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RESEARCH ARTICLE

Designing Stimulus as Cognitive Task Stimulus for Measurement of Cognitive Bias in Online Gamers

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Abstract

Problematic online gamers are shown to be biased towards information about gaming, focusing on it more than other subjects. Measuring cognitive processes requires tasks with specific stimuli, essential for studying decision-making. This research aims to create a gambling-related stimulus for a mental task. The research used a combination of methods. Qualitative data were gathered through interviews and focus group discussions, while quantitative data were collected through questionnaires. A total of 88 research participants were obtained by purposive sampling with inclusion criteria: aged 18–30, played games 4–10 hours daily for at least 12 months. Forty gamers participated in semi-structured interviews using an interview guide based on the Interaction of Person-Affect-Cognition-Execution (I-PACE) theoretical framework. Forty-eight gamers also took part in focus group discussions (FGDs). This research was conducted in Bandung from November 2023 to October 2024. The data were analyzed using NVivo-14 software and descriptive statistics. As a result, various stimuli were obtained, including 597-word stimuli, 87 image stimuli, and 97 audio stimuli. It was hypothesized that these stimuli would evoke a strong association with online games, prompting gamers to devote greater attention when encountering them, whether in visual, textual, or audio formats.

Keywords: Cognitive bias, cognitive task, game online, word stimuli

Introduction

The Fourth Industrial Revolution has brought humans closer to computers and the internet and is characterized by automation, big data, artificial intelligence (AI), and the internet of things, making the development of digital technology increasingly sophisticated, bringing changes to the order of human life, including in the psychological dimension. The gaming industry is one of the growing innovations related to the internet of things (IoT). With the internet network, online games can now be played on various electronic devices (personal computers, laptops, and cell phones) with many players worldwide. Not only can they cooperate or compete, but the players can also communicate directly with each other in the game arena.[1]

A report from We Are Social in 2022 states that Indonesia is the third-ranked country with the most significant number of video game players in the world. The report noted that 94.5% of internet users aged 16–64 in Indonesia play video games. Indonesia is one of the largest gaming industry markets in the world. It is similar to research conducted by Lopez-Fernandez et al.,[2] which states that the level of problematic internet use in Indonesia is among the highest among several countries examined in the study. This shows that Indonesia is one of the largest gaming industry markets in the world.

Today, there are many new types of games with more immersive, socially integrated, and financially rewarding features than previous types of games. For psychologically vulnerable individuals, these features open the door to problematic gaming behavior or even addiction.[3]

Non-problematic and problematic online gamers show the same enthusiasm for online gaming activities, leading to different decision-making. Non-problematic gamers decide to play online games for a reasonable amount of time. On

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the contrary, problematic gamers become fixated and unable to control their desire to continue playing. Brand et al.,[4] through the Interaction of Person-Affect-Cognition-Execution (I-PACE) multidimensional theoretical framework, state that problematic online gaming behavior is the result of a process of interaction of predisposing factors, affective and cognitive responses reflected in individual behavior that seeks satisfaction from specific activities, which leads to changes in mental and affective reactions so that they are very attached to online games as compensation for these changes.

One cognitive function is cognitive bias, which refers to the behavioral tendency to more quickly, efficiently, or accurately remember, recognize, and/or respond to stimuli associated with substances or rewarding behaviors.[5] Related research conducted by Zhou et al.[6] found that individuals with addictive behavior to online games have cognitive biases toward information related to online games. Cognitive biases of poor executive function skills (mental flexibility and lower response inhibition) have a role in internet addiction disorder. The assumption is that non-problematic gamers experience relatively no cognitive bias, while problematic gamers are assumed to experience cognitive bias towards information related to online gaming. Related to this matter, Yang et al.[7] stated that individuals' senses and emotions are affected by external stimuli, which also influence decision-making and behavior.

In the study by Chia and Zhang[8] regarding cognitive bias in online gaming disorder behavior, measurement is carried out by giving tasks such as the classic color-word Stroop task and the addiction-Stroop task. These tasks are instruments that are implicit or called implicit measures, namely indirect measurements of construct procedures that are indirectly obtained through behavior.[9] These tasks have stimuli in the form of words or pictures.[10,11] Another neuropsychological task commonly used to assess cognitive biases is the Go/No-Go task, where stimuli such as words or pictures are presented during short trials on a computer screen.[12] During each trial, participants are directed to distinguish target stimuli from distractor stimuli by pressing a specific key on the keyboard (e.g., space bar) when they see the target but withholding the response when the presented stimuli are a distracter (non-target).

Based on the studies, identifying the most suitable stimuli is fundamental to the study of decision-making. To the best of our knowledge, despite extensive research, no database of cognitive task stimuli has been identified that is specifically designed to assess the cognitive biases of game players. This underlies the researcher's design of word stimuli for cognitive tasks to measure cognitive bias in gamers' decision-making to play online games.

Methods

This research was conducted in Bandung from November 2023 to October 2024 and received recommendations from the ethics committee of the Faculty of Psychology, University of Indonesia (No. 069/FPsi.Komite Etik/PDP.04.00/2021) and from the Nusantara Scientific Psychology Consortium (No. 097/2024 Etik/KPIN).

