What does the perfect Companion in Games look like? Development and Validation of the Companion Design Scale

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***Abstract*—** Artificial intelligence gives companions in games (a special form of non-player characters) social, adaptive, and interactive characteristics that can influence the gaming experience. Initial design frameworks for these characteristics have been developed in research, but empirical validation and methods for quantifying their impact on game experience are still lacking. To close this gap, the study developed the Companion Design Scale, which operationalizes the design of companion characteristics and measures their impact on the game experience. Structural equation modeling shows that the scale measures companion characteristics reliably and validly. In addition, the study emphasizes the relevance of companion design in general, but also regarding specific design factors for the game experience. First practical analyses provide design recommendations for game design. This study thus offers insights into the design principles of humanoid AI companions and provides a basis for systematic studies on the psychological effects of artificial companions on users.

Keywords—companion, video games, game experience, non-player-characters, game design, human-computer-interaction

I. Introduction

Video games continue to advance in their technological complexity. In addition to large three-dimensional worlds and deep stories, interactive and social features of AI-based companions are also increasing video game quality [1]. Companions are a special form of NPCs (non-player characters) that assist gamers with tasks and are significantly involved in gameplay [2]. Well-designed NPCs give the virtual world a sense of life and diversity, are part of the video game's story, and are characters with personality. Although they are controlled by artificial intelligence, they can give players the illusion of liveliness in a coherent world through purposeful design [3]. Examples of companions are Ellie from The Last of Us [4], Atreus from God of War [5], and Lydia from The Elder Scrolls V: Skyrim [6]. Companions affect enjoyment and immersion in video games [7, 8]. Well-designed companions with personality, emotions, and intelligence are the desire of many players [9] and positively impact the game experience [10]. Social qualities, personality, emotional expressions, and intelligent behaviors positively affect player experience and strengthen attachment to the AI-controlled companion [11, 12]. The rapid progress in the development of artificial intelligence makes it possible to equip companions with social, adaptive, and interactive properties, which can enormously expand the range of applications for companions. However, empirical game research has thus far only delved into specific characteristics and design factors related to companions in games to a limited extent. Additionally, there is a paucity of knowledge regarding how these individual design factors impact the user's gaming experience. This study aims to create a solid basis for future research by developing a new measurement instrument to quantify companion characteristics. By applying and testing the measurement instrument in initial practical scenarios, the significance of individual companion characteristics for the game experience will be studied. The precise measurability of companion characteristics facilitates research into the companion-player relationship and can contribute to an authentic, appealing, and interactive companion design.

A. Related Work

The presence of and interaction with others can change one's perceived thoughts, feelings, and behavior [13]. Similarly, the presence of NPCs in video games affects players' behavior when they have human-like qualities. If NPCs seem social or have human-like characteristics, their presence is evaluated more positively [14]. In addition, players react more positively to human-like avatars, as they are more willing to sacrifice themselves for them or protect them [15]. In contrast, when players play with an artificial agent (controlled by AI), teammates are disadvantaged and receive more blame [15, 16]. Other studies also show that the human-like dialog skills and communication quality of NPCs have social effects. For example, people disclose more information about themselves to dialog-enabled NPCs and develop a stronger sense of intimacy with them [17].

The social effects of NPCs on the gaming experience are influenced by their believability [18, 19]. Believability refers to the illusion of aliveness [3] and the belief that NPCs in video games are real [20]. Many works are concerned with the question of how to display and design the believability and ‘humanity’ of NPCs [2, 21, 22]. Believable companion behaviors and personality traits enhance the social-emotional gaming experience and perceived immersion [23, 24]. The representation of the social dynamics between players and companions and the emotional expression of the companion also influence the game experience [10, 25]. Furthermore, appearance, motivations, or social relations play a significant role in the believability of NPCs [23]. Even if the NPC's

design substantially impacts gameplay and game experience, it is still unclear which design aspects impact the companion's believability and which design factors contribute to a positive game experience.

Bouquet, et al. [26] used qualitative methods and developed a design framework for important characteristics of companions in video games based on the research of Emmerich, et al. [7] and identified a total of 17 characteristics, which we call 'design factors'. Table A1 describes each of these design factors briefly. The design factors offer a conceptual framework for developing companions that can impact the gaming experience. The conceptual structure and the relevance of the design factors for the game experience are not yet statistically validated, and there is a lack of empirical evidence. Furthermore, no suitable measures exist to quantify and evaluate the design factors proposed by Bouquet, et al. [26].

