Chess for blind

Michal Řežábek, David Polák
Naming things is hard

- Chess for blind
- Braille chess set
- Chess for visually impaired
- Tactile chess
Standard chess set

- Chessboard
- 16 Chess pieces
  - Black and white
    - 1 King
    - 1 Queen
    - 2 Rooks
    - 2 Bishops
    - 2 Knights
    - 8 Pawns
Blind players

“Chess is said to be one of the few sports where blind people can compete independently and on equal terms with their sighted counterparts.”

“… and while this assertion may be largely true certain disadvantages should not be overlooked.”

Credit: The Braille Chess Association of Ireland
Issues facing blind players

- **Clocks**
  - “A dial fitted with reinforced hands” - FIDE handbook
    - FIDE – World chess federation

- **Learning the game**
  - Paper vs. digital chess games

- **Physical game analysis**
Participation in tournaments

- Accessibility
- Secondary chessboard
- Assistant needed
Despite these obstacles, blind players often reach very high levels in Chess, with some even attaining Master level.

Credit: http://www.iol.ie/~vics/bcai/
FIDE rules for blind chess sets

- Chessboard must be
  - at least 20 by 20 cm
  - the black squares slightly raised
  - a securing aperture in each square
  - every piece provided with a peg that fits into the securing aperture
  - pieces of Staunton design, the black pieces being specially marked
Pegged chess set
Qualitative study

- What issues do blind players have with the standard pegged chess set?

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Gender</th>
<th>Category</th>
<th>Onset</th>
<th>Skills</th>
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<tbody>
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<td>40</td>
<td>M</td>
<td>5</td>
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</tbody>
</table>

TABLE: List of participants, their age, gender, category of impairment (4 – light perception, 5 – no light perception [20]), and onset of impairment (C – congenitally blind, L – late blind), and chess skills.
Collected findings

- Board is difficult to analyse
  - Chess evolved to be played by sighted individuals

- Pieces are hard to move
  - Pegs stick
  - Small holes
Proposed solutions

- Smaller pieces make for faster analysis
Proposed solutions

- Flat pieces with symbols make for faster analysis
- Magnets

Credit: yankodesign.com/2012/04/17/play-chess-with-your-eyes-closed/
Proposed solutions

Credit: blog.innateagency.com/2006/05/25/chess_for_the_b/
Proposed solutions

- Chess pieces communicate their purpose
- Braille description identifies squares
- Texture indicates color
  - Pieces
  - Squares

Credit: blog.innateagency.com/2006/05/25/chess_for_the_b/
Collected findings

- Shape of the pieces does not matter
- Position is the key
- Players might forget a piece
Sighted / blind player game

- Sighted people might have a problem adjusting to chess sets for blind
- How do we minimize the pain of using a different type of a chess set?
  - Make the learning curve as small as possible
    - Familiar symbols
    - Fast game analysis
    - Fast piece manipulation
Our criteria for design

- Fast game analysis
- Minimal learning curve
- Can be used by sighted players
Problems

- Chessboard design
- Light vs dark squares
- Chess pieces
  - Shape
  - Black / White differentiation
  - Piece identification
Chessboard design

- Analytical board – initial sketch
Chessboard design

- Analytical board – initial sketch
Chessboard design

- Move mode
Chessboard design

- Move mode
Chessboard design

- Analytical and move mode
Chess pieces design

- Shape
- Black vs White
- Piece identification
Shape of the chess pieces

- Which type/shape to use?
Shape of the chess pieces

- Vertical orientation
- Ease of grip
- Ease of insertion
Symbols of chess pieces

- 6 unique symbols:
  - 4-fold rotational symmetry
    - Symbols do not change appearance when they are rotated by 90°
  - Maximal tactile difference

- Symbols should have the same height and follow tyflographic laws
Black vs White pieces

- Identification in analytical mode
  - Only the top of the piece is accessible

- Identification in move mode
Prototyping 2 - Chess pieces
Black vs White pieces

- Differentiation in analytical mode
  - Black piece is 2mm higher than a white piece
- Differentiation in move mode
  - Black pieces are hatched
Light vs Dark squares

- Color is for sighted people
- Solution ideas for blind
  - Height difference
  - Texture
  - Hatching
Light vs Dark squares differentiation

- Linear hatching
  - Black squares
  - Vertical hatching
    * Vertical hatching doesn't have the same size as a light square

→ Hatching lines rotated at 45°

- Squares have are of the same height
Mode switching

- Efficient
- Quiet
- Stable in both modes
- Assigned to a mechanical design team
Symbol testing

- 10 blind participants

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<th>Cat</th>
<th>Onset</th>
<th>Chess player</th>
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<td>4</td>
<td>L</td>
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</table>
Symbol testing

- Six permutated lines of symbols per participant
  - 360 symbols touched in total
Results
Error rate

- 360 symbols touched in total
- Only 2 errors
Our solution

- Fast analysis
- Easy manipulation
Thanks for your attention!

Michal Řežábek and David Polák,
27.11.2015

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