The research used a combination of methods. Qualitative data were gathered through interviews and focus group discussions, while quantitative data were collected through questionnaires. Researchers used purposive sampling to recruit participants, a sample deliberately chosen because it is considered the most appropriate for research.[13] The criteria for participants are: (1) Early adult individuals aged 18–30 years, (2) Actively playing online games in the last 12 months following the criteria for duration of experiencing behavior in DSM-5, (3) Every day playing online games, with a duration of playing games 4–10 hours/day. Literature shows that a person can be said to be problematic gamers if they play games for more than 4 hours per day,[14,15] as well as King and Delfabbro[16] who stated 70 hours per week (10 hours per day) as a differentiator between problematic and non-problematic gaming, (4) Included or not included in the criteria for problematic gamers, based on the results of measurements using the POGQ scale.[17] The total number of participants involved in this study was 88 gamers.

The qualitative approach studies were conducted through focused interviews using an interview guideline[18] with 40 gamers. Through NVivo-14 software, the results were analyzed by coding the interview script, which resulted in groups of codes (nodes) so that several themes emerged. The analysis also found several words

that appeared most frequently in the interviews. The following process was to rank the number of word stimuli through a word rating questionnaire and explore new words associated with gaming through focus group discussion (FGD) activities. FGDs were conducted in five series with 48 gamers. The quantitative approach was analyzed through simple descriptive statistical analysis of the rating results.

Results

Data were obtained through two activities, focused interviews and FGDs, in a qualitative approach to data collection.

The data that has been collected from conducting focused interviews with 40 participants, then carried out a thematic analysis of the entire script to identify patterns (themes) in the data by following the six steps proposed by Braun and Clarke,[19] namely: (1) data familiarization (done by reading each transcript several times), (2) initial coding, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes. Researchers used NVivo software as a data analysis tool. Figure presents the chart of theme analysis results obtained through Nvivo analysis.

Several themes related to gaming behavior were found: triggers, craving and urge, coping forms, protective factors, impact on personal role, affective and cognitive biases, decision to game, and executive function. The utilization of larger boxes indicates a more significant number of themes.

In addition to the themes, the 100 most frequently occurring words from the focused interviews of 40 participants were also obtained (Table 1).

The next activity, FGDs, was conducted on 48 participants in 5 sessions. The researcher asked three main questions, namely (1) "name the words or sayings that you think are strongly associated with online games, making you immediately think of games and want to play them," (2) "name the images that you think are strongly associated with online games, making you immediately think of games and want to play them," and (3) "name the sounds/audio that you think are strongly associated with online games, making you immediately think of games and want to play them." The discussion lasted for 45–60 minutes in each session. It generated data on several word stimuli (437 new words), image stimuli (87 types of images), and audio stimuli (98 types of sounds) that participants considered

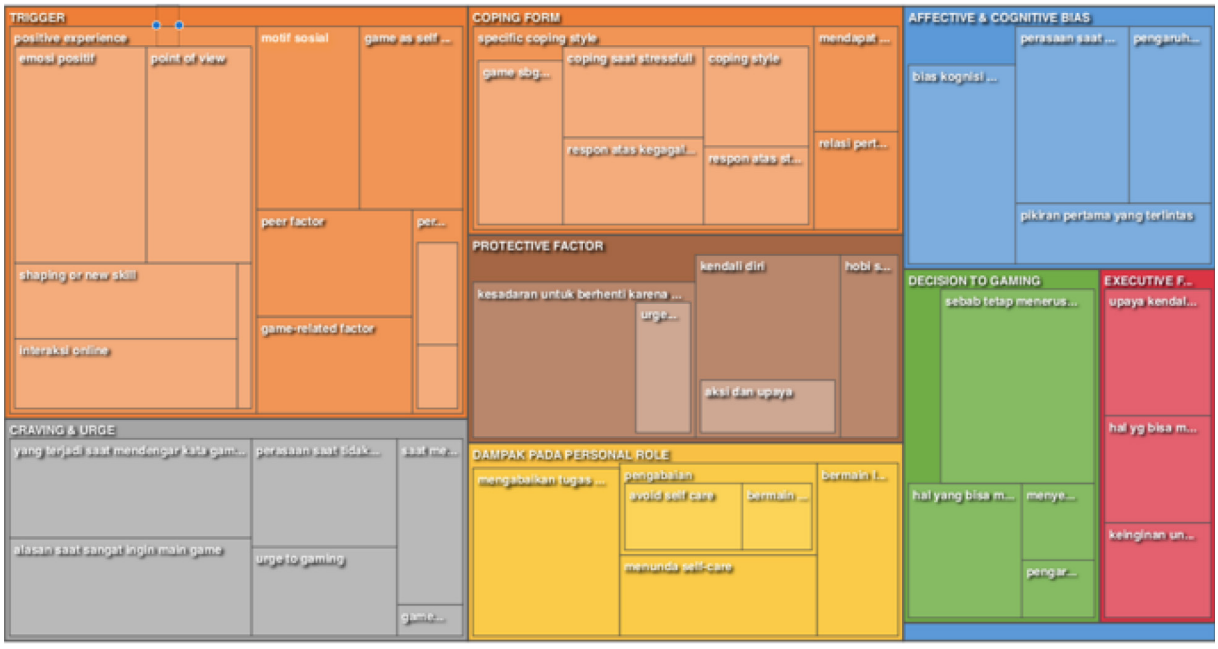

Figure Hierarchy Chart Theme Analysis (Nodes)