B. Summary and Present Contribution

Past work about NPCs shows the significant impact of companion design on gameplay and game experience [14, 18]. The rapid development progress of artificial intelligence intensifies this even more. Companions are equipped with social, adaptive, and interactive features that expand the operational and design spaces. Past work about NPCs shows the significant impact of companion design on gameplay and game experience [14, 18]. The rapid development progress of artificial intelligence intensifies this even more. Companions are equipped with social, adaptive, and interactive features that expand the operational and design spaces. Based on the companion design factors identified by Bouquet, et al. [26], the present study aims to develop a questionnaire that quantifies the characteristics of companions and examines the impact of these design factors on the game experience. Our work differs from previous research because it transfers abstract companion design dimensions into a concrete measurement instrument. The instrument also incorporates considerations of other researchers in the field [23]. Furthermore, it is unclear whether the design factors of Companions qualitatively identified by Bouquet, et al. [26] are reflected in an empirically confirmed factor structure. Our work aims to shed more light on this issue by conducting a confirmatory factor analysis and analyzing its validity and correlation with the gaming experience.

In summary, we aim to develop a measurement tool called the 'Companion Design Scale'. This instrument is intended to accurately capture companion design factors and examine how each contributes to the game experience. By clearly operationalizing them, we can gain valuable insights into which design factors influence the game experience and how they do so. This approach could help improve the overall game experience in game development. It also allows us to compare different companions and better address player wants and needs. As a result, the Companion Design Scale provides the opportunity to gain a deeper understanding of the specific impact of companion characteristics on the game experience. This opens up space for deeper exploration of the dynamics and interactions within the companion-player relationship.

II. METHOD

A. Scale Construction

For the questionnaire, we developed an item pool to assess companion design. We named the questionnaire the 'Companion Design Scale'. A total of 60 items were developed for the 17 design factors, according to Bouquet, et al. [26]. Items were formulated based on their construct definition [26]. Two professionals with expertise in UX design, academic UX research, and questionnaire construction evaluated the items for simplicity, appropriateness in reading level, and content validity. On a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree), the participant's level of agreement regarding the distinct design factors was measured (e.g., 'I knew exactly what the companion was feeling').

Bouquet, et al. [26] define the design factors Power Dynamics, Independence, and Obligation as dynamic characteristics between player and companion. For example, players are often represented as more powerful and endowed with better abilities than their companions. However, there are also video games in which the power dynamics are balanced, or the companion is more powerful than the player. These dynamic directions between player and companion also apply to the Independence and Obligation design factors. Despite their complexity, Bouquet, et al. [26] summarize the dynamics of Power Dynamics, Independence, and Obligation between players and companions in a single factor. In our study, we consider the variety of dynamic directions of these factors in a more differentiated way. To address this, we extended the model structure of Bouquet, et al. [26] to 20 design factors (Table 1). We expanded the design factors by splitting Power Dynamics, Independence, and Obligation into two scales. We formulated items 1) once in terms of the player and 2) once in terms of the companion (e.g., 'I had the better skills' vs. 'The companion had the better skills'). Finally, the design factor 'Independence' is split into Player Dependency and Companion Dependency. Similarly, the design factor 'Power Dynamics' has been divided into Player Power and Companion Power, and 'Obligation' has been divided into Player Obligation and 'Companion Obligation'. Participants rated items on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree), indicating feelings of power, dependence, or obligation compared to their companion.

B. Participants

Data analysis included N = 247 participants acquired via the Prolific recruitment platform (https://www.prolific.co/). Filter questions ensured that participants had video game experience (more than 3 hours a week) and were native German speakers. The sample consisted of 109 (44%) female, 132 (53%) male, and six (3%) diverse gamers. Participants' ages ranged from 18 to 61 years (M = 28.51, SD = 7.64). The average playing time per week was 13.79 hours (SD = 10.83).

C. Measurements

To analyze the relevance of the design factors for the game experience, the post module of the Game Experience Questionnaire (= GEQ) by IJsselsteijn, et al. [27] was applied. The questionnaire measures with 17 items on a 5-point Likert scale (0 = not at all; 4 = extremely) the factors Negative Experience ($\alpha = .83$), Positive Experience ($\alpha = .90$), Tiredness ($\alpha = .76$) and Returning to Reality ($\alpha = .62$).

Game Enjoyment was measured with seven items from Ryan, et al. [28] ($\alpha = .95$) and adapted to companions. A 5-point Likert scale (1 = strongly disagree; 5 = strongly agree) was used to rate the game with the companion (Specific Game-Enjoyment) and the video game itself (General Game-Enjoyment). The same Likert scale was used to measure the

extent to which participants are interested in playing a sequel to the selected video game (Sequel Interest) and tend to recommend the video game to others.

Convergent validity is assessed using the NPC Believability Scale [23], which measures NPC believability on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree) and captures the factors of appearance, behavior, personality, emotions, goals, and social relationships of NPCs. The scale consists of two subscales, General Believability (α = .89) and Specific Believability (α = .90). Convergent and discriminant validity of the Companion Design Scale is tested using the indexes composite reliability (CR), average variance extracted (AVE), maximum shared variance (MSV), and average shared variance (ASV) [29-32].

