INTRODUCTION

- Braille is communication media between blind and sighted persons
- Sighted persons use sight when communicating by reading tactile or grapheme form of Braille
- By knowing Braille, sighted professionals, teachers, parents and significant others support blind child, youth or adults in their personal effort and goal of reaching personal maximum Braille literacy potential
- Croatian Braille Code System is defined with 63 single/one cell Braille tactile grapheme
- Braille tactile grapheme (single cell Braille signs) are defined with code in two vertical and three horizontal lines
- Code is defined by numbers that represent dots within single/one Braille cell

32 (out of total of 63) one cell Braille Tactile Graphemes can be identified independently

Structure of Croatian Braille code system is defined with 7 groups of Braille tactile grapheme (single/one cell Braille code).

In the first 6 groups there are 10 different Braille tactile grapheme (single/one cell Braille code)

In 1 group there is 3 different Braille tactile grapheme (single/one cell Braille code)

Program is created to help develop skill of visual recognition (reading) by using sight (visual perception) of visual image of the single cell Braille Tactile Grapheme

Table content shows which Braille font image of Braille tactile grapheme – single/one cell Croatian Braille Code System (Croatian Braille Notation) is included in BBH (OHB 2009 v1.2) program (all Croatian letters and most common foreign letters w, y, q)

Table 1.
BBH (OHB 2009 v1.2) exercise content

<table>
<thead>
<tr>
<th>1 group</th>
<th>a(1)</th>
<th>b(12)</th>
<th>c(14)</th>
<th>d(145)</th>
<th>e(15)</th>
<th>f(124)</th>
<th>g(1245)</th>
<th>h(125)</th>
<th>i(24)</th>
<th>j(245)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 group</td>
<td>k(13)</td>
<td>l(123)</td>
<td>m(134)</td>
<td>n(1345)</td>
<td>o(135)</td>
<td>p(1234)</td>
<td>(12345)</td>
<td>r(1235)</td>
<td>s(234)</td>
<td>(2345)</td>
</tr>
<tr>
<td>3 group</td>
<td>u(136)</td>
<td>v(1236)</td>
<td>x(1346)</td>
<td>y(13456)</td>
<td>z(1356)</td>
<td>(12346)</td>
<td>(123456)</td>
<td>(12356)</td>
<td>z(2346)</td>
<td>(23456)</td>
</tr>
<tr>
<td>4 group</td>
<td>č(16)</td>
<td>lj(126)</td>
<td>čj(146)</td>
<td>d(1456)</td>
<td>š(156)</td>
<td>nj(1246)</td>
<td>dž(12456)</td>
<td>(1256)</td>
<td>(246)</td>
<td>w(2456)</td>
</tr>
<tr>
<td>5 group</td>
<td>(2)</td>
<td>(23)</td>
<td>(25)</td>
<td>(256)</td>
<td>(26)</td>
<td>(235)</td>
<td>(2356)</td>
<td>(236)</td>
<td>(35)</td>
<td>(356)</td>
</tr>
<tr>
<td>6 group</td>
<td>(4)</td>
<td>(45)</td>
<td>(34)</td>
<td>(345)</td>
<td>(346)</td>
<td>(3456)</td>
<td>(46)</td>
<td>(456)</td>
<td>(5)</td>
<td>(56)</td>
</tr>
<tr>
<td>7 group</td>
<td>(3)</td>
<td>(36)</td>
<td>(6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CROATIAN BRAILLE NOTATION STANDARD AND CROATIAN CONTRACTIONS

- Croatian language is written with Latin alphabet

- Blind persons in Croatia use Braille with respect of the Croatian Braille Notation Standard

- Latin alphabet is adjusted for Croatian language palatal sounds, which are not present in Latin language
  - with help of diacritical marks: č, Ć, š, Ž, đ
  - with help of merge of two letters (for one sound) in double letter: dž, lj, nj

- Croatian Braille Notation Standard - Croatian tactile Braille graphemes are different than Braille letter standard in other world languages due to content of specific letters for Croatian language

- 3 letters in Croatian Braille Standard Notation have both double- letter Braille code and equivalent single cell Braille contraction

- Baković A. (ur.): Osnove hrvatske brajice, Biblioteka šestotočka, HSS, 1994., Zagreb defines current Croatian Braille Notation Standard in more details

Table 2. Specific Croatian latin alphabet letters, braille letters (Croatian Braille Notation Standard)

<table>
<thead>
<tr>
<th>Specific TNR font image of the latin characters of Croatian language</th>
<th>OHB Braille font image of the Standard Croatian Braille tactile graphemes for the specific Croatian language latin alphabet letters</th>
<th>OHB Braille font image of the Standard Croatian Braille tactile graphemes for the specific Croatian latin alphabet letters</th>
<th>Constructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Croatian latin alphabet letters</td>
<td>Double cell form</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 lj</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 nj</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 dž</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 đ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 č</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 č</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 š</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 ž</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2* Baković A.: Osnove hrvatske brajice, Biblioteka šestotočka, HSS, 1994., Zagreb
THE IDEA FOR SOFTWARE DEVELOPMENT AND PROGRAM APPLICATION