Table 1 Most Frequent Words

No	Words	No	Words	No	Words	No	Words
1	Adrenaline	26	Picture	51	Release	75	Taking a break
2	Friend's invitation	27	Graphic	52	delay eating	76	I always wanted to play
3	Positive affirmations	28	Gameplay	53	Winning	77	Self-awareness
4	Anime	29	Gamers	54	Ignoring assignments	78	Having fun
5	Avatar	30	Gaming	55	Enjoying	79	Excited
6	Background	31	Gaming skill	56	Stress release	80	Bad mood
7	Skipping class	32	Hobby	57	Procrastinating	81	Circles
8	Happy	33	Praying	58	MMORPG	82	Social skill
9	Stay up late	34	Internet	59	Mobile legend	83	Gaming Strategy
10	Compete	35	Introvert	60	Mood booster	84	Streaming
11	It can be in any place	36	Champion	61	Music	85	Relieve
12	Communication skill	37	Lose	62	Chat	86	Sound
13	Computer	38	Character	63	Watch	87	Almost done
14	Damage	39	Addiction	64	Comfortable	89	Tense
15	Device	40	Family	65	Online	90	Pressure
16	Discord	41	Competition	66	Sports	91	No judgement
17	Drop out	42	Critical	67	Organization	92	Difficult to stop
18	E-sport	43	Gathering	68	Gaming device	93	Not Productive
19	Graphic effects	44	Level	69	Feel lonely	94	Time management
20	Sound effects	45	Login	70	Parental orders	95	Underestimated
21	Enjoy	46	Loneliness	71	Game	96	Valorant
22	Event	47	Playing together	72	Point	97	Visual
23	Focus	48	Lazy	73	Point of view (POV)	98	Internet cafe
24	Free expression	49	Very long game playing	74	Ragnarok	99	Youtube
25	Free speech	50	Night	75	Roleplay	100	MOBA

as words, images, and sounds that could immediately remind them of gaming activities, and could arouse the desire to play the game immediately. Furthermore, Table 2 presents several 497 stimulus words that are considered to be most associated with online gaming activities.

Table 3 presents 87 image stimuli most closely associated with online gaming activities. Table 4 presents a total of 98 audio stimuli that are considered to be most associated with online gaming activity.

The subsequent research activity was a quantitative approach. In the FGD activity, participants were requested to complete a questionnaire comprising 100 words from the focused interview (Table 1) by rating each word on a scale of 0–10 to ascertain the strength of the association between these words and online gaming. An interval of 3.33 yielded three association criteria: high, medium, and low. The final result was 70 words with high association criteria and 30 words with moderate association. The information above is presented in Tables 5 and 6.

Discussion

The contemporary online game gamer can be considered a representative example of the post-modern human, a digital native with a distinctive set of perspectives that differs from those of previous generations.[20] The concept of hyperreality proposed by Jean Baudrillard is assumed to explain this phenomenon. Baudrillard's fundamental premise is that the contemporary world has lost a crucial aspect: its connection with reality, history, and the potential for transcendence.[21] Hyperreality can be defined as a situation in which the real is so intertwined with the fictional, and the virtual world assumes a dominant position to the extent that it is perceived as more real than reality itself. Entering virtual

Table 2 Words Stimulus

No	Words	No	Words	No	Words	No	Words
1	Ability	56	Charger	111	Exciting	166	Skillful
2	Acc	57	Cheat	112	Exorcist	167	Network
3	Ace	58	Checkpoint	113	Exp lane	168	Joker
4	Add friend	59	Chest	114	EZ	169	Joki
5	Addict	60	Chicken	115	F2P	170	JP
6	Adrenaline	61	Circle	116	Face	171	Jump shot
7	Positive affirmation	62	Clan	117	Fanny-land	172	Jungler
8	AFK	63	Classic	118	Farming	173	Loose
9	Agent	64	Choco-latte	119	Fastest lup	174	Character
10	Airdrop	65	Combo	120	Feeder	175	KDA
11	Friend's invitation	66	Comms	121	Fire rate	176	Mediating skill
12	End of season	67	Competitive	122	First blood	177	Potato
13	Religious routinely	68	Computer	123	First kill	178	Knock-down
14	Anime	69	Console	124	Flanking	179	Knock-out
15	Assist	70	Cool-down	125	Focus	180	Competition
16	Attack	71	Corner	126	Fouls	181	Gather
17	Avatar	72	Credits	127	FPS	182	Kuronami
18	AWP	73	Creep	128	Fram-ming	183	Lagging
19	Backs-round	74	Critical	129	Free kick	184	Laptop
20	Bad mood	75	Crosshair	130	Picture	185	Last game
21	Lona clown	76	Ignorance	131	Gameplay	186	Late game
22	Happy	77	Just "nana,"	132	Gamers	187	Leader-board
23	Banned	78	Just EVOSS	133	Gaming	188	League
24	Battle-pass	79	Custom	134	Gaming skill	189	Legend
25	Battle spel	80	Cut-scene	135	Ganking	190	Level
26	Free expression	81	Danger	136	Gatcha	191	Line up
27	Staying up late	82	Dark system	137	GGWP	192	LMAO
28	Cursing	83	DC	138	Ghosting	193	Loadout
29	Best player	84	Deathmatch	139	GLFH	194	Lobby
30	Blaming	85	Debuff	140	Glory	195	Loneliness
31	Skipping class	86	Decal	141	God of war	196	Loot box
32	Booyah	87	Defuse	142	Gold lane	197	Looting
33	Bot	88	Device	143	Grafis	198	Lord
34	Bottom frag/bot-frag	89	Diamond	144	Grinding	199	Lore
36	Bottom lane	90	Dininja	145	Guild	200	Lose streak
36	Brawl	91	Discord	146	Gunsmith	201	Low
37	Break	92	DO	147	Hand-phone	202	M Series
38	Break shot	93	Double kill	148	Happy	203	Mabar
39	Buff	94	Download	149	Headshot	204	Macro
40	Buffering	95	DPS	150	Heal	205	Mage
41	Bug	96	Draw	151	Hero	206	Magic chess
42	Build	97	Money	152	Hitbox	207	Maintenance
43	Bullet	98	Duo	153	Hitam	208	Major champion-ship
44	Burst damage	99	Durasi	154	HS	209	Night
45	Buy one	100	Early game	155	IESF	210	Maniac
46	Buy pass	101	Effect	156	Impact	211	MAP
47	Buying time	102	EKIA	157	Individual skill	212	Mass kill
48	C4	103	Elkumar	158	Indomaret point	213	Matchmaking
49	Carry	104	Enemy missing	159	Instagram	214	MCL
50	Cbh	105	Enjoy	160	Internet	215	Medkit
51	CBT	106	Entry frag	161	Introvert	216	Mechanic
52	CC	107	Equipment	162	Inventory	217	Membership
53	Chains killer	108	E-sim	163	Invite	218	Winning
54	Champion	109	ESL Pro League	164	Item	219	Ignoring assignment
55	Character	110	Event	165	Item shop	220	Ostracize

