Presence

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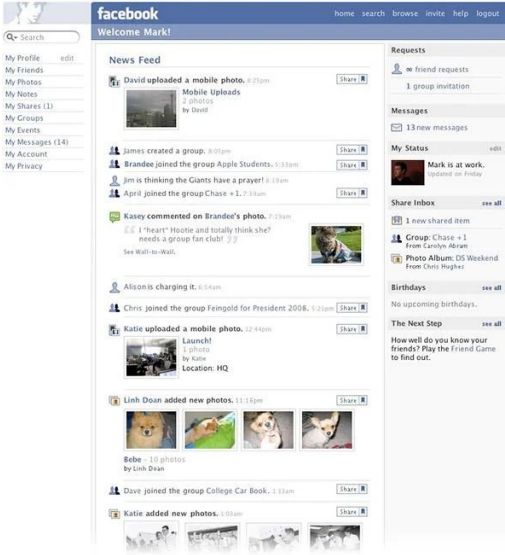
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BREAKING NEWS

Presence

The psychological feeling of non-mediation.

The psychological feeling of being there.

Example: The virtual world of Matrix (where you even don’t know you are not in the real world) would be a system that provides highest level of presence.

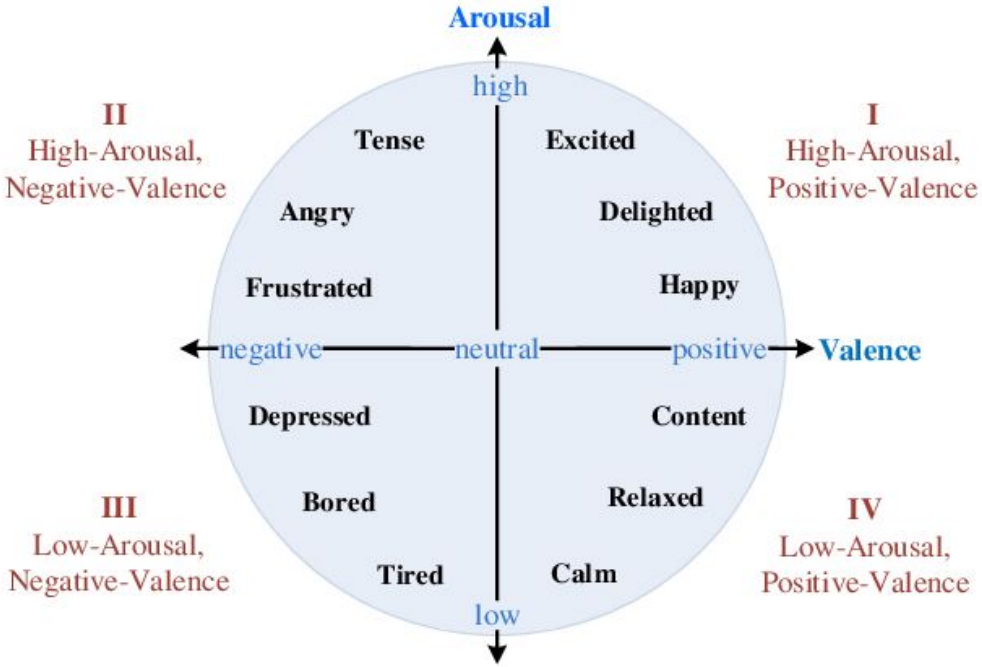
Definition of Social Psychology

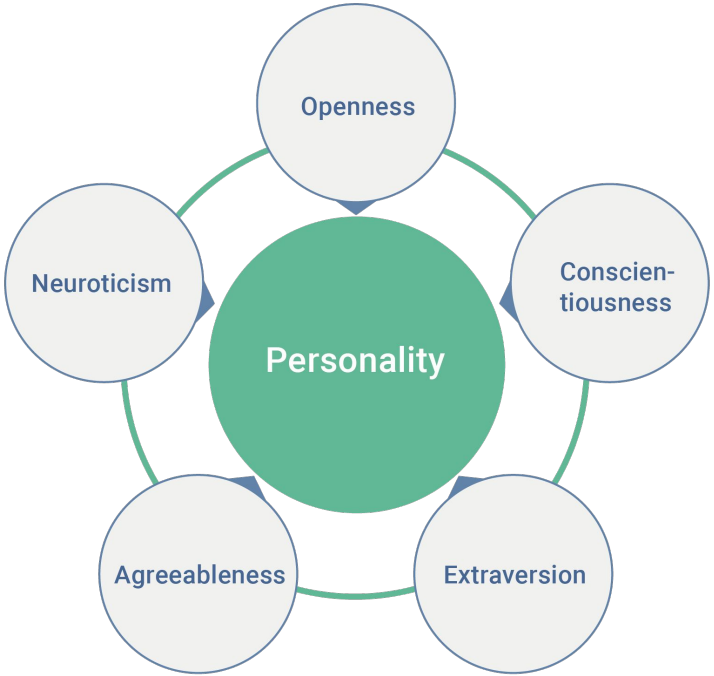