D. Procedure

The study was conducted online using the web application SoSci Survey [33]. Participants were first asked to recall a video game they played with a companion using the Critical Incident Technique (Step 1) [34]. They were then asked to report positive and negative experiences and characteristics of the companion. Then, participants selected and evaluated the described companion using the Companion Design Scale, completing questionnaires assessing the companion's believability and game experience (Step 2). This formed the basis for the subsequent data analysis (Step 3). Finally, participants reported their age, gender, and time playing video games. The survey took about 15 minutes to complete. Participants were compensated £7.55/hr for their participation. The study procedure is shown in Figure 1.

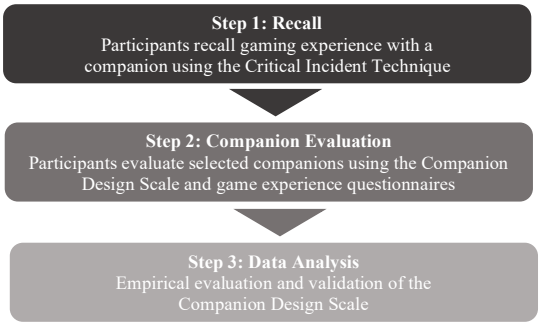


Fig. 1. Study procedure

III. Results

A. Confirmatory Factor Analysis

The model structure was analyzed using confirmatory factor analysis (CFA) in R Studio with the Lavaan package [35], employing maximum likelihood estimation with robust standard error. The model fit was evaluated with comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). In addition, the relationship between X^2 score and degrees of freedom was calculated to evaluate the model structure [36, 37]. Five items with non-significant standardized coefficients and large modification indices were eliminated [38]. A total of 55 items remained for the design factors (Table A2). We conducted two CFAs: The first CFA is the 20-factor solution we adopted, which separates the companion design factors of Power, Independence, and Obligation by player and companion. The second CFA is based on the 17-factor solution proposed by Bouquet, et al. [26]. Results for the 20-factor solution (Table 1) show a good fit of the observed data for the specified model. The Chi²-square value is $X^2 1240 = 1887.85$ ($p < .001$; $X^2/df = 1.52$). The standardized coefficients of the items range from $\beta = .62$ to $\beta = .92$ and are significant (Table 1). RMSEA (= .043; 90% CI [.038 - .047]) and SRMR values (= .050) indicate a very good model fit [39, 40]. CFI (= .926) and TLI (= .911) show an acceptable model fit [39, 40]. In comparison, the 17-factor solution, which does not separate the dynamics between player and companion in terms of Independence, Power, and Obligation, has a poorer model fit ($X^2 1294 = 2378.95$, $p < .001$, $X^2/df = 1.84$, RMSEA = .055, 90% CI [.051 - .059], SRMR = .070, CFI = .868, TLI = .849).

TABLE 1. DESIGN FACTORS OF COMPANION DESIGN SCALE (ITEMS (I) IN SUPPLEMENTARY MATERIAL) WITH UNSTANDARDIZED (B) AND STANDARDIZED FACTOR LOADINGS (B), STANDARD ERROR (SE), Z-VALUES (Z), AND CRONBACH'S A SCORES

	Design Factor	I	*B*	*SE*	*z*	*β*	*α*
AP	Appearance	1	0.75	0.08	9.05	.62***	.74
		2	0.82	0.07	10.75	.74***	
		3	0.84	0.07	11.32	.74***	
AW	Awareness	1	0.75	0.07	11.56	.77***	.82
		2	0.72	0.06	11.81	.73***	
		3	0.89	0.06	14.17	.84***	
EI	Emotional Intelligence	1	0.91	0.06	14.81	.79***	.87
		2	0.96	0.06	15.69	.80***	
		3	0.95	0.07	14.14	.83***	
		4	0.84	0.07	13.01	.77***	
SoR	Social Relations	1	1.03	0.07	15.28	.76***	.82
		2	0.87	0.07	12.76	.79***	
		3	0.73	0.07	11.02	.73***	
		4	0.81	0.07	11.82	.68***	
PS	Personality	1	0.79	0.08	10.02	.78***	.83
		2	1.00	0.07	13.61	.82***	
		3	0.88	0.07	12.59	.78***	
OA	Own Agenda	1	0.80	0.09	8.91	.69***	.78
		2	0.79	0.08	10.48	.79***	
		3	0.73	0.08	8.96	.71***	
BS	Background Story	1	1.06	0.07	15.81	.78***	.87
		2	1.11	0.06	17.42	.88***	
		3	1.08	0.07	14.77	.83***	
CS	Context Sensitivity	1	0.61	0.06	10.75	.68***	.72
		2	0.58	0.06	9.16	.68***	
		3	0.58	0.07	8.00	.69***	
AU	Autonomy	1	0.94	0.06	15.29	.80***	.79
		2	0.83	0.07	11.89	.71***	
		3	0.90	0.06	15.14	.75***	
IA	Initiative and Activity	1	0.96	0.07	14.63	.79***	.68
		2	0.71	0.07	10.38	.66***	
CWP	Communication with Player	1	0.62	0.08	7.81	.64***	.80
		2	1.18	0.07	18.27	.84***	
		3	1.09	0.06	18.63	.84***	
CWN	Communication with other NPCs	1	0.75	0.08	9.64	.63***	.65
		2	1.01	0.07	13.91	.78***	
SR	Story Relevance	1	1.13	0.07	17.20	.88***	.87
		2	1.04	0.07	14.54	.83***	
		3	1.01	0.07	14.59	.78***	
GR	Gameplay Relevance	1	0.98	0.08	12.86	.84***	.86
		2	1.07	0.07	15.61	.90***	
PD	Player Dependence	1	0.99	0.08	12.95	.89***	.79
		2	0.85	0.09	9.37	.73***	
CD	Companion Dependence	1	0.99	0.08	12.95	.89***	.79
		2	0.85	0.09	9.37	.73***	
PP	Player Power	1	0.87	0.08	11.52	.74***	.74
		2	0.67	0.08	8.23	.60***	
		3	0.80	0.08	10.72	.78***	
CP	Companion Power	1	0.81	0.07	11.57	.69***	.77
		2	0.84	0.07	11.55	.77***	
		3	0.77	0.07	11.80	.71***	
PO	Player Obligation	1	0.84	0.08	9.90	.66***	.75
		2	1.06	0.08	14.06	.91***	
CO	Companion Obligation	1	0.85	0.08	11.27	.72***	.75
		2	0.98	0.08	12.13	.83***	

