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Elise Grevet, Franck Amadiou, Jacques Py, D. Gasq, Camille Jeunet

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Improving the acceptability to enhance the efficiency of stroke rehabilitation procedures based on brain-computer interfaces

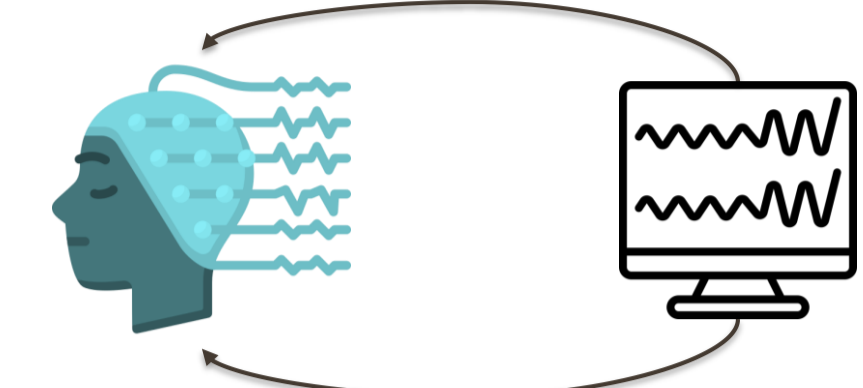
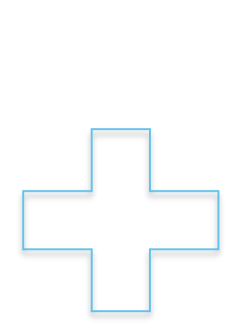
Elise Grevet¹, Franck Amadiou², Jacques Py², David Gasq³ & Camille Jeunet¹

¹INCIA, Univ. de Bordeaux, CNRS, EPHE, Bordeaux, France - ²CLLE, Univ. de Toulouse, CNRS, Toulouse, France - ³TOnIC, Univ. de Toulouse, INSERM, Toulouse, France

INTRODUCTION – Why to focus on BCI acceptability ?



Stroke leaves around 40% of surviving patients dependent in their activities of daily living, notably due to severe motor disabilities [1].



BCIs are efficient for improving motor recovery after stroke [2].

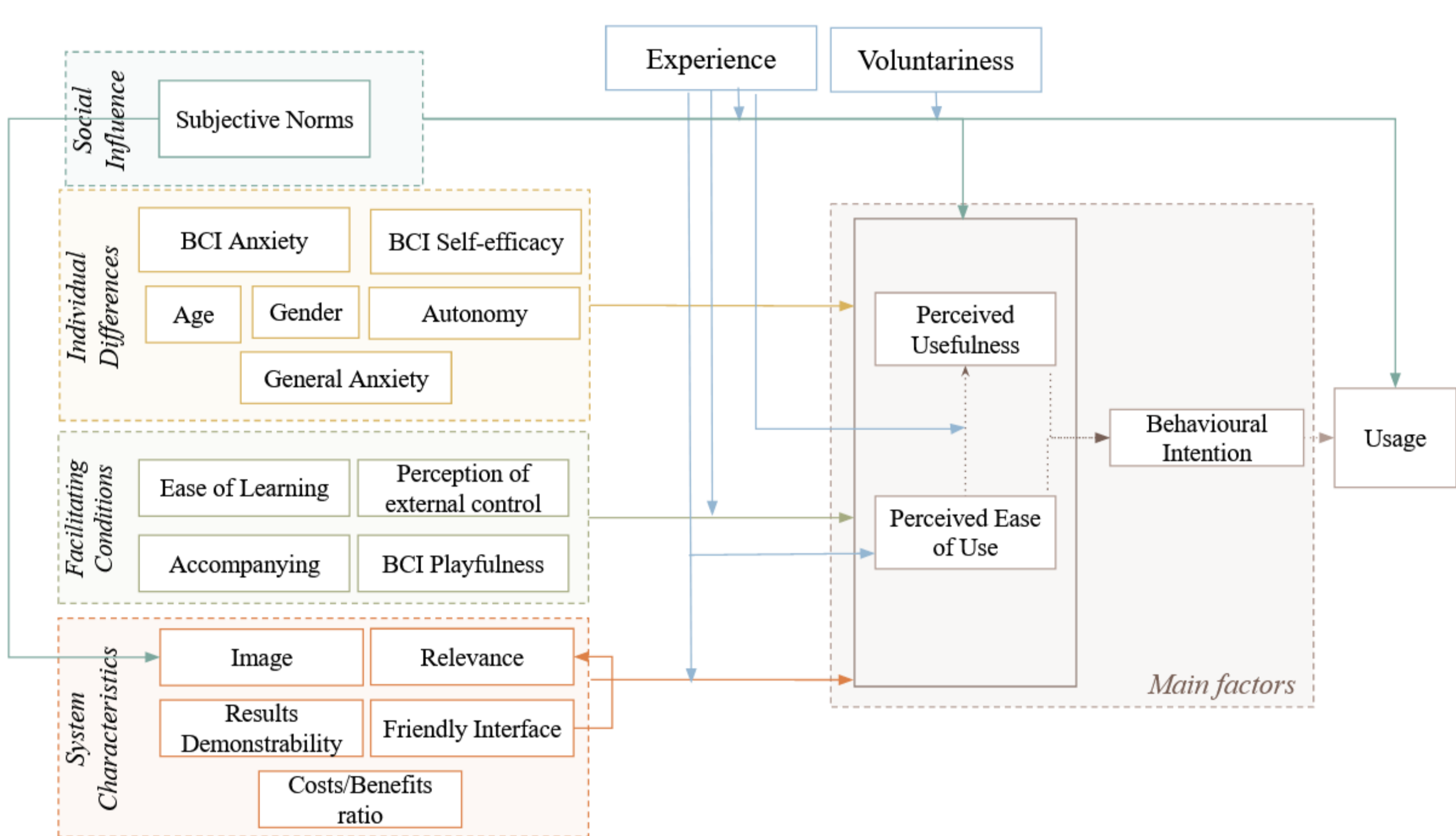
BUT... efficiency is still far from the level required to enable broad clinical use.