(continued)

No	Words	No	Words	No	Words	No	Words
221	Repeat	276	Overtake	331	Safe zone	386	TH
222	Swearing	277	Overtime	332	Savage	387	TI
223	Demeaning	278	Parachute	333	Scope	388	Can't stop
224	Smoking	279	Parry	334	Script	389	No, eat
225	Meta	280	Party	335	Sea games	390	Not taking a shower
226	Meta hero	281	Pattern	336	Season	391	Tier list
227	Micro	282	Peek	337	Always wanted	392	Tiktok
228	Midland	283	Penalty	338	Self-awareness	393	Time management
229	Min One	284	Penetration	339	Happy	394	Title
230	Mining	285	Ping	340	Weapon	395	Top frag
231	Minion	286	Pitstop	341	Sensitivity	396	Top global
232	Mission	287	Planting	342	Very senior	397	Top lane
233	MMORPG	288	Player	343	Shop	398	Top score
234	MMR	289	Play Station	344	Short cut	399	Chat topics
235	Moba	290	Playtime	345	Silent	400	Top-up
236	Mobile	291	PMPL	346	Skeleton	401	Town hall
237	Money	292	Point	347	Skill	402	Toxic
238	Mood booster	293	Poke	348	Skill issue	403	TPP
239	MPL	294	Pro player	349	Skins	404	Trade
240	MSC	295	Pub stomp	350	Score	405	Trash talk
241	MT	296	Push rank	351	Slading	406	Trio
242	MU	297	Push	352	Smurf	407	Triple kill
243	Multiplayer	298	PVE	353	Snowball	408	Trolling
244	Music	299	PVP	354	Social skill	409	Trophy
245	MVP	300	Quest	355	Solo	410	TYPE
246	Nerf	301	Queue	356	Speed run	411	Turn-based
247	Newbie	302	Racing line	357	Spek	412	Tournament
248	Ngalong	303	Rage Quit	358	Spike	413	Turrets
249	Ngebul	304	Ragnarok	359	Spin	414	Turtle
250	Framing	305	Rampage	360	Split push	415	UFC
251	Pushing	306	Rank	361	Sport	416	Ulti/ultimate
252	Chit-chat	307	Rarity	362	Squad	417	Underestimated
253	Nickname	308	Racist	363	Stat	418	Underperform
254	Night market	309	Recall	364	Steam	419	Unranked
256	Non-judge-mental	310	Recoil control	365	Sticker	420	Utility
256	Watching	311	Red zone	366	Story	421	Valorant
257	Noob	312	Refreshing	367	Strategi	422	VCT
258	NPC	313	Release	368	Stress release	423	Video
259	NR	314	Reload	369	Stressful	424	VIG
260	NT	315	Relog	370	Stuck	425	Visual
261	NU	316	Report	371	Stun	426	War
262	Comfort	317	Request back up	372	Sound	427	Internet café
263	Trash	318	Retreat	373	Submission	428	WCG
264	Objective completion	319	Retri Indomaret	374	Support	429	Weapon
265	Sport	320	Revamp	375	Surrender	430	Well played
266	One shot	321	Revive	376	Survival	431	Whaler
267	One tap	322	Reward	377	Sweat	432	Whiff
268	Online	323	RNG	378	Swing	433	Win streak
269	OP	324	Roam	379	Target	434	Wipe out
270	Open mic	325	Rokok	380	Taunting	435	WWCD
271	Open world	326	Role	381	Tea bagging	436	Youtube
272	Parents	327	Roleplay	382	Communication skill	437	Zoning
273	Organization	328	Rotate	383	Tele		
274	Overheat	339	RPG	384	Teleport		
275	Overpower	330	Rush-b	385	Friends		

