Haptic Experience Inventory (HXI) - Questionnaire Manual

Introduction

The Haptic Experience Inventory (HXI) is the first validated tool to measure Haptic Experience across five core factors: Autotelics, Realism, Harmony, Discord, and Involvement. Each factor represents a unique dimension of the user's experience with haptic interactions, offering a comprehensive framework for assessing the quality and impact of haptic feedback. This manual outlines its scope, structure, administration, scoring, interpretation, and reporting guidelines for the HXI.

We also recommend checking online instructions and aids for deploying the HXI at (https://hapticexperienceinventory.org/) for the most up-to-date guidance and best practices. Future deployments and shared results will continue to refine our understanding of the questionnaire's performance and enhance its utility in diverse contexts.

---

1. Scope of the HXI

- **HXI is designed to be broadly applicable across different haptic modalities, though caution advised when applying it to new modalities.** While only three (vibrotactile, mid-air, force-feedback) is included in the initial validation study, the consistent factor structure, loadings and item intercepts across these conditions, which vary significantly in their mechanisms, supports the HXI's diverse applicability. Nevertheless, for modalities not covered in the study, we recommend exercising caution. Researchers should adhere to the complete form of the HXI and report reliability metrics, as well as other relevant measures, to further examine its suitability.
- **HXI is intended for administration immediately or shortly after the haptic interaction.** In the initial validation study, the HXI was administered within 12 hours for online participants and immediately after the interaction for in-person participants. Prolonged recall periods may compromise the reliability of results from the HXI.

---

2. Structure of the HXI

The HXI measures five factors through 20 items, with 4 items for each of the five factors:

- **Autotelics** – Evaluates the pleasure derived from haptic sensations independent of functional value.

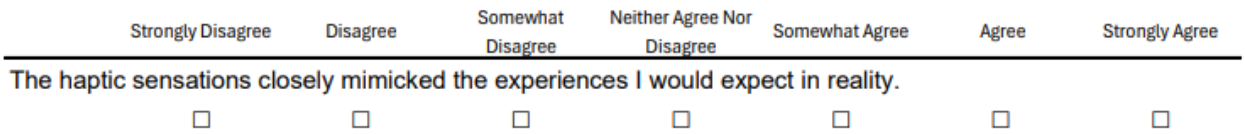
- **Realism** – Measures how closely haptic sensations simulate or represent real-world experiences.
- **Harmony** – Assesses the integration of haptic feedback with other sensory modalities.
- **Discord** – Identifies unpleasant or disjointed aspects of haptic feedback.
- **Involvement** – Captures the level of engagement haptic sensations create.

---

3. Form of the HXI

- **Presentation**: Items should be randomized to avoid order effects.
- **Instructions**: Before administering, briefly explain terms such as "haptic sensations" and "other senses" (refer to the Items document for recommended example).
- **Response Format**: Participants rate each item on a 7-point Likert scale from 1 (Strongly Disagree) to 7 (Strongly Agree) based on their agreement with each statement.
- **On using selected sub-scales**: Sometimes people use only a subset of an established questionnaire, but there have been cautions against doing so and study showed psychometric properties may change when only using a subset of the questionnaire. We recommend using the complete and standard form of the HXI if the situation allows.

Sample Item:



---

4. Scoring the HXI

- For each item, the seven options should be scored from 1 (Strongly Disagree) to 7 (Strongly Agree).
- **Factor Scores**: Average the scores of the four items for each factor to obtain individual factor scores.
- **General Score**: Reverse the score for Discord first, then add it with other four factors scores. Thus, *General Score = Autotelics + Involvement + Realism + Harmony + (8 − Discord)*. This provides a comprehensive view of the overall haptic experience.

- We recommend against scoring items on a scale from -3 to 3, as a score of 0 does not correspond to a meaningful condition, which may lead to interpretive inconsistencies.

---

5. Interpreting Scores

- **Context-specific Priorities**: The General Score offers an overall assessment, and each factor score provides insight into specific attributes of the haptic experience. It is important to note, though, that haptic applications have different goals and contexts, and the relative importance of each factor may vary across each product. This was also echoed in expert interviews. Depending on the context, not all factors are targeted equally. For example, a relaxation app may prioritize Autotelics, while haptic design for a game may prioritize Involvement.
- **Comparative Analysis:** As a quantitative measurement, you can quantitatively compare HXI scores across different variations or iterations to highlight the impact of haptic design improvements when applicable. The HXI also established measurement invariance, indicating you can compare the HXI score for your product with other products, even if they are using a different haptic modality! Choosing proper products to compare against is important to produce the most useful insights.

---

6. Reporting HXI Results

- **Reliability Metrics**: Report Cronbach's alpha for each factor to demonstrate scale consistency. Some rules of thumb recommend values >0.6 or >0.7 as a sufficient level. If the alpha coefficient of a factor is small, you should interpret the results with caution, it may indicate that some items within the factor are misinterpreted by many of the participants, or these items are not relevant to the experience being evaluated. We also recommend that you share this finding with us to facilitate better understanding of HXI when it occurred.
- **How the HXI relates to other measurements:** Report how the HXI relates to other measurements (e.g., other UX questionnaires, overall ratings, psychophysiological measures like electrodermal activity and eye-tracking data) could help the community gain a better understanding of the ecological validity of the HXI and how to best use HXI in practice.