Note. *$p < .05$. **$p < .01$. ***$p < .001$

B. Convergent Validity and Construct Reliability

Convergent validity exists when AVE is greater than .50, and CR is greater than .70 [30] or .60 [29]. AVE values for all design factors ranged from .68 (Context Sensitivity) to .87 (Game Relevance) (Table 2). The CRs of the design factors range from .66 (Communication with other NPCs) to .88 (Emotional Intelligence), indicating convergent validity. The internal consistency of Initiative and Activity (α = .68) and Communication with other NPCs (α = .65) are less than .70 (Table 1). Cronbach's α scores of the other design factors are higher than the minimum requirement of .70 [32]. The reliability of the overall Companion Design Scale is α = .94.

TABLE 2. AVE, CR, MSV, AND ASV FOR VALIDITY ASSESSMENT ACCORDING TO FORNELL & LARCKER (1981) AND BAGOZZI & YII (1988)*

	AVE	CR	MSV	ASV	Convergent Validity		Discriminant Validity	
Design Factor					CR > .70	AVE > .50	MSV < AVE	ASV < AVE
AP	.70	.74	.38	.49	✓	✓	✓	✓
AW	.78	.82	.53	.61	✓	✓	✓	✓
EI	.80	.88	.69	.64	✓	✓	✓	✓
SR	.74	.83	.46	.55	✓	✓	✓	✓
PS	.79	.84	.61	.63	✓	✓	✓	✓
OA	.73	.78	.48	.54	✓	✓	✓	✓
BG	.83	.87	.61	.69	✓	✓	✓	✓
CS	.68	.72	.48	.47	✓	✓	✓	✓
AU	.75	.80	.50	.57	✓	✓	✓	✓
IA	.73	.69	.44	.53	✓	✓	✓	✓
CWP	.78	.82	.41	.61	✓	✓	✓	✓
CWN	.71	.66	.38	.50	✓	✓	✓	✓
SR	.83	.87	.61	.69	✓	✓	✓	✓
GR	.87	.86	.71	.76	✓	✓	✓	✓
PD	.81	.80	.53	.66	✓	✓	✓	✓
CD	.84	.83	.58	.71	✓	✓	✓	✓
PP	.71	.75	.36	.51	✓	✓	✓	✓
CP	.73	.77	.49	.53	✓	✓	✓	✓
PO	.80	.77	.44	.63	✓	✓	✓	✓
CO	.78	.75	.52	.60	✓	✓	✓	✓

Note. AP = Appearance, AW = Awareness, EI = Emotional Intelligence, SoR = Social Relations, PS = Personality, OA = Own Agenda, BG = Background Story, CS = Context Sensitivity, AU = Autonomy, IA = Initiative and Activity, CWP = Communication with Player, CWN = Communication with NPCs, SR = Story Relevance, GR = Gameplay Relevance, PD = Player Dependence, CD = Companion Dependence, PP = Player Power, CP = Companion Power, SO = Player Obligation, CO = Companion Obligation.

C. Discriminant Validity

Table 2 shows that the MSV and ASV values are smaller than the design factors' AVE values, so that discriminant validity can be assumed [31]. Discriminant validity can be accepted if √AVE scores of design factors are greater than the correlations of one design factor with any other [41, 42]. Table A3 (see supplementary materials) shows that the scale constructs are discriminant.