Table 3 Images Stimulus

No	Images	No	Images	No	Images
1	Pirates of the Caribbean movie actor (Bane hero Mobile Legend)	31	Rice cake (ketupat)	61	Pro-player (mindfreak)
2	Armor	32	Gaming keyboard	62	Play Station
3	Assault Rifle	33	Silver or gold coins	63	Tree branches
4	Slightly gray chicken (Counter-Strike)	34	Kopikap	64	RGB
5	BA game (Gebian - Mobile Legend)	36	First aid box (PUBG)	65	Ronaldo
6	Characters in media social banner	36	Turtle (Mobile Legend)	66	Horror houses
7	Abandon house	37	Gaming table chair	67	Grass (Mobile Legend)
8	Coboy	38	Monitor screen	68	Login screen (FPS, Dota)
9	Controller	39	Live streaming pro-player games	69	Paper roll
10	FIFA 24	40	Garena logo	70	AK 47 weapon
11	Game character's photos	41	Team logo (Mobile Legend, Dota, Valorant)	71	Sickle
12	Application logo	42	E-sports team logo (Evos/ RRQ)	72	Blue shoes
13	Hero picture	43	Thief	73	Situations that are similar to game scenes (tornado, fire)
14	Image of wifi logo showing strong signal	44	Seeing other people become champions	74	Steam
15	Gameplay (video) in YouTube/TikTok	45	ROG logo	75	Stick cue (8 Ball Pool)
16	Finish line	46	Police car	76	Play Station joystick
17	Jars and hammer	47	Wrecked car	77	Army bag
18	Granat	48	Gaming mouse	78	A friend who likes to play games
19	Hairdryer (knife weapon in Point Blank)	49	Watching live-stream YT/ Twitch/social media	79	Police gunshot
20	Headset	50	Nyi Roro Kidul	80	Parachuting
21	Helm lev 3 (PUBG)	51	Abandoned factories	81	AFK letters at the end of the motor vehicle license plate
22	Oversized helmet	52	Pot (in PUBG)	82	Tower (Turret ML)
23	Hero Barats (Mobile Legend)	53	PC	83	Vial
24	Smartphone	54	PC gaming	84	Game wallpaper
25	Icon game	55	Swords and sandals	85	Ranking color (iron to radiant)
26	Indomie	56	Swords and shields juxtaposed	86	Internet café
27	Infernus classic (mobil)	57	Persib	87	Werewolf
28	E-sport jersey	58	Trophy		
29	Jungle	59	Knife (Counter-Strike)		
30	Katana	60	Tournament posters		

reality entails crossing a threshold where the conventional physical and temporal boundaries are effectively suspended. Introduces the concept of 'cyberspace,' which describes a realm of fluidity where the conventional boundaries and limitations are erased and re-established at will. The ease with which multiple virtual identities can be constructed exemplifies this fluidity. Virtual reality may be experienced by various individuals, each with their own unique identity, and it may also involve interactions with other virtual personalities within the digital domain.[21]

Previous studies revealed that individuals who frequently engage in online gaming with social characters tend to possess a considerably smaller social circle in the tangible world and of

Table 4 Audio Stimulus

No	Words	Link	No	Words	Link
1	“Legends never day” (League of Legends)	https://youtu.be/r6zIGXun57U	29	Footsteps (PUBG)	https://youtu.be/PFHayd-soWo
2	“Moon over the castle” (Gran Turismo)	https://youtu.be/GdNWJd9AiJE	30	LOL girl band: K/DA "pop/stars"	https://youtu.be/UOxkGD8qRB4
3	“On my way” (PUBG Mobile)	https://youtu.be/dhYOPzcsbGM	31	Maniac	https://youtu.be/VdvWUaUPgic
4	“Rampage”	https://youtu.be/-CSRKm60U6I	32	Masskill	https://youtu.be/ysEaeQtvzN8
5	“Victory”	https://youtu.be/kaGcoPCaNFM	33	Missing shot	https://youtu.be/ysEaeQtvzN8
6	Alan Walker Omy (PUBG)	https://youtu.be/uXuG1k4K810	34	More and more and more (FIFA/PES)	https://youtu.be/qLYAy3A_2Aw
7	Ambiance (natural sound: wind, birds chirping, etc.)	https://youtu.be/wKnS8VPxpHI	35	Medieval music	https://youtu.be/jZ7a1yPaJh0
8	The announcer's voice says, "First kill," "double kill," and "maniac."	https://youtu.be/VdvWUaUPgic	36	Orchestra music	https://youtu.be/vjlWr9W1i30
9	Whispers	https://youtu.be/P5ADqo2DjUI	37	Sound of the waves (ML)	https://youtu.be/lBrVVnYOlyE
10	Chain headshot	https://youtu.be/FPAVEHkj3eY	38	On mic in ML game	https://youtu.be/5mFFctdVZng
11	Chain killer	https://youtu.be/YbBKAjanKBk	39	On mic in the PUBG game	https://youtu.be/0m2NT5nB60c
12	Dear God a7x	https://youtu.be/mzX0rhF8buo	40	COC game opening songs	https://youtu.be/LIWEMsRqvXo
13	Defeat	https://youtu.be/mcDAZ2XeLmw	41	ML game opening songs	https://youtu.be/ZjgK9pf5k0I
14	Double kill	https://youtu.be/VdvWUaUPgic	42	Orchestra music as game OST	https://youtu.be/mA3k4lLt1dU
15	First blood	https://youtu.be/VdvWUaUPgic	43	OST game (ML)	https://youtu.be/ZjgK9pf5k0I
16	Footstep	https://youtu.be/mPgGg4MJKKc	44	Firecracker sound	https://youtu.be/VyQmhe_DKys
17	Dog’s barking	https://youtu.be/toeu0orxCt8	45	Piercing shot	https://youtu.be/ysEaeQtvzN8
18	Gregorian chant	https://youtu.be/k4q9YdUPbuw	46	Radio chat (among us)	https://www.youtube.com/live/JwvMeXfhoR8
19	Happy Asmara	https://youtu.be/QE8H1HF0Wu4	47	Ringtone COC/opening game Supercell (developer)	https://youtu.be/_DyknFouot8
20	Headshot	https://youtu.be/ysEaeQtvzN8	48	Savage	https://youtu.be/VdvWUaUPgic
21	COC game song intro	https://youtu.be/hD1bjvwL8Rk	49	Shakira waka waka song (PES)	https://youtu.be/iMwORduCknE
22	GTA game San Andreas songs intro	https://youtu.be/TTB6eEHCAko	50	Whistling in ML game	https://youtu.be/p8neiq0ZRso
23	ML game song intro	https://youtu.be/ZjgK9pf5k0I	51	Whistling	https://youtu.be/cWISPlQyrc8
24	Sounds of coin clicking	https://youtu.be/itp3B9bALl0	52	All-game song theme	https://youtu.be/dhYOPzcsbGM
25	Killing spree	https://youtu.be/x6kCrrrV2iU	53	Sound effect weapon skin	https://youtu.be/EgRvVq8mStE
26	Konami Cup	https://youtu.be/6pEfUzWW_w0 and https://youtu.be/wHAJdgUS1w4	54	Champion sound effect	https://youtu.be/N1Ovi75omJk
27	"If I Can Stop One Heart from Breaking" song	https://youtu.be/8v0RVyPlUA4	55	Attack/killing sounds	https://youtu.be/BGlqbWDmLWw
28	“Ready for Love" Blackpink song	https://youtu.be/7WyHtSlvHD4	56	Lobby game soundtrack	https://youtu.be/cWISPlQyrc8