- this is basic software package
- it is suitable for sighted beginners in reading Croatian Braille
- software is created to help sighted persons visually recognize and read Croatian Braille
- it can be used by sighted students, mainstream teachers, special teachers, rehabilitation worker, social worker as well as everyone who wants to refresh their knowledge in reading Croatian Braille
- realizing idea of reaching the goal to enable a student to master recognition of Braille font (BBH font) image of Braille Tactile Grapheme and learn to read Croatian Braille by using sight in easier and user friendly manner
- this program package does not contain methodological exercises for Level 1, Level 2 and Level 3
- software is free of charge
- authors permission is compulsory (afajdetic@erf.hr)
- it is recommended to use it as additional help in lifelong learning programs (workshops, university courses …), with author’s permission and help
- for lifelong learning purposes and other educational purposes, with author’s permission author / expert for rehabilitation/education methodology will create individual exercises to fit the need of the program

PROGRAM - HELP

- Software offers help at all program levels
- “Help answer” – helps by giving correct answer
- “Help table” – helps by offering table of possible answers (letters)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Č</th>
<th>Ć</th>
<th>D</th>
<th>DŽ</th>
<th>Đ</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>I</td>
<td>J</td>
<td>K</td>
<td>L</td>
<td>U</td>
<td>M</td>
<td>N</td>
<td>NJ</td>
<td>O</td>
<td>P</td>
</tr>
<tr>
<td>R</td>
<td>S</td>
<td>Š</td>
<td>T</td>
<td>U</td>
<td>V</td>
<td>Z</td>
<td>Ž</td>
<td>X</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

PROGRAM - STATISTICS

- program offers current exercise statistics
- program statistic keeps track of the % of correct answers within single exercise
- using “help answer” or “help table” is considered as a wrong answer
- program offers Clock Timer of a current exercise
- time is not criteria that measures learning outcome of an exercise
LEVEL ONE – letter recognition

BBH font image of BRAILLE TACTILE GRAPHEME (LETTER) RECOGNITION EXERCISE

Goal

- to be able to visually recognize all BBH font (image) of Braille tactile grapheme of the Croatian Braille Notation (letters) – 50 letters
- this basic program package offers different Braille code listed in Program Exercises Content

Criteria

- **Less than 70 % recognition** - student is guided to continue exercise at this level

- **More than 70 % recognition** – student can continue exercise on WORD LEVEL
LEVEL TWO – word recognition

BBH font image of BRAILLE TACTILE GRAPHEME (WORD) RECOGNITION EXERCISE

Goal

- to be able to visually recognize BBH font (image) of Braille tactile grapheme of the Croatian Standard Braille Notation (letters) when written as words – 30 words
- this basic program package doesn’t offer exercises for this level (user creates word exercises content)

Criteria

- **Less than 50 % recognition** of words - student is guided to go back on the LETTER LEVEL and have more exercise

- **50-70% recognition** - student is guided to continue and have more exercises at this level

- **More than 70 % recognition** – student is guided to continue exercise on SENTENCE LEVEL
LEVEL THREE
BBH font image of BRAILLE TACTILE GRAPHEME (WORD WITHIN SENTENCE)
RECOGNITION EXERCISE

Goal
- to be able to visually recognize BBH font image of Braille tactile grapheme of the Croatian Standard Braille Notation (letters) when written as SENTENCES – 20 sentences
- this basic program package doesn’t offer exercises for this level (user creates sentence exercises content)

Criteria
- Less than 50% recognition of words within sentences - student is guided to go back at the WORD LEVEL and have more exercises
- 50-70% recognition of words within sentences - student is guided to continue and have more exercise at this level
- More than 70% of words within sentence recognition – student is guided to APPLY FOR AND EXAM 😊
CHALLENGES DURING OHB v1.2 (BBH) PROGRAM DEVELOPMENT

- **coordinating** interdisciplinary cooperation
- **defining** goals and criteria for the program
- **defining** exercises for every program level
- **decision making**

  - Croatian Standard Braille Notation (letters) contractions or double letter form of specific letters
- **lack of** Braille font adapted for Croatian language
- **lack of software** for same or similar purpose for Croatian language
- **decision making**
  - of making this software as basic program package
  - of not including specific visual recognition exercise as a content of this basic package due to limited resources
  - Level 1., 2., and 3. visual recognition exercises offer as an addition to the program
  - of defining goals for the future program development

**BBH SOFTWARE**

- For BBH software development Microsoft Visual Studio 2008 has been used as development tool
- VS 2008 is development tool used for making console applications and application with graphic interface, Windows Forms application, web sites, web application and web services on .NET platforms (and compact devices), Silverlight and Windows Mobile

- BBH is written with C# programming language with .NET Framework 3.5
- BBH has dependence upon preinstalled .NET Framework 3.5. in order to function

- Default (user friendly) setting of the software makes automatic download of .NET framework
- Default setting of the software installs OHB Braille font (for Croatian Braille alphabet) on your personal computer
- Main windows form is in MDI (Multiple Document Interface) form, it enables user to choose different Braille practice levels