D. Game Experience

Overall, companion design correlated moderately positively with General Game Enjoyment (r = .39, p < .001) and strongly with Specific Game Enjoyment (r = .66, p < .001). Emotional Intelligence (r = .53, p < .001), Social Relations (r = .56, p < .001), and Personality (r = .53, p < .001) correlated particularly strongly and positively with Specific Game Enjoyment. Specific Game Enjoyment correlated strongly and positively with. The overall companion design correlated moderately positively with Positive Experience (r = .34, p < .001), Return to Reality (r = .39, p < .001), and weakly negative with Tiredness (r = -.15, p = .02). Sequel Interest correlated moderately (r = .31, p < .001) and the tendency to recommend the video game to others correlated weakly positively (r = .24, p < .001) with the overall companion design. Correlations between design factors and game experience variables are in Table 3.

TABLE 3 . CORRELATIONS BETWEEN COMPANION DESIGN FACTORS (ABBREVIATIONS IN TABLE 1), GAME EXPERIENCE VARIABLES, AND BELIEVABILITY

Design	1	2	3	4	5	6	7	8	9	10
AP	.05	.25 ***	.19 **	.09	.14 *	-.07	.02	-.00	.29 ***	.34 ***
AW	.21 **	.39 ***	.17 **	.02	.16 *	-.03	.14 *	.08	.51 ***	.51 ***
EI	.31 ***	.53 ***	.21 ***	.11	.34 ***	-04	.24 ***	.22 ***	.55 ***	.77 ***
SoR	.37 ***	.56 ***	.25 ***	.01	.35 ***	-.10	.28 ***	.25 ***	.62 ***	.75 ***
PS	.38 ***	.53 ***	.30 ***	.02	.30 ***	-14 *	.32 ***	.30 ***	.54 ***	.76 ***
OA	.30 ***	.43 ***	.26 ***	-.04	.29 ***	-.16 *	.23 ***	.20 ***	.53 ***	.65 ***
BG	.30 ***	.46 ***	.13 *	.08	.36 ***	-.07	.24 ***	.16 *	.40 ***	.59 ***
CS	.34 ***	.40 ***	.25 ***	-.09	.20 **	-.15 *	.22 ***	.24 ***	.59 ***	.62 ***
AU	.15 *	.32 ***	.19 **	.07	.23 ***	-.14 *	.14 *	.09	.24 ***	.39 ***
IA	.26 ***	.40 ***	.25 ***	.05	.28 ***	-.14 *	.25 ***	.17 **	.39 ***	.55 ***
CWP	.25 ***	.46 ***	.21 *	.07	.30 ***	-.05	.21 ***	.16 *	.50 ***	.72 ***
CWN	.24 ***	.48 ***	.25 ***	.09	.27 ***	-.08	.22 ***	.14 *	.49 ***	.68 ***
SR	.17 **	.42 ***	.24 ***	.02	.26 ***	-.08	.18 **	.11	.39 ***	.47 ***
GR	.28 ***	.44 ***	.20 **	-.11	.19 **	-.15 *	.20 **	.18 **	.30 ***	.28 ***
PD	.05	.20 **	.05	.05	.10	-.03	.05	-.01	.14 *	.20 **
CD	.14 *	.23 ***	.17 **	-.16 *	.05	-.15 *	.13 *	.10	.11	.04
PP	.08	-.05	.03	.06	.01	.04	.00	.06	.02	-.03
CP	.03	.25 ***	.14 *	.06	.10	-.03	.03	.03	-.03	.01
PO	.11	.14 *	-.00	.15 *	.16 *	.06	.12	.07	.05	.14 *
CO	.09	.10	.16 *	.07	.00	-.05	.01	.01	-.01	-.05
OCD	.39 ***	.66 ***	.34 ***	.06	.39 ***	-.15 *	.31 ***	.24 ***	.62 ***	.79 ***

Note. *p < .05. **p < .01. ***p < .001; 1 = General Game-Enjoyment, 2 = Specific Game-Enjoyment, 3 = Positive Experience, 4 = Negative Experience, 5 = Returning to Reality, 6 = Tiredness, 7 = Sequel Interest, 8 = Word to Mouth, 9 = General Believability, 10 = Specific Believability, OCD = Overall companion design.

E. Practical Outlook 1: Design Rating of Companions Selected by Gamers

We used the companions that participants named and rated in the Companion Design Scale and analyzed the differences between companions regarding their companion design and users' experienced enjoyment of the game. We then derive recommendations for the game design based on the results. In total, participants named 77 different video games in which they played together with a companion. Table 4 contains a list of the companions most mentioned by the participants. In this analysis, we compare the companions ‘Ellie’ and ‘Lydia’ regarding the quality of their companion design factors. We have chosen Ellie (n = 15) and Lydia (n = 10) due to their frequent mentions by participants and their significant differences in technological advancements. In the following, both Companions are briefly described and differentiated regarding their design and technology. We then present the results of our comparative analyses.

