AUSENS

Designing for the sensorial needs of ASD

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As you can see, it is difficult to design a product for a person with ASD.

Depending on the context, the company, the activities to be performed, or simply the emotional or physical state of the moment, their interaction and relationship with the environment changes.

For this purpose, we developed the AUSENS method.

- ✓AUSENS is a user-centered design method.
- ✓It is useful for the development of products adapted to the perceptual sensory system of people diagnosed with autism spectrum disorder.
- ✓It is composed of several modules, each one specialized in a sense of the human system. It includes principles, design tools, decision making, and evaluation of optimal solutions.
- ✓In this activity, you will use the haptic perceptual module and analyzing the tactile dimension of the design.

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In this activity, you will have to follow the haptic tool of the AUSENSE method. This tool includes:

- Haptic Design Principles
- Interactive Modules

HAPTIC DESIGN PRINCIPLES

Principles	Heuristic	Recommendation
Integrated Tactile Design	The product interface interacts with the five types of tactile perception.	The interface must integrate tactile perceptual components in a balanced way: shape and texture, space and 3D objects, movement and events, and temperature.
Biomechanical adaptation	The tactile elements of the product must be adapted to motor difficulties.	Haptic elements should allow fine motor skills (pressing, pinching, sliding, holding down, etc.) and thick (holding, crawling, etc.); and should be adjusted to different body areas (fingers, hand, and arm) to adapt to the biomechanical (pressure) capacity of the user.
Temporality	Tactile stimulus processing time is longer in users with autism	Adequate feedback on the interface (type, amount of information, and sufficiency in action-reaction time) minimizes human error and its impacts (frustration and stress). To ensure that individual skin signals are perceived by receptors, stimuli must be separated by at least 5.5 ms.
Multimodality (visual-tactile)	Multimodality minimizes cognitive load	Independent tactile and visual information for different actions reduces the sensory overload of each modality.
	Tactile and visual information must be compatible with respect to time and type of information.	Time lags between visual and haptic information loops should be avoided. The change from a visual stimulus to a tactile stimulus implies a greater cognitive load than the change from a tactile stimulus to a visual one.
	Information coming	Vision is the dominant modality in tasks of perception of size

HAPTIC DESIGN PRINCIPLES

Principles	Heuristic	Recommendation
	Information coming from visual perception is usually prioritized over tactile perception.	Vision is the dominant modality in tasks of perception of size, shape, or position. Tactile information reinforces the understanding of visual information.
	Reinforcement of attention improves the acceptability of tasks	Haptic dynamic elements redirect visual attention (and vice versa).
Usability	Simplicity and intuitivity	Haptic elements should be designed with affordances. They should not include additional information to be interpreted. Touch contact should always be initiated by the user, not by the product.
	Sensitivity	Haptic elements must be adapted to the sensitivity of body areas: full body, upper trunk, lower trunk, arms, hands, and fingers.
	Sensibility	Interface components must be robust and capable of withstanding a wide pressure range (N or Nm) to accommodate the hyposensitive (impact resistant) or hypersensitive (caress detection capability) threshold.
	Tactile action-reaction mapping	Action/reaction sensors should be distributed equally to create sensitivity on the entire surface of the product interface.

HAPTIC DESIGN PRINCIPLES

Principles	Heuristic	Recommendation
Safety and comfort	Nociceptors should not be activated.	The product must be designed according to the tactile perception thresholds for each type of receptor (Pacinian and Meissner corpuscle, Ruffini endings, and Merkel disk), taking into account that haptic perception in autism does not conform to Weber's law. Pain thresholds depend on hypersensitivity or hyposensitivity reactions.
	Prioritize affective touch over discriminative touch	Slowly moving (velocities of 1-10 cm/s) and low-force mechanical stimulation with temperature around 32°C
	In a state of crisis, the senses are overstimulated and cannot process more information.	The interface must have an automatic control mechanism to maximize tactile feedback (type and amount of information) in periods of crisis. It would be beneficial to make use of certain textures that have a calming effect (smooth surfaces) such as fur. Flock or mink fabric.

MODULES

AUSENSE-Touch presents four modules to be used in the conceptual and design phases (Modules I, II, and III) of the design, as well as the evaluation phase (Module IV).

CONCEPTUAL AND DETAIL DESIGN

- Module I. Development
- Module II. Tactile Design
- Module III. Material Selection

EVALUATION

- Module IV. Evaluation

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Conceptual and detail design

Module I. Development: integrates the theoretical and procedural framework of the AuSENSE method. It includes the terms, definitions, general considerations, and design principles that serve as background for the knowledge basis applicable to design adapted to the perceptual system and tactile interpretation of people with ASD. In addition to this, it establishes the steps to be followed for the use of the method. https://cornell.box.com/s/iak08h3uo2m72pdm85bbdkerfszlpllt

Module II. Tactile Design: incorporates guidelines, biases, and visual design considerations for the conceptual design and detail design. This tool guides the design in three stages: 1) definition of the type of tactile perception and selection of the most suitable components of the tactile message for it; 2) configuration of the conceptual and detail design making use of general design parameters and in each case, parameters adapted to hypersensitivity (over-responsiveness) or hyposensitivity (under-responsiveness); and 3) checking tactile comfort across sensation thresholds that relate each design parameter to the components of the tactile message. https://cornell.box.com/s/f4yfzacc0nk7uahhf9vy1d94uct7c7vy

Module III. Material Selection: dedicated to determining the best materials for hyper and hyposensitivity according to visual design parameters: shine and gloss, rugosity, transparency, refraction and scattering, density, fluorescence, phosphorescence, and flexibility. A ranking is presented in order to establish the most adequate materials for toys for hyper and hyposensitivity.
https://cornell.box.com/s/hdxcg1d1ooc63pci9zditiss8q0h59nf

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Evaluation

Module IV. Evaluation: assists designers in analyzing the product solution developed according to the adequacy of the design (parameters) to the six principles and the set of guidelines, biases, and haptic design considerations provided by the AuSENSE method. This tool contains 3 steps.

- **Step 1**: consists of a questionnaire that includes 45 indicators of analysis, distributed according to the type of tactile perception. These indicators evaluate the adequacy of the design parameters (general or specific hyper-hypo sensitive) used in the product: 7 questions for textures, 16 for shapes, 7 for 3D space, 5 for movement and events, 3 for pain and 2 for temperature.

- **Step 2**: a process of analyzing the answers and indicators of stage 1, generates the results of the evaluation of the product in each perceptual group: hypersensitivity (over-responsiveness) or hyposensitivity (under-responsiveness). Both the numbered weighted values obtained [-1, 1] and the color scale [red, green] allow the design team to interpret the adequacy of the design to the target user.

- **Step 3**: defines a sensory adequacy profile for each hyper- or hypo-sensitive group. This profile presents the final scores of the design parameters related to the components of the tactile message, for each type of perception (textures, shapes, three-dimensional space, movement-event, pain and temperature). Finally, it includes a percentage indicator for each type of perception, which helps to interpret the level of success of the design solution [0, 100]%.

Find Module IV. Evaluation here:
https://cornell.box.com/s/le1ro8jyon64szjh83icynshv7rffv3s

Now...

Use the AUSENSE method (Modules I, II, III, and IV) to design and evaluate your product!

MODULE I – Select the tactile components that are more relevant to your design.

MODULE II – Follow the design guidelines for the sensorial profile you chose.

MODULE III – Make a selection of materials.

MODULE IV – Evaluate your design