[Social psychology is] an attempt to understand and explain how the thought, feeling, and behavior of individuals are influenced by the actual imagined, or implied presence of others. (Gordon Allport, 1954)

Psychology is a study on human thoughts, feelings, and behaviors, which are psychological constructs.

Construct: a word with a meaning not that different from a “concept”

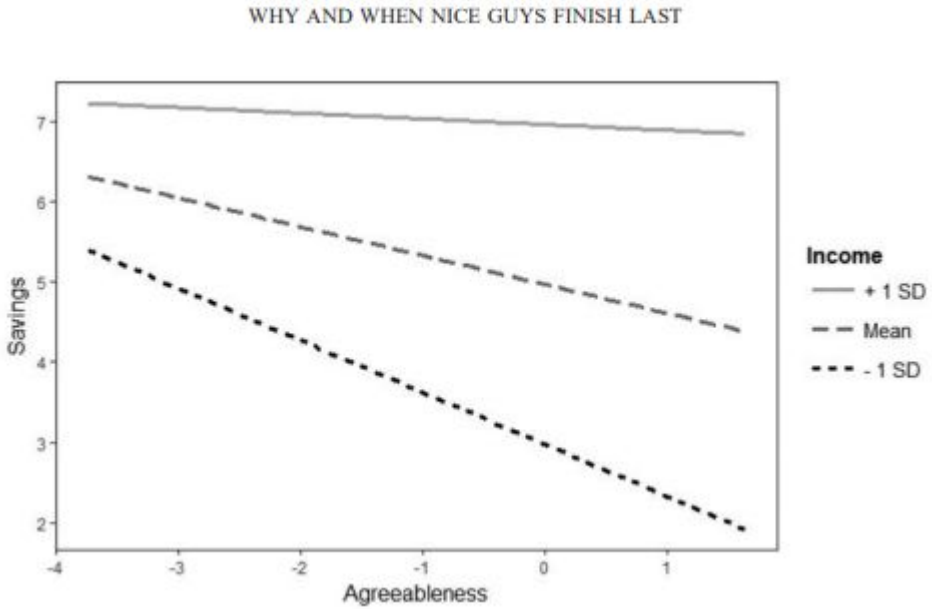
Examples of Psychological Constructs





An Example of Psychological Research

Models describe relationships between constructs.



