

Oral presentation by Stéphane Bouchard at the Cybertherapy Conference
in Basel in June 2005



Reliability and Validity of A Single-Item Measure of Presence

Stéphane Bouchard, Geneviève Robillard,
Julie St-Jacques, Marie-Josée Patry & Patrice Renaud

*Université du Québec en Outaouais
Laboratoire de Cyberpsychologie de l'UQO*

Context

- Presence, or the subjective feeling of *being there* in a virtual environment, is an important construct in VR.
- There are many questionnaires measuring presence, but they are long to fill-in (10 to 110 items) and cannot be used during VR immersion.
- Would a measure consisting of only one item could be valid and reliable ?
 - “On a scale from 0 to 100, how much did you feel being there in the virtual environment ?”

Study 1

Content and face validity

- Can people in the community understand the meaning of the question, as well as other items from various presence measures ?
- 49 people from a downtown mall in Gatineau were immersed in a virtual flight for seven minutes.
 - More than 70% were in the low to moderate SES
 - Less than 20% has a university degree
- Understanding of the items were rated on a scale from 0 to 10.
- Control items were also used.

Contact: stephane.bouchard@uqo.ca

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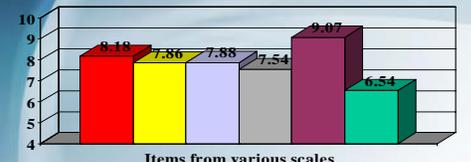
Apparatus



- IBM Pentium III (866 Mhz, 128 Meg RAM).
- HMD: VFX3D (tracker 3 dof).
- A VR immersion was necessary to understand to context of the items.

Results

How well do you understand the meaning of the phrase ?



Item	Mean Score
Single item	8.18
Witmer & Singer	7.86
Kim & Biocca	7.38
Banos et al.	7.54
Ctrl-easy	9.07
Ctrl-difficult	6.54

- 60% of the participants rated the single item 9 or 10
- ANOVAs: Single item = Ctrl easy > all others.
- $p < .001$

Study 2

Test-retest reliability

- Is the single-item measure reliable over time ?
- Sample 1:
 - 31 university students were asked the single-item measure at mid and post-immersion during a 5-minute immersion.
- Sample 2:
 - 26 adults from the community answered the single-item measure after two 5-minute VR immersions, each in a different environment.

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Apparatus



- VR environment used as a control situation for a study on emotions and VR (current sample 1).
Bouchard, St-Jacques et al.
- VR environments used to compare the reaction of phobics and non-phobics (current sample 2).
Robillard, Bouchard et al.

- IBM Pentium III (866 Mhz, 128 Meg RAM).
- HMD I-Glass, tracker Intertrax² (3 dof)

Results

- Sample 1 (same environment, 5 min)
 - $r = .81, p < .001$
- Sample 2 (different environment, 5 min)
 - $r = .83, p < .001$
 - Phobics scored higher on presence than non-phobics ($p < .01$).

Study 3

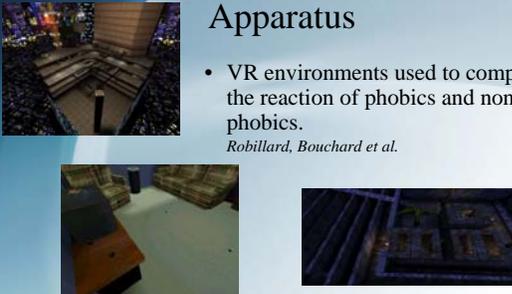
Convergent and divergent validity

- How does the single-item measure correlate with measures of related (presence) and different (realism, immersive tendency) constructs ?
- Convergent validity:
 - Presence Questionnaire by Witmer and Singer.
 - Does not address subjective perceptions...
- Divergent validity:
 - Perceived realism (0 to 100)
 - Immersive Tendency (Witmer & Singer, 1998).

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Apparatus



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Results

- Convergent validity:
 - Presence Questionnaire (W&S).
 - Total: $r = .43, p < .05$
 - Realism: $r = .51, p < .05$
 - Affordance to act: $r = .59, p < .05$
- Divergent validity:
 - Perceived realism: $r = .43, p < .05$
 - Immersive Tendency: $r = .36, p < .05$

Study 4a

Sensitivity to change

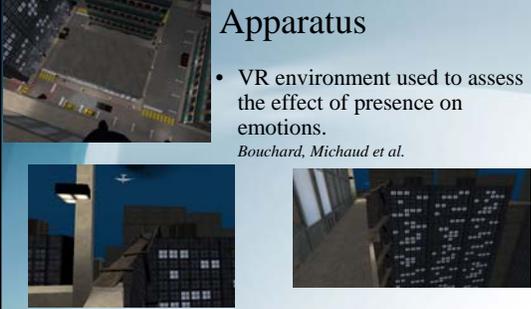
- It the single-item measure sensitive to change ?
- 33 height phobics were immersed twice in the same VR environment under a condition that maximises presence (dark room, no exterior sounds) or hinders presence (lights open in the room background music).