(continued)

No	Words	Link	No	Words	Link
57	"Ah"	https://youtu.be/ATkHnm0DbIY	78	"Panik panik" Leo Murphy sounds	https://youtu.be/snlq4yxEhc8
58	Roaring (hero roger)	https://youtu.be/8hl0fJUFAoM	79	Parachute open sounds	https://youtu.be/aExT1qu5qp8
59	Door open sound	https://youtu.be/WiRJga4lcw4	80	Pascol bujang sound	https://youtu.be/YC-gh67dq08
60	Bird sound (diggie) in the ML game	https://youtube.com/shorts/Pg0XFVn4er0	81	Sword sounds	https://youtu.be/EgRvVq8mStE
61	"Gaskeun" sound when login game	https://youtu.be/RsBoaZqLSuI	82	War sounds	https://youtu.be/YVdZHz48uIs
62	Sword swipes sound	https://youtu.be/dxb2mYozQZs	83	Airplane sound	https://youtu.be/sXANrP1738A
63	Animal sounds (chicken, goat, cow, horse, bird)	https://youtu.be/N_d4fUq_I_8	84	Lightning bolt sounds (hero eudora)	https://youtu.be/35HJYfm8hyg
64	Horror sounds	https://youtu.be/e2wnNXIvMU4	85	Weapon reload sound	https://youtu.be/ZoiSxoA-Qyg
65	Walkie talkie sound	https://youtu.be/Pv6sh1vfXPw	86	Alan Walker OMY soundtrack	https://youtu.be/uXuG1k4K810
66	Mechanical keyboard sound	https://youtu.be/XuTaNJC54x8	87	Supporters sound	https://youtu.be/_QCYcMOxWxI
67	Horn sound (PUBG)	https://youtube.com/shorts/jLTSWHg5j5k	88	Sports game supporter sounds	https://youtu.be/_QCYcMOxWxI
68	Football commentator voice	https://youtu.be/vgP8HLXDXGI	89	AK47 gunshot sounds	https://youtu.be/m-GGBiP0eTE
69	Explosion sounds	https://youtu.be/VyQmhe_DKys	90	Weapon shot sounds	https://youtu.be/m-GGBiP0eTE
70	Race car engine sounds	https://youtu.be/IyM6fp85mEo	91	Gamers mate voices	https://youtu.be/RsBoaZqLSuI
71	Car sounds (hero Johnson)	https://youtu.be/zalKQjClXFM	92	"Ugh" voice	https://youtu.be/RuPV5tM5j54
72	F1 car sounds	https://youtu.be/9HgTpWgw6q8	93	Triple kill	https://youtu.be/VdvWUaUPgic
73	Monster voice	https://youtu.be/I6KMAxpqUw8	94	Victory	https://youtu.be/8qMfGCsiXVc
74	Motorcycle sound	https://youtu.be/0GENoZjw9Wk	95	Voice line	https://youtu.be/VdvWUaUPgic
75	KLX motorcycle sound	https://youtu.be/kXmk-cgT9ls	96	Wake me up avicii (game pes)	https://youtu.be/ubP994i5CHs
76	Voice of an angry man	https://youtu.be/tSfgtegVctQ	97	Windah basudara	https://youtu.be/P-022s7vzTQ
77	Arrow sound	https://youtu.be/fWGdG_NLocU	98	Winner winner chicken dinner sounds	https://youtu.be/2WXQIDYt1jM

lesser quality. The social obligations associated with gaming are becoming increasingly dominant in gamers' lives, superseding the importance of real-world relationships. Consequently, the social displacement effect related to this type of gaming increases the likelihood of sustained gaming behavior. This indicates that the phenomenon of online game gamers is characterized by fluidity and hyperreality.[22,23] A previous study also asserted that a significant aspect of gaming behavior is the player's attachment to virtual items, actions, and identities. The virtual becomes increasingly perceived as real. A substantial proportion of the gaming population is profoundly attached to the actions and identities they assume within the virtual realm.[24]