Presence for Media Studies

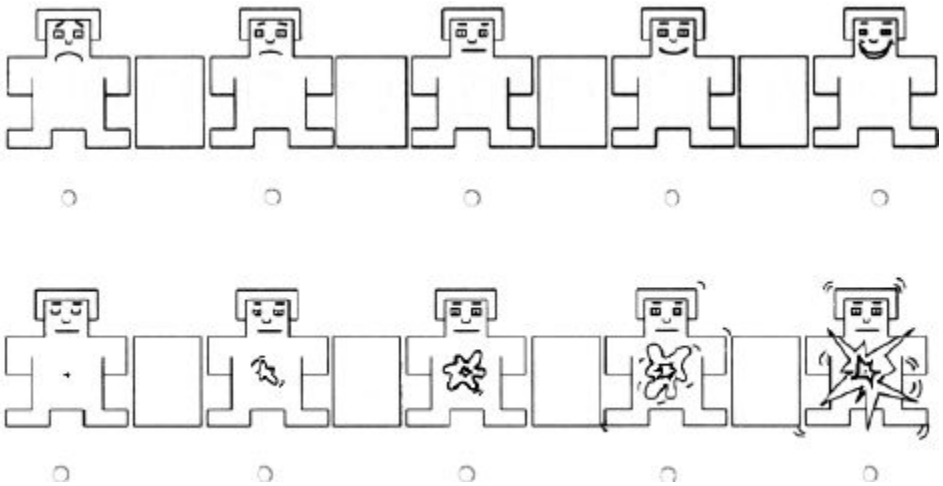
A psychological construct with huge value for media research because

The goal media design can be simplified to achievement of higher level of presence, especially for immersive media (e.g., AR/VR).

Problem: how to measure presence?

Example: Valence and Arousal

Questionnaire-based: Pick one each

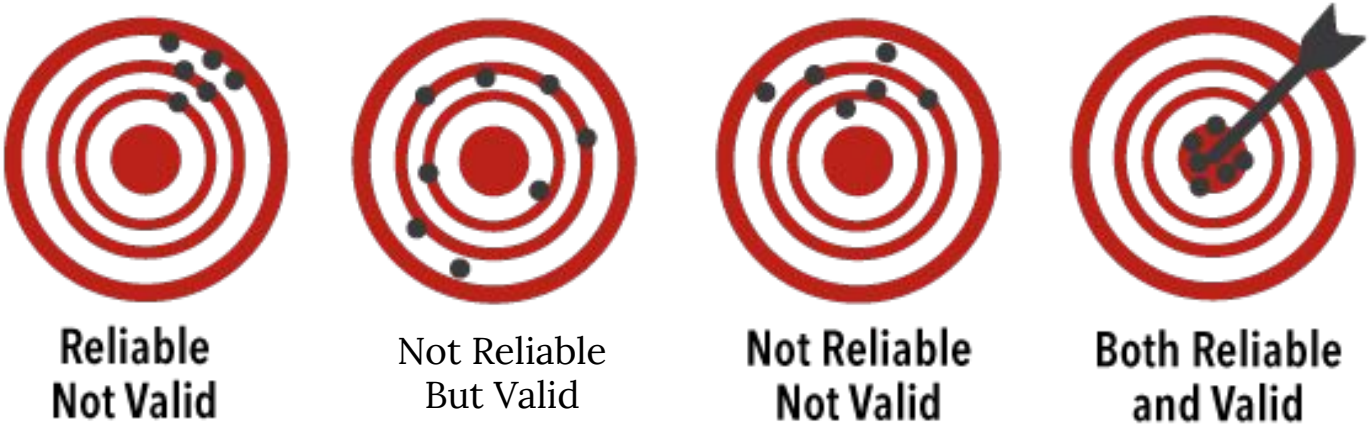


Quality Measures for Psychological Measures

Is the measure validity and reliable?

No.	*Dimensions*	*Test Re-test*	*Cronbach's Alpha*
1	Neuroticism	0.76***	0.80
2	Extraversion	0.79***	0.61
3	Openness	0.64***	0.69
4	Agreeableness	0.62***	0.73
5	Conscientiousness	0.62***	0.60

*** Statistically significant at the level of ($\alpha < 0{,}001$)



Presence Questionnaires

Involvement

1. How much were you able to control events?
2. How responsive was the environment to actions that you initiated (or performed)?
3. How natural did your interactions with the environment seem?
4. How much did the visual aspects of the environment involve you?
5. How natural was the mechanism which controlled movement through the environment?
6. How compelling was your sense of objects moving through space?
7. How much did your experiences in the virtual environment seem consistent with your real world experiences?
8. How completely were you able to actively survey or search the environment using vision?
9. How compelling was your sense of moving around inside the virtual environment?
10. How well could you move or manipulate objects in the virtual environment?
11. How involved were you in the virtual environment experience?
12. How easy was it to identify objects through physical interaction, like touching an object, walking over a surface, or bumping into a wall or object?