AND... technical improvements are not sufficient: Fully optimised BCIs are pointless if patients and clinicians do not want to use them

OBJECTIVE : Identify the factors that influence the intention to use BCIs in order then to:
i) Personalise BCI-based rehabilitation procedures to each patient
ii) Better inform clinicians and patients about BCI functioning

HYPOTHESIS: Improving BCI acceptability and acceptance will favour both patients' and clinicians' engagement in the rehabilitation process, reduce anxiety, and result in an increased efficiency of BCI-based stroke rehabilitation procedures.

METHODS – Design, implementation and evaluation of a BCI acceptability model for stroke rehabilitation



We created a questionnaire in order to evaluate the validity of our model and to quantify the influence that the different factors had on our target factors:

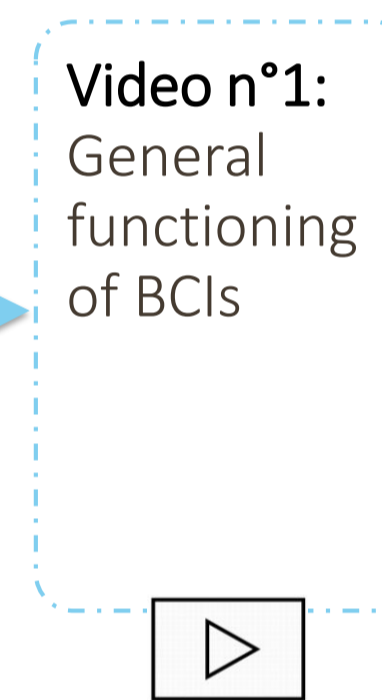
- Perceived usefulness (PU)
- Perceived ease of use (PEoU)
- Behavioural intention (BI)

Each factor was assessed by 3 items minimum. Participants rated each item on a visual analog scale ranking from "Strongly disagree" (score=0) to "Totally agree" (score=10). We also included explanatory videos in order to inform people about BCIs.