In examining online gaming behavior in non-problematic and problematic groups, researchers employed a multidimensional model (I-PACE) that synthesizes a range of theoretical considerations and empirical findings about Internet use disorders. The I-PACE model posits that individuals with a predisposition to addiction seek gratification from gaming behavior, leading

Table 5 Word Stimulus with the High Rating Category

No	Words	Rating	No	Words	Rating	No	Words	Rating
1	Adrenaline	7.07	25	Gaming skill	8.56	49	Online	8.92
2	Friends Invitation	8.22	26	Graphic	8.18	50	Gaming gear	7.96
3	Background	6.69	27	Hobby	7.96	51	Gaming	8.37
4	Happy	7.45	28	Internet	9.07	52	Point	8.39
5	Staying up late	7.62	29	Good at gaming	7.92	53	Point of view (POV)	7.56
6	Competition	8.62	30	Win	7.00	54	Take a break	7.35
7	Can be anywhere	7.33	31	Loose	7.66	55	Self-awareness	6.83
8	Communication skill	7.75	32	Character	7.83	56	Happy	8.03
9	Computer	6.90	33	Competition	7.71	57	Excited	8.50
10	Damage	8.47	34	Gather	7.75	58	Circle	7.24
11	Device	8.79	35	Level	8.26	59	Social skill	7.09
12	Discord	7.45	36	Login	8.83	60	Game strategy	8.47
13	E-sport	8.26	37	Mabar	9.30	61	Streaming	7.20
14	Graphic effect	8.52	38	Very long game playing	7.05	62	Stress	6.96
15	Sounds effect	8.20	39	Night	8.07	63	Sound	7.49
16	Enjoy	8.24	40	Win	8.67	64	Almost done	6.75
17	Event	7.94	41	Enjoy	8.33	65	Tension	7.67
18	Focus	8.18	42	Stress release	7.00	66	Pressure	7.11
19	Free expression	7.66	43	Mobile legend	8.54	67	Time management	6.84
20	Free speech	7.22	44	Mood booster	7.88	68	Underestimated	6.69
21	Picture	8.13	45	Music	8.13	69	Visual	7.84
22	Gameplay	9.07	46	Chit-chat	8.43	70	Youtube	7.71
23	Gamers	8.47	47	Watching	6.77			
24	Gaming	8.52	48	Comfort	7.50			

Table 6 Word Stimulus with the Moderate Rating Category

No	Words	Rating	No	Words	Rating	No	Words	Rating
1	Positive affirmation	5.66	11	Lazy	5.81	21	Ragnarok	5.41
2	Anime	4.71	12	Release	6.22	22	Roleplay	6.32
3	Avatar	6.00	13	Delay eating	4.41	23	I always wanted to play	6.54
4	Drop-out	3.84	14	Ignoring assignment	3.96	24	Bad mood	6.11
5	Praying	5.50	15	Procrastinating	5.22	25	No judgment	5.84
6	Introvert	4.41	16	MMORPG	6.62	26	Difficult to stop	5.92
7	Addiction	6.62	17	Sports	6.11	27	Un-productive	5.15
8	Family	5.56	18	Organization	5.54	28	Valorant	6.66
9	Critical	6.60	19	Feel lonely	6.39	29	Warnet	6.37
10	Lonely	5.30	20	Parental order	4.35	30	Skipping class	2.32

to significant alterations in emotional and cognitive responses to gaming. This, in turn, gives rise to habitual gaming behavior, which serves to compensate for changes and ultimately results in negative consequences.[16]

Brand et al.[4] posit that problematic gaming behavior results from an interaction process between predisposing factors and affective and cognitive responses that are reflected in individual behavior and that seek satisfaction from specific activities. This leads to changes in cognitive and affective responses, resulting in a strong attachment to the game as compensation for these changes. Conversely, there is a cohort of gamers who evince equal enthusiasm and enjoyment of online games yet do not manifest indications of problematic behavior. It stands to reason that the psychological mechanisms at play in these two groups, which exhibit disparate characteristics despite being exposed to the same

stimulus (online games), will also differ.

The multidimensional model's affective and cognitive response component is the affective and cognitive responses to internal and external stimuli. It encompasses mood and thinking changes following exposure to a gaming stimulus, including coping tendencies, cognitive bias, craving, and urge. The cognitive bias component pertains to the behavioral tendency to more rapidly, efficiently, or accurately recall, recognize, and/or respond to stimuli associated with rewarding substances or behaviors.[5] Zhou et al.[6] researched individuals with addictive behavior towards online games and found that they exhibited a cognitive bias towards information related to internet games. Cognitive biases, in conjunction with deficiencies in executive function skills (including diminished mental flexibility and response inhibition), are postulated to play a role in the development of internet addiction disorder. It is hypothesized that non-problematic gamers do not experience any cognitive bias, whereas problematic gamers are assumed to experience a cognitive bias towards information related to online gaming.