Criticism to Questionnaires

How colorful was your day? (Mel Slater, 2004)

1) Think back to yesterday. How colorful was your day?
2) Were there times during the day that you would describe as having been colorful?
3) To what extent were there times during the day that you felt were overwhelmingly vivid?
4) When you review the events of yesterday in your mind's eye, how colorful are the images?

Are presence questionnaires even better than the colorfulness questionnaire?

(Slater accomplished statistical significance even with the colorfulness questionnaire.)

FIVE (Slater & Wilbur, 1997)

A Framework for Immersive Virtual Environments

> “We modern, civilised, indoors adults are so accustomed to looking at a page or a picture, or through a window, that we often lose the feeling of being *surrounded* by the environment, our sense of the *ambient* array of light... We live boxed up lives.” (Gibson, 1986)

FIVE (Slater & Wilbur, 1997)

Immersion: the ability of a device to provide the feeling of being there

Presence: the psychological feeling of a person being there

Examples:

- Headsets can have high/low levels of immersion.
- People can feel high/low levels of presence.

Social Influence Theory (Blascovich, 2002)

On whether virtual humans can change human behavior.

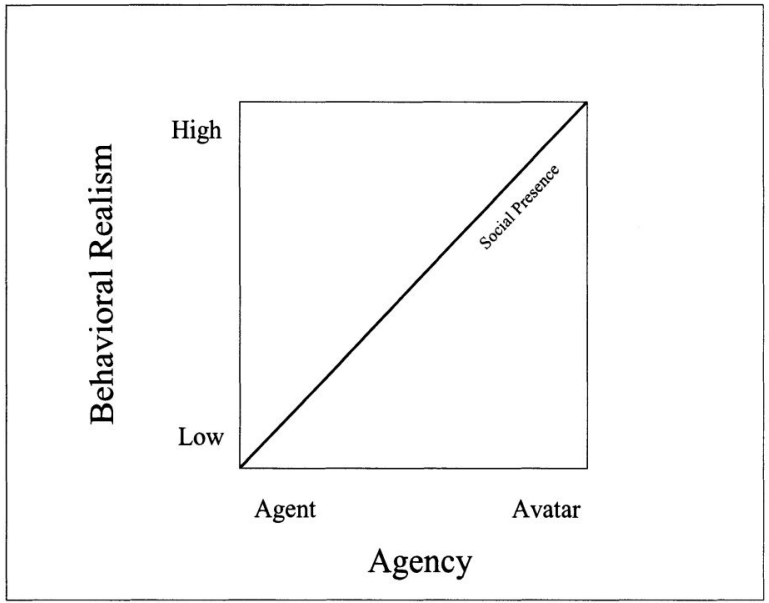


Figure 8.1 Social presence as a function of behavioral realism and agency.

Social Influence Theory (Blascovich, 2002)

