

Haptic Experience Inventory (HXI) - Questionnaire Manual

Introduction

The Haptic Experience Inventory (HXI) is a validated tool designed to measure user experiences with haptic technologies across five core factors: Autotelics, Realism, Harmony, Discord, and Involvement. Each factor captures a distinct aspect of the user's haptic interaction, providing a structured approach to evaluating the quality and impact of haptic feedback. This manual outlines the purpose, structure, administration, scoring, interpretation, and reporting guidelines for the HXI.

1. Structure of the HXI

The HXI measures five factors through 20 items, with each factor represented by four items rated on a 7-point Likert scale, from 1 (Strongly Disagree) to 7 (Strongly Agree):

1. **Autotelics** – Evaluates the pleasure derived from haptic sensations independent of functional value.
 2. **Realism** – Measures how closely haptic sensations simulate or represent real-world experiences.
 3. **Harmony** – Assesses the integration of haptic feedback with other sensory modalities.
 4. **Discord** – Identifies unpleasant or disjointed aspects of haptic feedback.
 5. **Involvement** – Captures the level of engagement haptic sensations create.
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2. Administering 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 based on their agreement with each statement.

- **Using selected sub-scales only:** 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:

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Agree	Strongly Agree
The haptic sensations closely mimicked the experiences I would expect in reality.						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. 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.

4. 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.

5. 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.
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