters looked stronger than the animated card (P.18)
- The character looked weak and an attack seemed to be hopeless. (P.11)

Consequently, when the warrior showed an encouraging behavior the participants still played the character (18 out of 19 times), and when the weak character had a discourage behavior, participants were not playing the card as:

- The warrior is the strongest card and looks cool through the pose. Therefore i wanted to win by this card (P.5)
- The tree seems to be anxious and looks weak overall (P.4)

6 DISCUSSION

We will discuss here our three major findings: (1) suggestive behavior influences game decisions as (1.a) encouraging characters motivate to play their card through their confident appearance and (1.b) discouraging characters make players not only not believing in their strength but also feeling sorry for their fear to fight. (2) animation only is not enough to make players play a card as the characters seem undecided or not ready to act. (3) suggestive behavior and look of the character have to fit as (3.a) the will to fight is perceived more authentic when a strong character suggests such, while players believe in fear more when shown from a weak character.

6.1 Suggestive Behavior

Suggestive *behavior* of game card characters influence player decisions similar to inter-social conclusions we are used to draw from person's behavior in the physical world [36]. When the character acts confident and has an encouraging *behavior* the participants also feel confident to play that card, which is in line with the trust we have in confidence showing people. Even weak characters are perceived stronger through encouraging *behavior*. Like hesitating people are less convincing, not-suggestive *behavior* does not make players play a card.

Hereby we show that our approach to add a social-like component to a game successfully works.

6.2 Animation only is not enough

Bringing the attention of the players to animated cards due to the oriental reflex [44] does not make one play that card. If the character does not clearly suggest being played, rather another card is chosen, which can be explained by the unconvincing effect of shown insecure and hesitating behavior.

Hereby we show that our suggestive behaving characters can be used as solid game elements, which previous games with animated characters that do not communicate with the player did not allow [13, 48].

6.3 Look of the characters

Just like doorkeepers show through their body size that they probably win a physical fight strongly designed characters work better in convincing players to let them attack the opponent. Vice versa, players are least willing to send a weak character into a fight. Again, our findings fit with the experience we gained in the physical world. While a muscular body can give the impression of body strength, small people may awaken our protective instincts, like children or fragile looking older people.

Hereby, we encourage to (A) design game characters carefully and (B) play with consistent but also counter-intuitive game situations as such mental challenge adds to game flow and fun [11, 12].

7 CONCLUSION

Through bringing game card characters to life we explored if animated characters can influence player decisions through suggestions, similar to helping players or bluffing them. The suggestive characters brought social components to the game and influenced players to play more aggressive through suggestions (especially when made by strong looking characters) and to play more defensive (especially when weak-looking characters suggested them to do so).

Based on our findings we deliver guidelines for behavioral game character design.

(A) The animation of the characters should show a clear suggestion.

(B) The suggestion is more successful if animation and the look of a character fit.

(C) Animations without suggestions are neither convincing nor grabbing all attention and static game elements are still perceived and considered by players.

As this work is successfully introducing suggestively behaving characters, we hope to inspire game developers to integrate such aspects into game design and to motivate researchers to further investigate how characters can be alive-like social components in all kinds of AR applications.

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