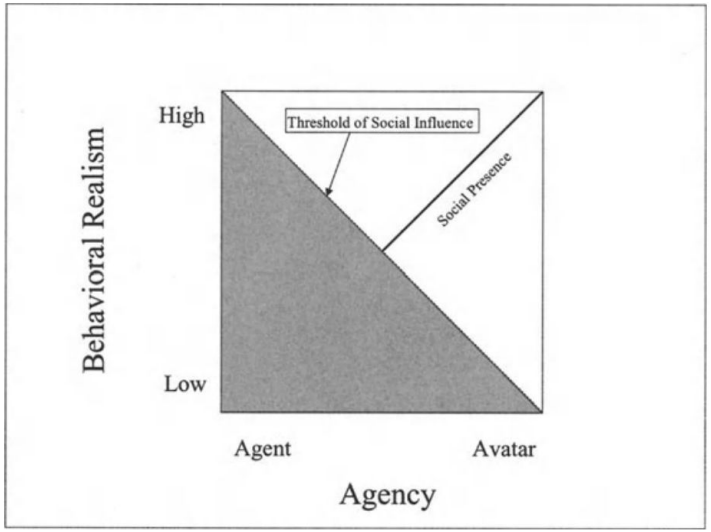


Figure 8.2 Threshold of social influence

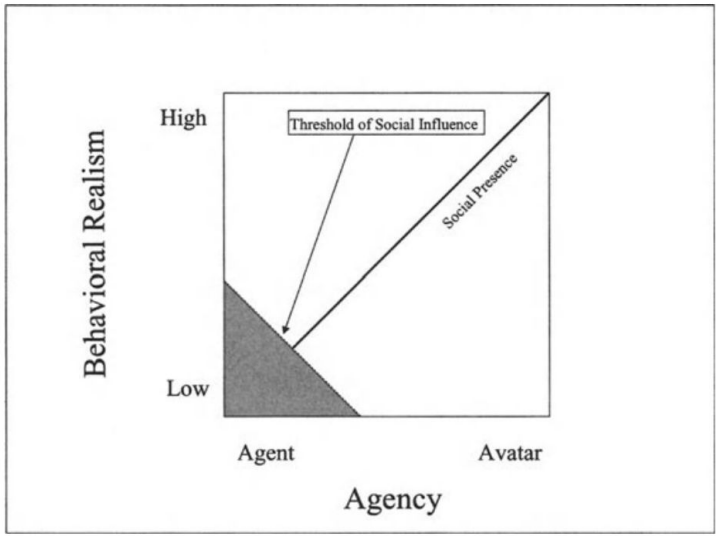


Figure 8.4B Social influence threshold for low-level responses.

Place Illusion & Plausibility (Slater, 2009)

Full title of the paper:

Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments.

Place Illusion: the visual quality of the virtual environment being real enough

Plausibility: the virtual environment making sense in terms of behavior

Place Illusion + Plausibility -> Realistic Behavior of Real People in VR

Social Influence vs. Place Illusion & Plausibility

Social Influence Theory:

A *virtual human* needs to “look-like it is controlled by a human” enough and “behave like a human” enough to have social influence (i.e., be a source of behavioral change) to people.

Place Illusion & Plausibility:

A *virtual environment* needs to “visually look real enough to induce place illusion” and “contains things with enough plausibility” to make people inside it to behave as if they are in the real world.

Social Influence vs. Place Illusion & Plausibility

Social Influence Theory:

A person does not enter a room because of a realistic virtual human telling the person to not enter the room.

Place Illusion & Plausibility:

A person behaves as if in the real world (e.g., avoids touching fire) in a realistic virtual environment.

Presence VR Meta Analysis

Cummings & Bailenson (2016)