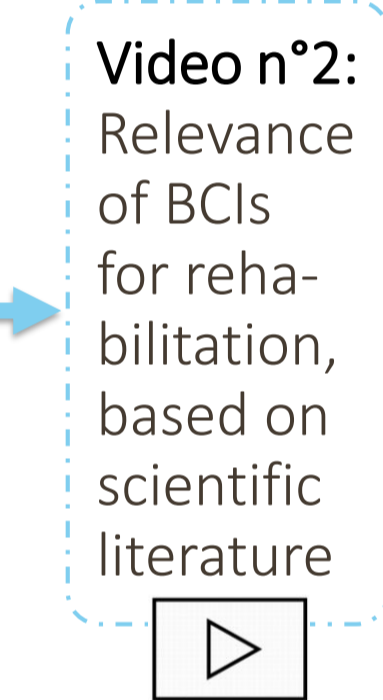
Example item - Subjectives norms : "People who are important to me would be in favour of using BCIs for rehabilitation"

Strongly disagree - 0 |-----| 10 - Totally agree

Items related to factors:
- Relationship with technology
- Individual differences
- Knowledge of BCIs



Items related to factors:
- Social Influence
- Individual differences
- System Characteristics
- Facilitating conditions
- PU, PEoU & BI

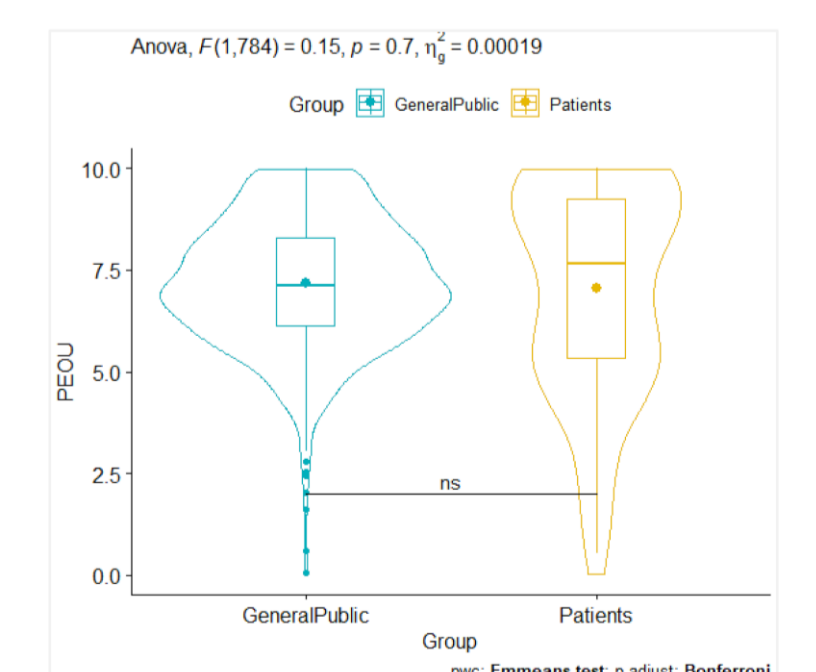
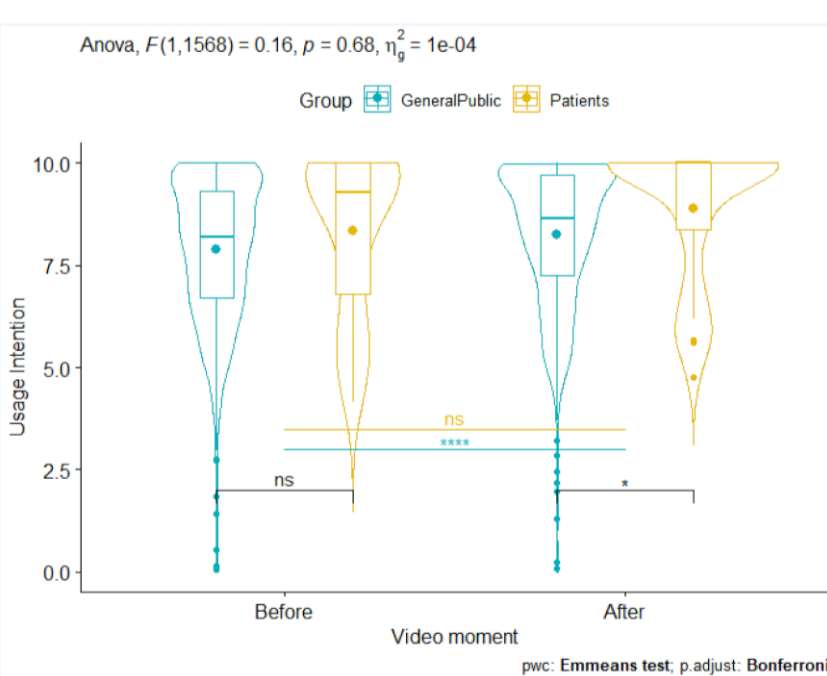
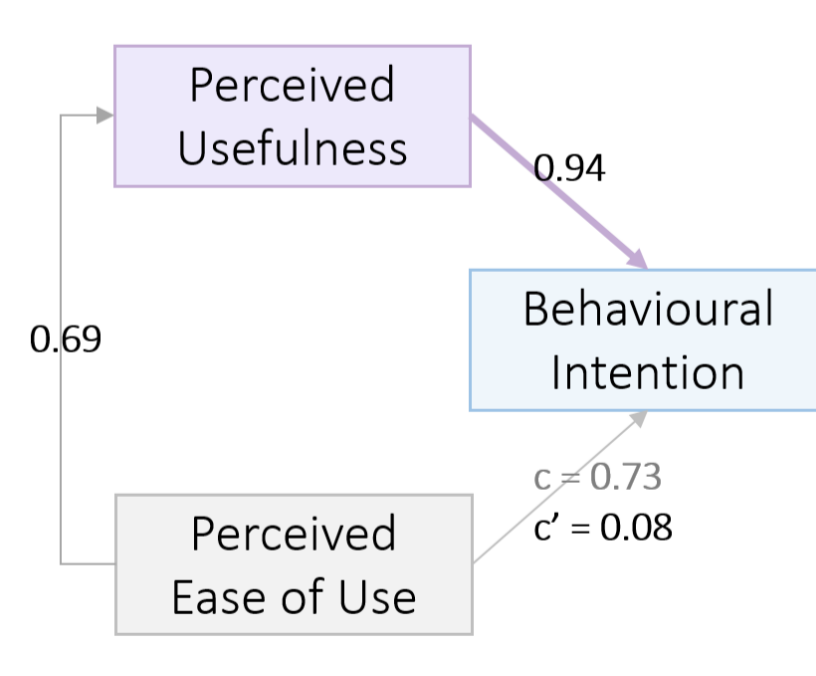
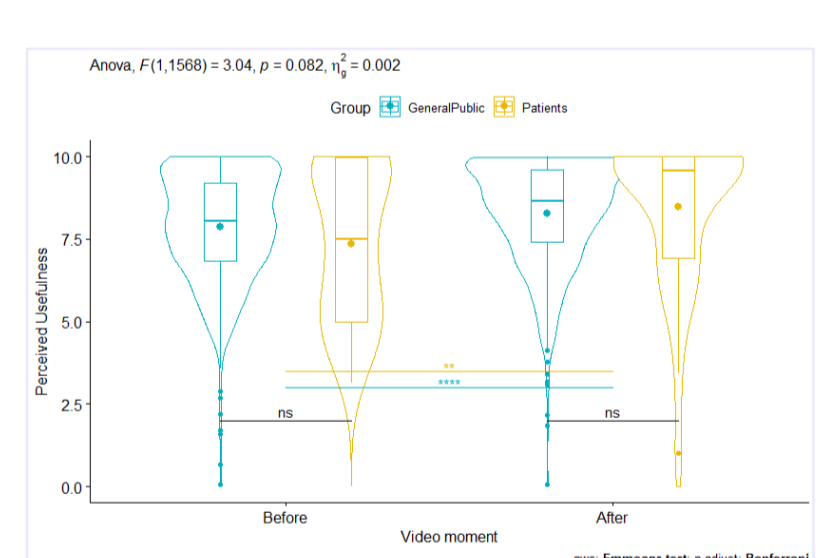


