



Specification of symbols used on Audio-Tactile Maps for individuals with blindness

D2.5

Testing results








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Lifelong
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THE ATMAPS CONSORTIUM

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5	Mustafa Kemal University (MKU)	
6	Panhellenic Association for the Blind (PAB)	
7	Association of Barrier Free Access (ABFA)	

ABBREVIATIONS

Term	Explanation
IVIs	Individuals with Visual Impairments
AT-MAPS	Audio-Tactile Maps
AT-Symbols	Audio-Tactile Symbols
WP	Work Package

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1. EXECUTIVE SUMMARY

Touch and hearing are the primary senses that Individuals with Visual Impairments (IVIs) use in order to access written and graphical information and to acquire knowledge about attributes of an environment and their surroundings.

Until now tactile maps included raised graphic patterns recognizable only by touch.

Nowadays, information technology offers the means to convert spatial information into audio, tactile or audio-tactile form.

Therefore the benefits of tactile graphics can be combined with audio information with the use of special devices. Audio-touchpad devices are touch-sensitive pads that can simultaneously provide users with tactile and audio information, while they explore tactile graphics with their fingers. In the case of audio-tactile maps, information is represented by audio symbols, tactile symbols, audio-tactile symbols (combined) and Braille labels.

What needs to be carefully examined is the basic query of which information should be presented in haptic mode by tactile symbols or with braille labels and which information should be presented in audio mode by audio symbols or delivered via audio-haptic mode by audio & tactile symbols combined.

Moreover, it should be specified what audio-tactile symbols (tactile, audio, audio & tactile) will represent specific information in audio-tactile maps.

The fundamental aim of the ATMAPS project is the specification of audio, tactile and audio-tactile symbols to be used in Audio-Tactile Maps (AT-Maps).

In practice this means that it needs to be defined what information should be included in the AT-Maps in which format and by which symbol this information should be presented.

The fifth deliverable of WP2 is a report that presents analytically the results of testing procedure the elaborated statistical analysis of data for the evaluation of the readability/ ease of identification of tactile symbols developed within the project.

Specifically, it includes a presentation of:

- a) the best perceived symbols when they are applied individually, and
- b) the best perceived tactile symbols when they are applied within tactile maps.

The results presented for the second case (b) are based on the testing procedure decided by the research team where the participants tested the tactile symbols within Indoors, Outdoors and Physical tactile maps and not in any of the different type of maps (inner space of buildings, neighborhood/residential areas, campuses, city centers, political, physical, historic and thematic maps) as it was initially proposed.

The results presented will consist the base on which the specification activities will be implemented in next deliverables of WP2.






2. BEST PERCEIVED TACTILE SYMBOLS WHEN APPLIED INDIVIDUALLY












The lists of best perceived tactile symbols are sorted from best to worst symbol (with symbols ranked with 1 being the best symbol).












The lists of symbols that are sorted based on their readability/ ease of identification (100 point, 40 linear and 20 areal) were derived based on a survey study which was conducted with the participation of blind individuals from the four project partner countries (Greece, Cyprus, Germany and Turkey). The order of symbols occurred after taking into account: 1) the identification or not of each symbol, 2) the time for identification, and 3) the number of times a symbol was confused with another one.












2.1 Best perceived Point Symbols when applied individually












The list of best perceived tactile symbols is sorted from best to worst symbol (with symbol ranked with 1 being the best symbol).












Ranking	Point Symbol	Reference No.
1		P099
2		P009
3		P059
4		P036
5		P005












Ranking	Point Symbol	Reference No.
6		P027
7		P028
8		P060
9		P026
10		P001
11		P100
12		P037
13		P035
14		P054
15		P039
16		P098












Ranking	Point Symbol	Reference No.
17		P090
18		P053
19		P029
20		P081
21		P055
22		P002
23		P067
24		P040
25		P063
26		P034
27		P049












Ranking	Point Symbol	Reference No.
28		P092
29		P091
30		P004
31		P072
32		P043
33		P093
34		P006
35		P014
36		P032
37		P080
38		P068








Ranking	Point Symbol	Reference No.
39		P077
40		P062
41		P085
42		P074
43		P073
44		P082
45		P097
46		P089
47		P071
48		P095
49		P048

Ranking	Point Symbol	Reference No.
50		P047
51		P033
52		P096
53		P058
54		P070
55		P003
56		P038
57		P087
58		P031
59		P083
60		P046

Ranking	Point Symbol	Reference No.
61		P013
62		P042
63		P075
64		P094
65		P084
66		P010
67		P069
68		P011
69		P065
70		P079
71		P064







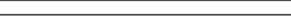








Ranking	Point Symbol	Reference No.
72		P025
73		P017
74		P007
75		P041
76		P076
77		P018
78		P050
79		P061
80		P020
81		P015
82		P052

















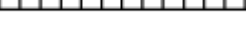

Ranking	Point Symbol	Reference No.
83		P012
84		P044
85		P078
86		P088
87		P086
88		P066
89		P030
90		P051
91		P021
92		P045
93		P016


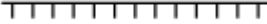





Ranking	Point Symbol	Reference No.
94		P023
95		P057
96		P056
97		P019
98		P022
99		P008
100		P024

2.2 Best perceived Linear Symbols when applied individually

The list of best perceived tactile symbols is sorted from best to worst symbol (with symbol ranked with 1 being the best symbol).