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Apparatus

- VR environment used to assess the effect of presence on emotions.
Bouchard, Michaud et al.

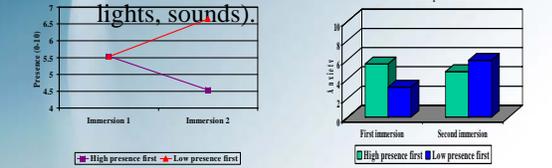


- IBM Pentium III (866 Mhz, 128 Meg RAM).
- HMD Cy-Visor, tracker I-Cube (3 dof)

Sensitivity to change 4a

External stimuli reduce presence (and anxiety)

- Height phobics had to perform an anxiety-inducing task under conditions that should either maximise or disrupt presence (ambient lights, sounds).



Measured at post immersion

Legend: High presence first (red line), Low presence first (purple line)

Legend: High presence first (green bar), Low presence first (blue bar)

• ANOVA : Time ($F=0.27, ns$)
• Interaction Time x Condition ($F=8.75, p < .05$)
• Condition ($F=1.26, ns$)

• ANOVA : Time ($F=1.47, ns$)
• Interaction Time x Condition ($F=12.73, p < .05$)
• Condition ($F=1.6, ns$)

Study 4b

Sensitivity to change - b

- It the single-item measure sensitive to change ?
- 29 snake phobics were immersed in a control environment and twice in the same experimental VR environment.
- In the experimental environment, participants were falsely lead to believe that there were dangerous hidden snakes (high emotion) or no snakes (normal emotion).

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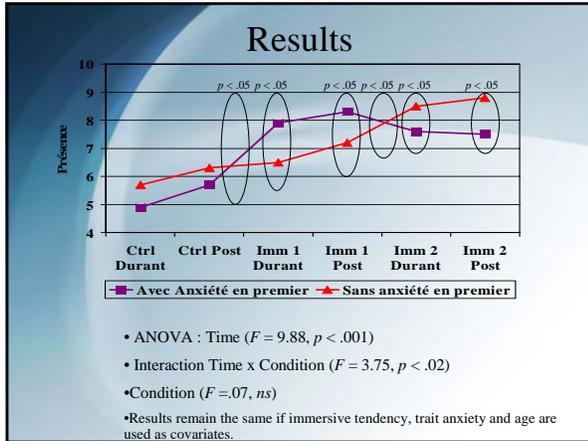
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Apparatus

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Bouchard, St-Jacques et al.



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Conclusion

- Item-response theory would recommend to be careful in using only one item to measure a construct.
- But practical factors may militates in favour of the briefest measure possible.
- Such a measure has now been validated.
 - High face validity and well understood, good test-retest, good sensitivity. Convergent validity with the WS is questionable.
 - + Presence items are not very well understood.
 - + Phobics feel more present than non phobics.
 - + Increasing presence leads to increase in anxiety.
 - + Increasing anxiety leads to increase in presence.

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Copies of this presentation are available on the lab's web site at w3.uqo.ca/cyberpsy

The Cyberpsychology Lab

Stéphane Bouchard, Ph.D. CRC Clinical CyberPsychology
Patrice Renaud, Ph.D.

<u>Researchers and professionals</u>	<u>Students</u>
<ul style="list-style-type: none">• Judith Lapierre, Ph.D.• Bruno Émond, Ph.D.• Genevieve Robillard, M.Sc.• Christian Villemaire.• Dominic Boulanger.	<ul style="list-style-type: none">• Micheline Allard, Ph.D. Cand.• Sophie Côté, Ph.D. Cand.• Julie St-Jacques, Ph.D. Cand.• Stéphane Dumoulin, Ph.d. Cand.• Sylvain Benoît, Ph.D. Cand.• Guillaume Albert, M.A. Cand.• Geneviève Chartrand L. Ph.D. Cand.• Tanya Guitard, Ph.D. Cand.• Daniel Howe, B.A.

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