In recent years, notable advancements have been made in comprehending the fundamental aspects of problematic gaming behavior. These developments have focused on the processes, content, and structure of cognitions that shape gaming behaviors with adverse outcomes.[25–27] Studies identifying decision-making processes have employed standard experimental paradigms to test problematic gaming behavior, with control groups comprising healthy or non-problematic online game players.[16]

A previous study exemplified the concept of cognitive biases. In this study, a modified version of the semantic fluency task was used to study drug fluency as a marker of cocaine use disorder. In this measure, participants must recall as many words belonging to a specific semantic category (e.g., names of animals or fruits/vegetables) as possible within a limited time frame. In this study, the authors requested that a cohort of cocaine users and a control group recall as many drug-related terms as possible. A notable discrepancy was observed between the experimental and control groups about the mention of drug-related terminology. Individuals with a cocaine use disorder exhibited a greater propensity to reference such terms. Conversely, there was no significant difference in the number of non-drug words mentioned by either group.[28] Similarly, this phenomenon has been observed in non-substance addiction behaviors, such as problematic gaming. Those with problematic gaming behavior have been demonstrated to exhibit a series of decision-making biases that fundamentally interfere with their capacity to make reasonable judgments regarding gaming activities. Those with internet gaming disorder (IGD) or problematic gaming behavior tend to justify their decision to continue engaging in online gaming despite being aware of the adverse consequences.[16] It may be posited that non-problematic gamers evince no discernible cognitive bias, whereas those exhibiting problematic gaming behavior demonstrate a bias towards information about online gaming.

The focused interview process employed in this study yielded information indicating that individuals engaged in gaming activities tend to demonstrate heightened attention and accelerated response when presented with the term "game" or related terms such as: "Mabar," 'Login,' 'Damage,' 'GG,' 'NT,' 'Hero,' 'Top Global,' 'AFK,' 'Winstreak,' 'Savage,' 'Wipeout,' 'Guild,' and others. Upon reading or hearing these words, respondents immediately associate them with their preferred games; in some cases, they even experience a desire to play online games immediately. It is reinforced by the calculation results in Table 5, which show a difference in word association rating numbers. Higher ratings indicate stronger associations with gaming activities. The words that get the 10 highest ratings are: "Mabar," "Internet," "Gameplay," "Online," "Login," "Device," "Win," "Competition," "Mobile Legend," and "Damage."

It then progresses to encompass both words and sounds (audio) or images related to the game. Audio stimuli may include the background music of a gaming environment, the commendatory voice of an announcer (e.g., "victory!" or "maniac!"), the melody of a game's theme song, the sound effects of in-game characters or weapons, or even real-world sounds (e.g., the sound of a racing motorcycle, the sound of a Formula 1 car in a racing area, or the sound of an airplane taking off). Additionally, auditory stimuli may include the sound of footsteps or invitations from fellow gamers perceived as highly related to the game. This is reinforced by the results in Table 4, which show that many types of audio sounds are

associated with gaming activities.

Additionally, related visual stimuli may include images of game team logos, logos of popular gaming-gear brands, photographs of popular professional players, as well as photographs of real-world situations such as images of abandoned buildings, images of empty factories, images of damaged cars, images of Japanese swords (katana), and banners on social media promoting a game. These elements have been demonstrated to stimulate the desire to commence gameplay effectively. This is reinforced by the results in Table 3, which show that many types of images are associated with gaming activities.

It can be posited that the words, images, and sounds associated with the game are positively correlated with online gaming. This finding is consistent with incentive sensitization theories of addiction, which posit that reward-associated stimuli become incentive salience, prompting pathological motivation to engage in addictive behaviors despite the presence of positive affect.[29]

The term "game" is typically associated with positive connotations among gamers, including enjoyment, excitement, interest, social interaction with friends, and stress relief. Additionally, some respondents linked the term "game" to specific characteristics, such as competition, conflict, and entertainment. All participants spontaneously identified the term "game" by playing online games. It was evident that the concept of preoccupation was present in the gamers.

The findings of this research, based on the focused interviews conducted with both groups of gamers (non-problematic and problematic), indicate that both groups demonstrate a heightened interest in online games. The game's auditory, visual, and textual elements, including the theme song, background sounds, words, images, and videos, collectively reinforce curiosity and stimulate an immediate desire to engage with the game. They demonstrate heightened interest and a more rapid response to stimuli related to the game. The distinction between the two groups lies in the way in which problematic gamers ascribe meaning to gaming. The participants reported experiencing positive emotions, including happiness, excitement, enthusiasm, and an adrenaline rush, and perceived gaming as a source of dopamine.

In contrast, the non-problematic gamers perceived gaming as a fun leisure activity. The more profound significance and investment of time and attention by those with problematic gaming habits resulted in a diminished concern for external matters. Game-related stimuli elicit a prompt response in the form of interest, subsequently giving rise to online gaming behavior. It corroborates the initial assumption of the researcher, namely that both problematic and non-problematic groups are subject to cognitive bias. Nevertheless, the varying degrees of significance attributed to games also influence the extent and swiftness to which game-related cues are responded.

Cognitive tasks such as the Go-Nogo task require participants to respond as rapidly as possible when a Go stimulus is presented, while they must inhibit their response when a Nogo stimulus is presented.[30,31] As outlined by Nosek and Banaji,[12] the Go-Nogo task involves the presentation of target (signal) and distractor (noise) stimuli in rapid succession. In response to the presentation of a target item (e.g., a word related to online games), participants indicate their response by pressing a button. Conversely, in response to the presentation of a distractor item (e.g., a neutral word not related to online games), participants refrain from pressing a button. The stimuli gathered from this study, whether in the form of words, images, or audio, can serve as a fundamental database for cognitive tasks designed to assess the cognitive biases of gamers.

Through this article, we expect the findings from this study to be used as a prior database to measure the level of association between the stimulus and the cognitive process of decision-making in relation to playing online games.

Conclusion

It was concluded that word, picture, and audio stimuli would evoke a strong association with decision-making to play online games, prompting gamers to devote greater attention when encountering them, whether in visual, textual, or audio formats.

Conflict of Interest

There is no conflict of interest in this study.

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