Items related to factors:
- System Characteristics
- Individual differences
- Facilitating conditions
- PU + BI

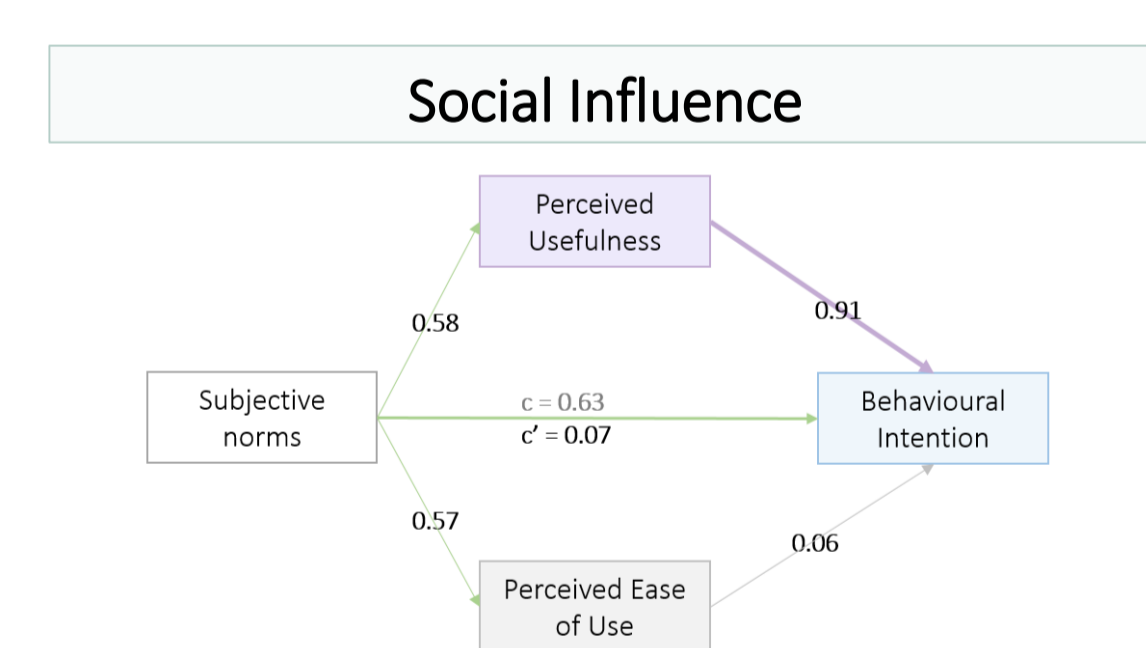
Our model of BCI acceptability based on acceptance models from the literature (TAM3 [3] and UTAUT2 [4])

RESULTS – Important impact of PU on the intention to use & providing people with comprehensive information

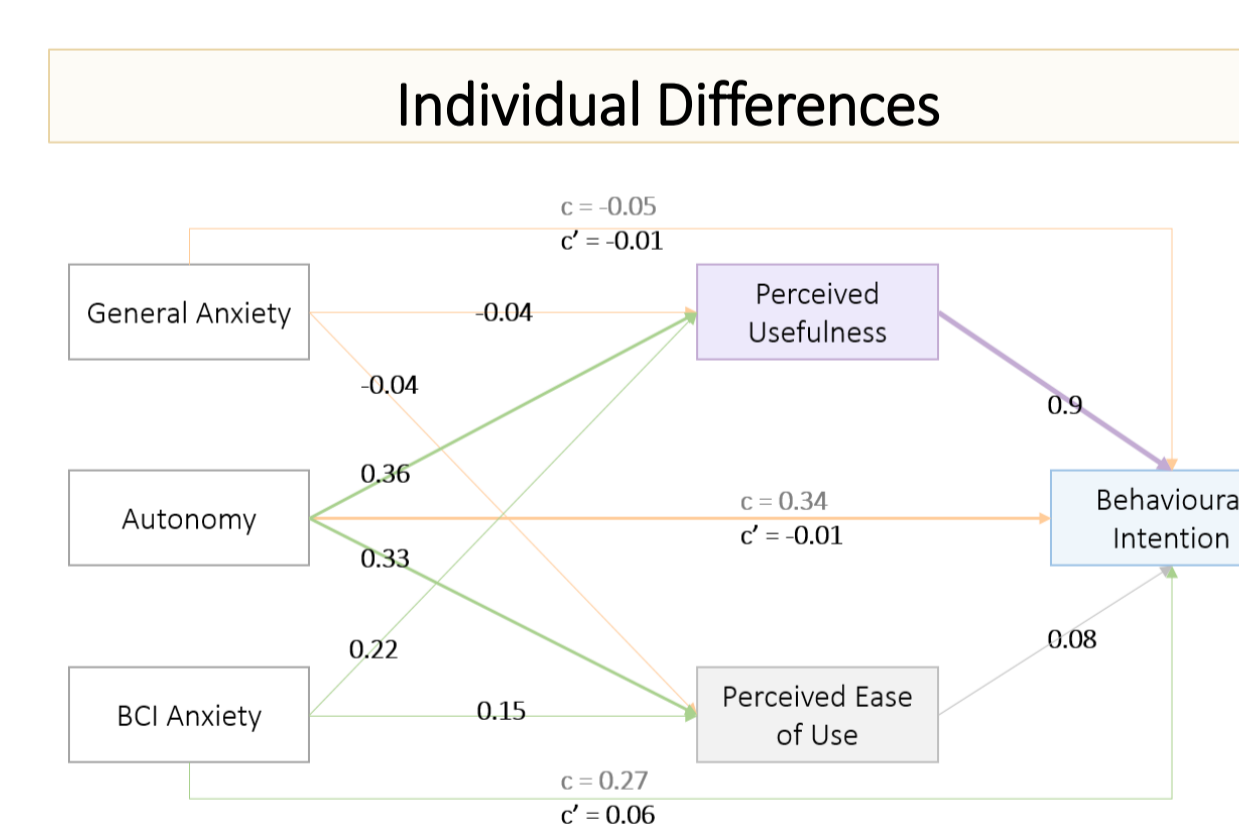
We collected data of 753 persons (general population – sample representative of the French population). Below, we show descriptive analyses and mediation analyses, the aim of which is to estimate and quantify the causal relationships between factors.



