Static and dynamic tactile directional cues experiments with VTPlayer mouse

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Outline

Introduction

Our goal is to use tactile cues to give the guide a user.

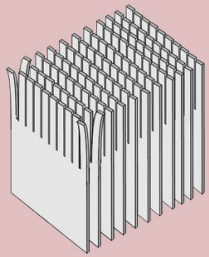
Examples

- schematic exploration: electronic, architecture, ...
- map exploration: path finding, location information, ...
- maze exploration: path finding, preventing obstacles, ...

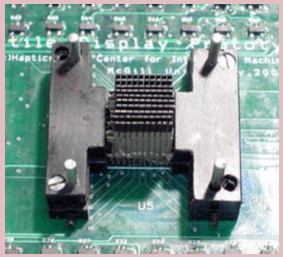
Our choice is to diplay icons with matrix displays.

Devices

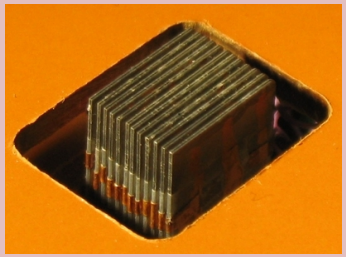
Hayward's devices [PH03, LPHL05]



STReSS schematic



STReSS device



Virtual Braille Device

Lecolinet's devices [LM05]

Tactiball

Tactipen

VTPlayer

Virtouch

VTPlayer

Navigation

Exploration with tactile cues

- 3D environment with obstacles by Maingreaud et al. [MPOL04]
- maps by Jansson and Pedersen [JP05]
- graphs by Wall and Brewster [WB06]
- maze by Crossan and Brewster [CB06]

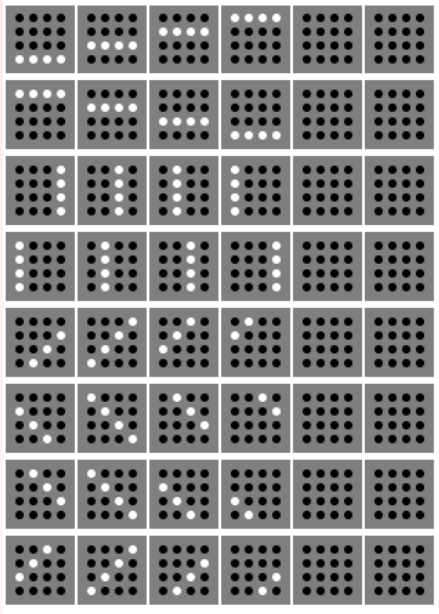
Tactile icons

- Haptic Icons by Maclean and Enriquez [ME03]
- Tactons by Brewster and Brown [BB04]
- Haptic bumps by Pietrzak et al. [PMP05a, PMP05b]

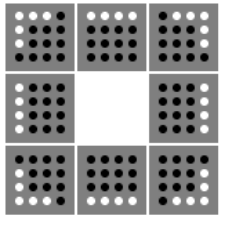
Icons

Design

- we use the VTPlayer to display 4×4 patterns.
- several icon sets have been designed
- 8 directions in each set
- two kinds of icons:
  - static icons: one pattern per icon
  - dynamic icons: several patterns per icon (one for each frame)



dynamic icon set



static icon set

- raised pins
- lowered pins

Experiments

The goal is to find static and dynamic icon sets quickly and efficiently recognizable.

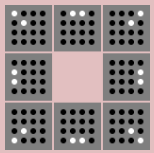
Participants

All the participants are right-handed, used to deal with computers and sighted (but blindfolded). None of them have already used braille cells.

Protocol

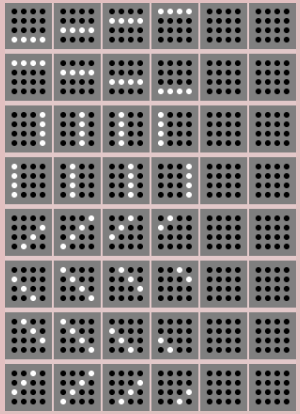
- training session : the can explore all the icons of the set before the tests
- blocks of 100 icons to be recognized
- the user has to guess the direction
- answers and times logged

Sets 1 and 2



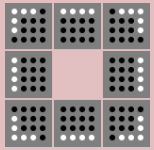
The icons of set 1 blinks, the ones of set 2 are static

Set 3



"waves"

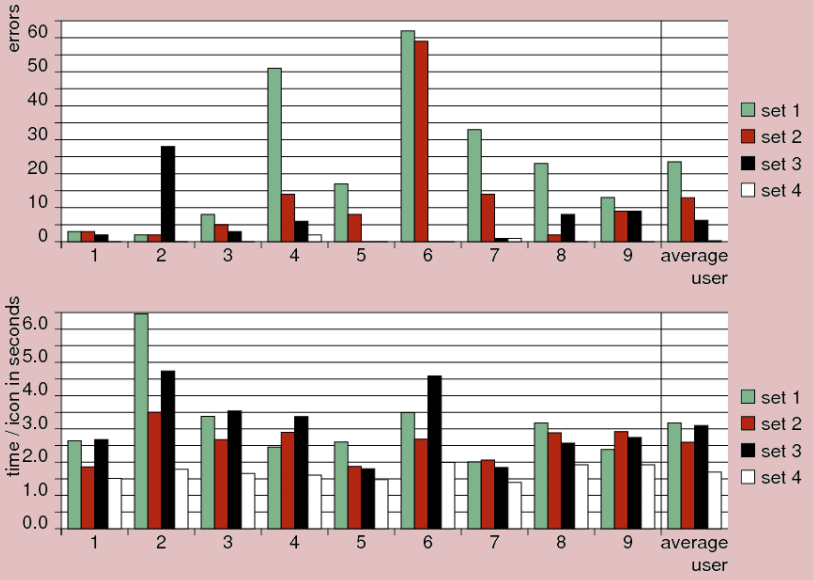
Set 4



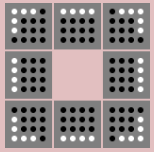
More pins than in sets 1 and 2 to know if user prefer icons with more or less pins

