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

Reliability and Validity of A Single-Item Measure of Presence

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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.

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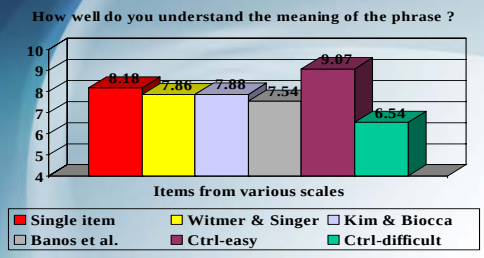
Apparatus

- 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



- 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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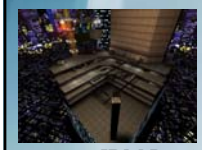
Apparatus

- 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 Intertrax^2 (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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  Robillard, Bouchard et al.

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- HMD I-Glass, tracker Intertrax^2 (3 dof)

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

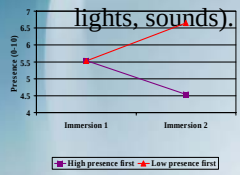
- VR environment used to assess the effect of presence on emotions.
  Bouchard, Michaud et al.

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

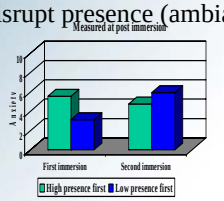
Sensitivity to change 4a

External stimuli reduce presence (and anxiety)

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



• 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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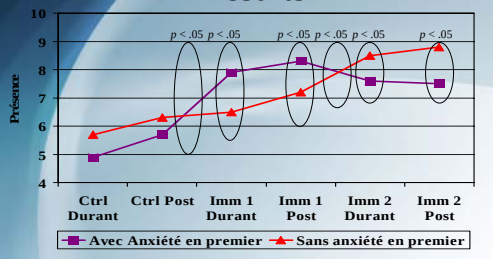
Apparatus

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

- IBM Pentium III (866 Mhz, 128 Meg RAM).
- HMD I-Glass, tracker Intertrax^2 (3 dof)

Results



- ANOVA : Time (F = 9.88, p < .001)
- Interaction Time x Condition (F = 3.75, p < .02)
- Condition (F =.07, *ns*)
- Results remain the same if immersive tendency, trait anxiety and age are used as covariates.

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-restest, 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*

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