

these items because they would make little sense in a relatively simple single player game. This article provides first indications for the validity of the factor structure and its stability for the PENS questionnaire as well as a comparison with the GEQ which did not reveal the proposed factor structure and appears to be less stable.

In a next step, it is planned 1) to conduct an item-level analysis in order to identify items of the GEQ which should be rephrased or excluded, and 2) run confirmatory factor analysis to examine the fit of this model compared to a simpler factorial structure. In case the found structure can be confirmed, correlations of the PENS and GEQ subscales with outcome variables such as enjoyment, intention to continue playing, and behavioral measures should be examined to study the concurrent and predictive validity of the questionnaires.

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References

- [1] Bargas-Avila, J. A., and Hornbæk, K. Old wine in new bottles or novel challenges: A critical analysis of empirical studies of user experience. In *Proc. of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '11, ACM (New York, NY, USA, 2011), 2689–2698.
- [2] DeVellis, R. F. *Scale development: Theory and applications*, vol. 26. Sage Publications, 2011.
- [3] Frederick, C. M., and Ryan, R. M. Self-determination in sport: A review using cognitive evaluation theory. *International Journal of Sport Psychology* 26, 1 (1995), 5–23.
- [4] IJsselsteijn, W., van den Hoogen, W., Klimmt, C., de Kort, Y., Lindley, C., Mathiak, K., Poels, K., Ravaja, N., Turpeinen, M., and Vorderer, P. Measuring the experience of digital game enjoyment. In *Proc. of Measuring Behavior*, Maastricht Netherlands (2008), 88–89.
- [5] Johnson, D., Watling, C., Gardner, J., and Nacke, L. E. The edge of glory: The relationship between metacritic scores and player experience. In *Proc. of the First ACM SIGCHI Annual Symposium on Computer-human Interaction in Play*, CHI PLAY '14, ACM (New York, NY, USA, 2014), 141–150.
- [6] Lorenzo-Seva, U., and Ten Berge, J. M. Tucker's congruence coefficient as a meaningful index of factor similarity. *Methodology: European Journal of Research Methods for the Behavioral and Social Sciences* 2, 2 (2006), 57–64.
- [7] Moshagen, M., and Thielsch, M. T. Facets of visual aesthetics. *International Journal of Human-Computer Studies* 68, 10 (2010), 689–709.
- [8] Norman, K. L. Geq (game engagement/experience questionnaire): a review of two papers. *Interacting with Computers* 25, 4 (2013), 278–283.
- [9] Ryan, R., and Deci, E. Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary educational psychology* 25, 1 (2000), 54–67.
- [10] Ryan, R., Rigby, C., and Przybylski, A. The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion* 30, 4 (2006), 344–360.
- [11] Yi, M. They got game: Stacks of new releases for hungry video enthusiasts mean its boom time for an industry now even bigger than hollywood. *San Francisco Chronicle* (2004), A1.