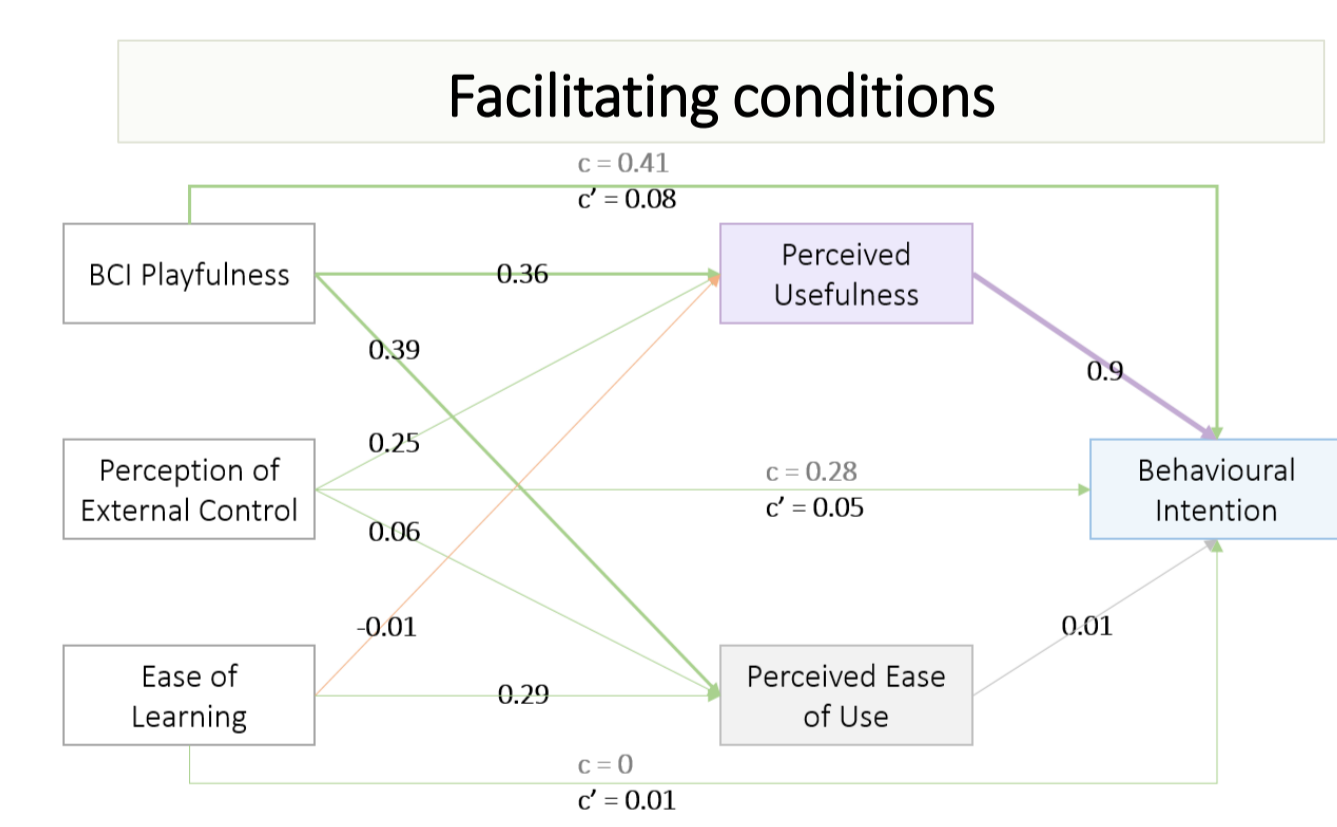
c = total effect of variable on the target factor (BI)
 c' = direct effect of variable on the target factor (BI)



Subjective norms have a similar and high impact on both PU and PEoU.