TABLE 1 Descriptive Summary of Sample Studies

Study	Date	*r*	*CI* (95%)	*N*	Presence measurement	Task(s)	Location	Domain	Additional notes
					Update rate				
Barfield & Hendrix	1995	.395	−.15, .94	13	Custom (6 items)	Navigation and search task	United States	Eng	25 Hz vs. 5 Hz
Barfield et al.	1998	.506	−.19, 1.20	8	Custom	Navigation and search task	United States	Eng	20 Hz vs. 10 Hz
Gandy et al.	2010	.106	−.59, .80	8	PQ (modified)	Navigation and ball-dropping task	United States	SS	60 fps vs. 15 fps
Snow & Williges	1998	.691	.12, 1.26	12	Magnitude estimate	Distance estimation, ball manipulation, navigation, search, choice/selection	United States	Eng	16 Hz vs. 8 Hz
					Tracking level				
S. J. Ahn	2011	.008	−.19, .20	101	ITC-SOPI (11 items)	Simulated tree-cutting experience	United States	SS	Self-move vs. other-move
Aymerich-Franch	2009	.000	−.26, .26	56	SUS questionnaire (modified)	Block placement game	Australia	SS	Body-tracking vs. joystick
Balakrishnan & Sundar	2011	.832	.71, .96	240	MEC-SPQ (5 select items)	Navigation and search for clues around virtual office	United States	SS	High vs. low steering control
Barfield et al.	1998	.045	−.65, .74	8	Custom	Navigation and search task	United States	Eng	6 DOF (spaceball) vs. 3 DOF (joystick)
Broek	2008	.318	.17, .46	180	SAM presence scale	Unreal Tournament 2004 (FPS game)	Netherlands	SS	Active vs. passive
Bystrom & Barfield	1999	−.271	−.71, .16	20	Custom (based on Barfield & Hendrix)	Navigation, search and location marking	United States	Eng	Head-tracking & mouse vs. neither
Fox & Bailenson	2009	.233	.00, .47	69	Custom (10-item composite)	View imitation avatar eating	United States	SS	Change vs. no-change in avatar
Hendrix & Barfield (Exp. 2)	1996b	.425	−.14, .99	12	Custom (2 items)	Navigation	United States	Eng	Head-tracking vs. none
K. J. Kim & Sundar	2013	.932	.71, 1.15	80	ITC-SOPI (spatial presence subscale)	The House of the Dead 2 (FPS game)	Korea	SS	Gun replica controller vs. traditional controller
H. Lee & Chung	2013	.464	.22, .71	64	Custom (spatial involvement subscale)	Top Spin 4 (tennis simulator game)	Korea	SS	PS Move (motion tracking) vs. PS3 controller
McGloin et al.	2011	.138	.00, .28	195	Perceived Spatial Presence (based on Skalski et al., 2011)	Top Spin 3 (tennis simulator game)	United States	SS	Wiimote (motion tracking) vs. PS3 controller
Moreno & Mayer (Exp. 1)	2002	.040	−.22, .31	53	Modified PQ	View/navigate ("plant design" environment)	United States	SS	HMD and tracked walking vs. HMD and sitting

(*Continued*)

Presence VR Meta Analysis

TABLE 2 Meta-Analysis Results for Overall Immersion and Individual Immersive Features

Independent variable	*K*	*r* (weighted)	95% Confidence interval	*N*	χ^2	Variance attributable to sampling error (%)
Immersion (all studies)	115	.316	.295 to .338	6998	2069.179*	15
Update rate	4	.529	.311 to .747	41	4.391	100
Tracking level	22	.408	.360 to .456	1566	319.772*	8
Natural vs. abstract mapping	7	.360	.279 to .441	587	133.295*	6
Many vs. some	6	.645	.546 to .745	390	44.578*	1
Some vs. none	10	.281	.204 to .358	645	189.786*	32
Field of view	14	.304	.246 to .363	1081	487.886*	5
Image quality	10	.150	.086 to .214	855	259.432*	39
Stereoscopy	18	.320	.257 to .383	928	270.748*	16
Sound	13	.260	.203 to .317	757	202.378*	30
User perspective	2	.234	.003 to .464	72	38.775*	100
High vs. low	32	.339	.294 to .385	1698	476.491*	30

*$p < .001$.

Presence VR Meta Analysis

Low Latency Tracking is Key!

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Types of Presence

Social presence: presence coming from other people. The default meaning of presence.

Self-presence: the feelings of yourself being there.

Environmental presence: the feeling of being in the specific environment.

Copresence: similar to social presence. The feeling of being there together.

Spatial Presence: the feeling of being in that space.

And a lot more...

Summary

Presence by definition easily becomes a central construct for AR/VR research.

However, it is not a construct easy to accurately define.

Also, it is not a construct that is easy to measure.

At the same time, the 1D (high/low) interpretation of introduces concerns.

But still, it is the most useful psychological construct for understanding AR/VR.