TABLE 4. COMPILATION OF HIGHLY REFERENCED COMPANIONS

Companion	Video Games	Release Year	Count
Elizabeth	Bioshock Infinite	2013	17
Ellie	The Last of Us (Part 1)	2013	15
Lydia	The Elder Scrolls: Skyrim	2011	10
Atreus	God of War	2018	9
Dogmeat	Fallout 4	2015	8
Paimon	Genshin Impact	2020	6
Garus	Mass Effect	2007	5
Midna	Zelda – Twilight Princess	2006	5
Ciri	The Witcher 3 – Wild Hunt	2015	4
Claptrap	Borderlands 3	2019	4

Ellie is a companion from 'The Last of Us' [4]. The player takes on the role of Joel, tasked with protecting Ellie in a post-apocalyptic world. Ellie is characterized by intelligence and humor. A strong relationship develops between Ellie and Joel throughout the game. Ellie's AI skills are progressive regarding her behavior and emotional expressiveness. She moves skillfully through the game environment, reacts quickly to the player's inputs, and adapts dynamically to the changing scenarios in the game. In combat scenarios, she proactively searches for cover or supports the player. Ellie represents an advanced form of companion AI.

Lydia is a companion in 'The Elder Scrolls V: Skyrim' [6]. As the player character's warrior and personal bodyguard, she provides assistance in battle, carries items, and offers health potions when the player's health is low. The AI was not as advanced as today when the game was released. Lydia's AI is often perceived as limited. Lydia gets stuck in strange places in the game and blocks paths. There are problems with Lydia's pathfinding and her combat behavior. Lydia's AI represents a simpler form of companion AI.

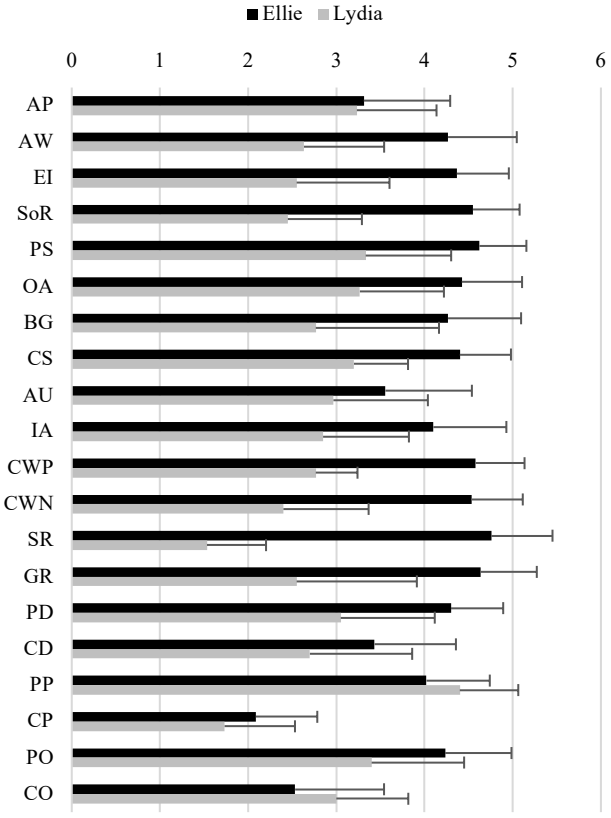
Due to the group size, non-parametric procedures are used. A one-factor ANOVA for non-parametric data indicates that the companion design differs significantly between the companions ($X^2(1)= 15.51$, $p < .001$; $\eta^2 = .65$). The three design factors in which the two companions differ most strongly are Social Relations ($\eta^2 = .68$), Story Relevance ($\eta^2 = .61$) and Communication with Player ($\eta^2 = .67$). Table 5 provides analyses of the differences between the companions concerning each design factor. Figure 2 illustrates the comparison between the two companions. A one-factor MANOVA also shows that the companions differ significantly from each other depending on their overall companion design and Specific Game Enjoyment ($F(2, 22) = 29.34$, $p < .001$, partial $\eta^2 = .57$).

TABLE 5. MEANS (*M*), STANDARD DEVIATIONS (*SD*), NON-PARAMETRIC ONE-WAY ANOVA (X^2), AND EFFECT SIZE (η^2) FOR ELLIE'S AND LYDIA'S DESIGN FACTORS