Results

- set 4 is the best
- icons with more pins are easier to distinguish
- dynamic icons (sets 1 and 3) take more time to be recognized

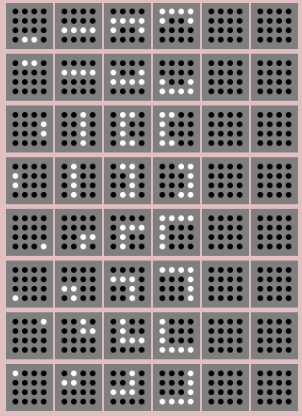


Set 4



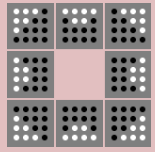
We keep this set to compare these sets with the previous ones

Set 5



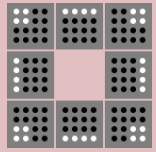
"growing waves"

Set 6



Try to use more pins, the same number for each direction

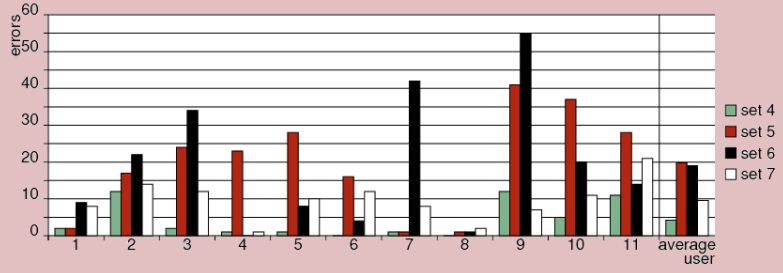
Set 7

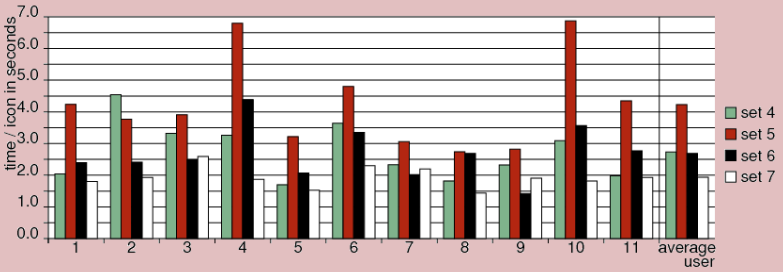


Try to improve set 4, with different diagonals

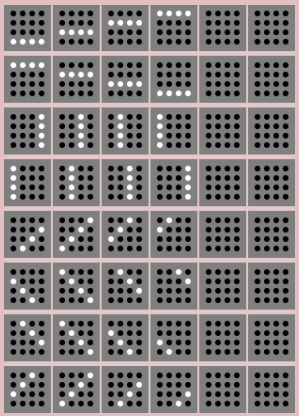
Results

- set 4 is still the best
- it's not efficient to use too many pins
- too complex animation is not good for discrimination



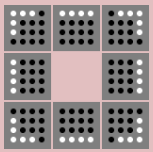


Set 3



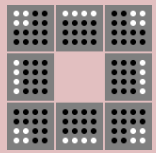
first "waves"

Set 4



still the best...

Set 7

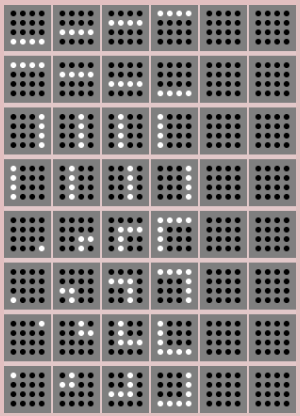


supposed to have almost the same results than the set 4...

Results

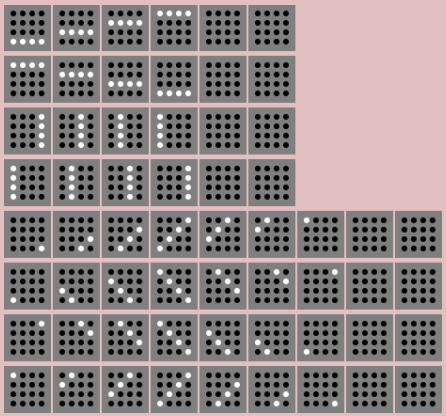
- noisy conditions
- previous results confirmed : set 4 has less errors

Set 8



diagonal icons have a "growing shape"

Set 9



radial and diagonal icons have different duration

Results

- both sets are efficient
- we have found usable dynamic icons

Conclusion

Summary

- users rather prefer static icons
- hard to recognize icons with too few or too much pins raised
- dynamic icons need a significant difference between radial and diagonal icons

Future work

- tests with different speeds for dynamic icons
- tests with mixed icons: static and dynamic pins
- tests with highest resolution devices

Thank you for your attention.

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