Autonomy is the most influential factor, it mainly impacts PU and PEoU.



BCI Playfulness is the most influential factor, it mainly impacts PU and PEoU

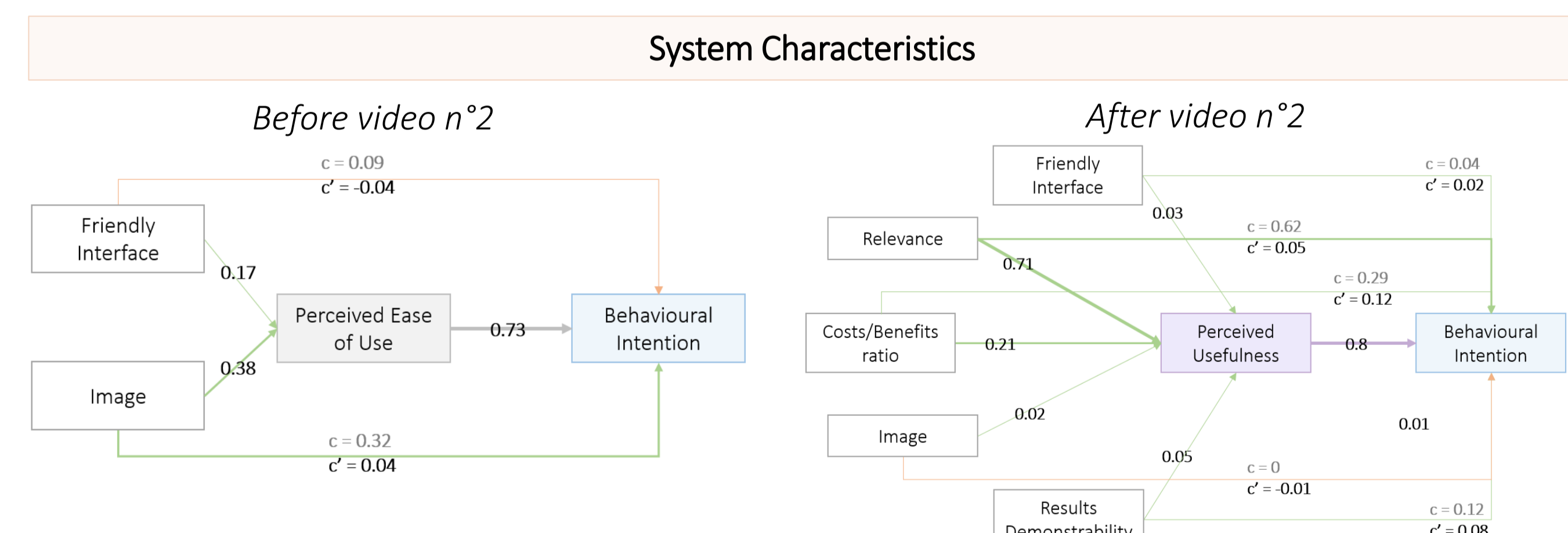


Image is the most influential factor on PEoU
Relevance and Costs/Benefits ratio are the most influential factors on PU

Additional analyses: Random Forests

Before video 2
BI is mainly explained by subjective and personal factors:
(i) PU, (ii) PEoU, (iii) BCI playfulness.

After video 2
BI is explained by more scientific/rational factors:
(i) PU, (ii) costs/benefits ratio, (iii) scientific relevance.

Shift of main explanatory factors from subjective representations to scientific arguments: **stresses the importance of providing people with clear information regarding BCIs.**

FUTURE WORK – Modeling the acceptability of post-stroke patients and clinicians

- . Continue the inclusions: questionnaires and interviews with post-stroke patients (N=33 so far) and clinicians.
- . Design and implement personalised rehabilitation procedures based on our results (e.g., in terms of tasks, feedback and support provided by the caregivers).
- . Design and implement multimedia content to better inform clinicians and the general population about BCIs, as well as fight false representations.

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CONTACT : elise.grevet@u-bordeaux.fr