Design factor	Ellie (n = 15)		Lydia (n = 10)		X^2 (2,22)		p	η^2
	M	SD	M	SD				
AP	3.31	0.98	3.23	0.90	0.01		.933	.00
AW	4.27	0.78	2.63	0.91	11.65	***	<.001	.46
EI	4.37	0.59	2.55	1.05	12.92	***	<.001	.54
SoR	4.55	0.53	2.45	0.84	16.35	***	<.001	.68
PS	4.62	0.53	3.33	0.97	10.08	***	.001	.42
OA	4.42	0.68	3.27	0.95	7.71	**	.005	.32
BG	4.27	0.83	2.77	1.40	8.32	**	.004	.35
CS	4.40	0.58	3.20	0.61	13.29	***	<.001	.55
AU	3.56	0.98	2.97	1.07	1.51		.219	.06
IA	4.10	0.83	2.85	0.97	8.47	**	.004	.35
CWP	4.58	0.56	2.77	0.47	16.14	***	<.001	.67
CWN	4.53	0.58	2.40	0.97	15.84	***	<.001	.66
SR	4.76	0.70	1.53	0.67	19.11	***	<.001	.80
GR	4.63	0.64	2.55	1.36	14.52	***	<.001	.61
PD	4.30	0.59	3.05	1.07	8.74	**	.003	.36
CD	3.43	0.92	2.70	1.16	2.64		.104	.11
PP	4.02	0.72	4.40	0.66	1.99		.158	.08
CP	2.09	0.70	1.73	0.80	1.62		.203	.07
PO	4.23	0.75	3.40	1.05	4.26	*	.039	.18
CO	2.533	1.01	3.00	0.82	1.47		.226	.06
OCD	80.97	7.65	56.78	8.32	15.51	***	<.001	.65

Note. *$p < .05$. **$p < .01$. ***$p < .001$. AP = Appearance, AW = Awareness, EI = Emotional Intelligence, SoR = Social Relations, PS = Personality, OA = Own Agenda, BG = Background Story, CS = Context Sensitivity, AU = Autonomy, IA = Initiative and Activity, CWP = Communication with Player, CWN = Communication with NPCs, SR = Story Relevance, GR = Gameplay Relevance, PD = Player Dependence, CD = Companion Dependence, PP = Player Power, CP = Companion Power, PO = Player Obligation, CO = Companion Obligation, OCD = Overall companion design.

Fig. 2. Mean Comparison of Design Factors between Ellie and Lydia (abbreviations of design factors in Tables 1 and 5)



F. Practical Outlook 2: Exemplary Implications Based on Companion Design Scale

Lydia scores lower than Ellie in many design factors. To improve the game experience with the companion, Lydia's communication skills should be expanded to allow for more understandable and varied conversations. In addition to expanding the dialogue skills, the companion could learn more about the backstory of the video game, which would shed more light on the companion's goals. Lydia's game mechanics are considered relatively irrelevant to the video game. The companion would benefit from being provided with useful features that players would perceive as necessary. Players rated Lydia's ability to take initiative lower than Ellie's. Game designers should ensure that the companion is more active, independent, and has more initiative (e.g., better combat skills). Similarly, the character is attributed as being less aware of changes in the environment and exhibiting less context-sensitive behavior. Lydia's emotional intelligence is also less pronounced. Possibly due to the design, players are less able to read the companion's emotions or interpret the emotional state. Players feel comparatively less able to describe the companion's personality. Defining the character with opinions, unique traits, and attitudes can help describe the companion. This could also positively affect the idea of Lydia as a social interaction partner.

IV. DISCUSSION

Through developing the Companion Design Scale, this study makes an essential contribution to future research and practice. The statistical analyses demonstrate the validity and reliability of the Companion Design Scale and the model structure comprising 20 design factors. The internal

consistencies indicate that the formulated items appropriately represented the different design factors. Only the Initiative, and Activity and Communication scales with other NPCs fall slightly below the critical threshold [32]. This may be due to the small number of items representing the corresponding factor [43]. Internal consistencies of .60 or greater are acceptable if their plausibility prevails [40, 44]. Therefore, the two design factors are considered appropriate for studying companion design and are retained in the Companion Design Scale. Expanding the item pool may help to improve the instrument quality for future research.

Furthermore, the study highlighted the relevance of companion design for game experience and enjoyment. Results show that the design of personality, emotional intelligence, and the representation of social relations strongly influence players' perceived game quality. In addition, companion design affects whether players would recommend a video game to others or play a sequel of the video game. Therefore, the socially intelligent representation of companions and the optimization of companion design are also related to economic interests. This will become even more important in the future when AI makes companions even more adaptive, intelligent, and social.

The study also attempted to compare two different companions in their design statistically. The questionnaire highlighted significant differences in companion design and emphasized the impact on the gaming experience that game developers should consider creating a high-quality gaming experience. With targeted content character analysis, selected design factors can be more focused, problems can be addressed, and companions can be modified for a better user experience. It is conceivable that already popular and established companions can serve as a reference point. Also, the companion's development process can be tracked through measurement iterations, making design progress visible and enabling a user-centered game development process. Therefore, the questionnaire is a tool for optimizing the game experience and a quality management tool for game developers.

The design factors for companions in video games identified by Bouquet, et al. [26] were empirically validated by the confirmatory factor analysis of this study. Nevertheless, conceptual extensions for the design space of Bouquet, et al. [26] should be pointed out. For example, the extracted design factors were obtained from a limited number of games, impairs generalizability. Furthermore, there is a strong focus on single-player games, which neglects companions in cooperative or competitive multiplayer games. Regarding the design factor ‘autonomy’, we also propose extending the existing definition: According to Bouquet, et al. [26], companions are autonomous if their actions are outside the player's control. The companion example of Ashley Graham from Resident Evil 4 [45] shows that although she is considered autonomous by this definition, she is not in reality. In the game, Ashley is kidnapped and must be found and rescued by the player character. She repeatedly puts herself in danger due to her dependent behavior and is unable to fight, defend herself, or extricate herself from predicaments [46]. From this perspective, the companion is not and does not act autonomously, as it lacks independence and requires constant intervention from the player, which contradicts the definitions of Bouquet, et al. [26]. Therefore, we suggest expanding the autonomy design factor to encompass aspects of the actual definition of autonomy. Bandura [47] defines autonomy as independent behavior free from environmental influences. Therefore, in our opinion, companions are then fully autonomous when players do not have to correct their actions. The more independently companions act, the better players can satisfy their need for autonomy, as they will need to pay less attention to the companion and can freely pursue their preferred gameplay style [26, 48, 49]. This relationship could be explored in future research.

A. Limitations

The Critical Incident Technique depends on the participants' memories and ability to remember retrospectively [50]. Participants were asked to recall companions that were most memorable to them. We did not control for the time of the last interaction and for factors such as nostalgia or confabulation. Therefore, we cannot exclude bias. In future studies, the survey could be conducted immediately after gaming sessions with companions [51]. Furthermore, we used the Game Experience Questionnaire by IJsselsteijn, et al. [27] and only identified weak correlations with the design factors of companions in some cases. This could be due to shortcomings in the questionnaire's psychometric properties [52]. Considering this, we recommend using other questionnaires to capture the game experience to understand better how the companion design factors interact with other facets of the game experience.

Another limitation is the study's representativeness in terms of age. 68% of the participants were in the 18 to 30 age group, which characterizes the sample as predominantly young. However, user heterogeneity is essential for assessing game enjoyment [53-55]. In addition to demographic diversity, exploring the companion design factors in the context of different personality traits [9] or motivational player types [56] would enrich the current research findings. This would reveal preferences for individual companion design factors, which provides an essential approach to target group-specific game design from a practical perspective.

The Companion Design Scale has many items and could be cumbersome in practice. Future research should develop a psychometrically valid short version. Some design factors identified by Bouquet, et al. [26] (e.g., Own Agenda or Obligations) also relate more to player perception and are not clearly defined in their practical design implementation. While the player's obligation towards the companion can influence the game experience, it remains unclear how game designers can ensure that players develop a sense of obligation towards the companion. We recommend interdisciplinary collaboration between psychologists and game designers for concrete design approaches. In addition, the Companion Design Scale should be adapted for animal or non-communicative companions, as design factors such as personality, emotional intelligence, or communication could be abstract.

B. Outlook

This study shows that design factors of companions are correlated, but the exact interaction remains unknown due to a lack of experimental research. Integrating established psychological theories could deepen the understanding of the relationships between design factors and offer practical implications. For example, it would be interesting to investigate whether companions' appearance influences behaviors or traits' expectations. Previous research suggests

that a human-like appearance can elicit higher expectations of autonomy [18]. Similarly, a human-like appearance of NPCs is associated with more social behavior [12], which could influence perceived obligations to protect the companion [57]. Other interesting interactions could arise from looking at background history and social relationships, such as how the companion's background history influences the development of the social relationship.

Finally, the results are not limited to companions in games. AI generally interacts more and more 'socially' with people [58, 59]. Research already emphasizes the significant impact of AI appearance and embodiment on trustworthiness, acceptance, and interaction [60]. For example, human-like attributes of AI-based technologies can be used for manipulative purposes [61] to elicit more personal information from users [62, 63]. It would be interesting to investigate if companion design factors as design features of AI technologies can predict such risks in interaction with AI. The Companion Design Scale is thus a starting point to quantify this impact in further contexts of human-AI interaction.

V. Conclusion

This study used current scientific findings on companion design principles to make companion characteristics assessable. The valid and reliable Companion Design Scale provides a starting point for further companion research regarding the effect of companions on game experience and behavior. The scale enables the measurement of various design factors and thus facilitates the research on the significance of these characteristics. This can lead to valuable insights that relate to the game experience and the interactions between companions and players. Furthermore, game developers could practically use the Companion Design Scale to assess companion quality, identify areas for improvement, and enhance the overall game experience. In this way, it may be possible in the future to adapt the AI of companions to the desired social effect to expand operational areas or improve the game experience for players. The scale can also be adapted to AI design in further contexts of human-AI interaction.

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