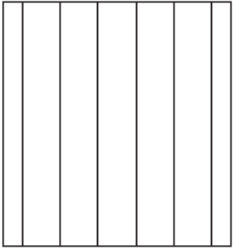
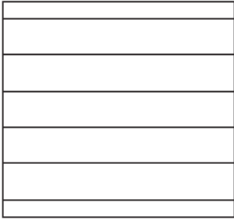
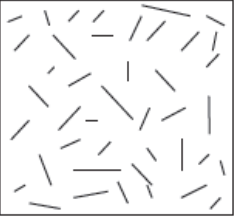
Ranking	Areal Symbol	Reference No.
1		L03
2		L02
3		L10
4		L01
5		L30
6		L23
7		L09
8		L22
9		L11
10		L20
11		L05
12		L14
13		L15
14		L12
15		L21

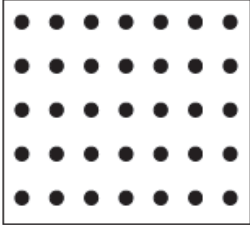
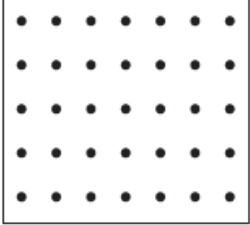


Ranking	Areal Symbol	Reference No.
16		L35
17		L38
18		L19
19		L29
20		L28
21		L39
22		L18
23		L13
24		L26
25		L40
26		L36
27		L24
28		L17
29		L16
30		L31
31		L37
32		L32
33		L25

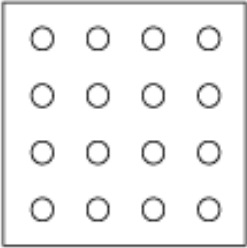
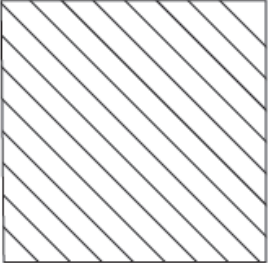
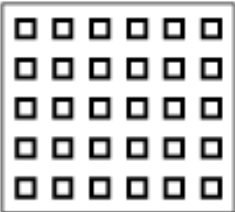
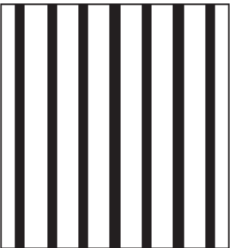
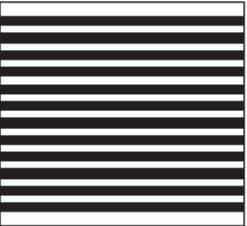
Ranking	Areal Symbol	Reference No.
34		L04
35		L33
36		L27
37		L34
38		L06
39		L07
40		L08


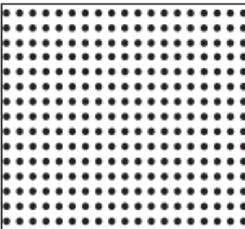
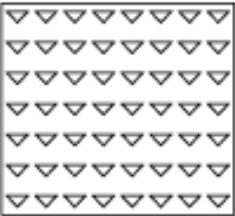

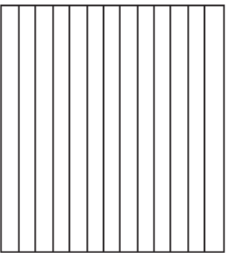
2.3 Best perceived Areal Symbols when applied individually

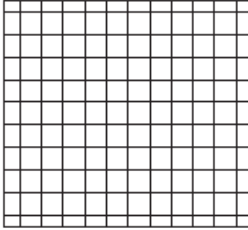
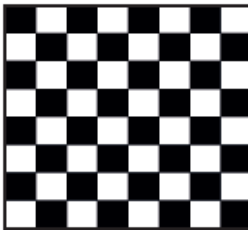
The list of best perceived tactile symbols is sorted from best to worst symbol (with symbol ranked with 1 being the best symbol).

Ranking	Areal Symbol	Reference No.
1		A04
2		A07
3		A03
4		A17

Ranking	Areal Symbol	Reference No.
5		A11
6		A12
7		A06
8		A10

Ranking	Areal Symbol	Reference No.
9		A14
10		A09
11		A18
12		A08
13		A02









Ranking	Areal Symbol	Reference No.
14		A01
15		A13
16		A15
17		A16
18		A05












Ranking	Areal Symbol	Reference No.
19		A20
20		A19












3. BEST PERCEIVED TACTILE SYMBOLS WHEN APPLIED IN TACTILE MAPS












3.1 Best perceived Point Symbols when applied in tactile maps












The list of best perceived tactile Point symbols when applied in maps is presented below.












Ranking	Point Symbol	Reference No.
1		P001
2		P091
3		P100
4		P009
5		P099
6		P036
7		P002
8		P081












Ranking	Point Symbol	Reference No.
9		P068
10		P054
11		P027
12		P074
13		P067
14		P037
15		P029
16		P034
17		P055
18		P069
19		P039












Ranking	Point Symbol	Reference No.
20		P059
21		P026
22		P063
23		P028
24		P062
25		P005
26		P035
27		P071
28		P083
29		P093
30		P084












Ranking	Point Symbol	Reference No.
31		P006
32		P060
33		P089
34		P073
35		P090
36		P049
37		P080
38		P053
39		P082
40		P097
41		P017





Ranking	Point Symbol	Reference No.
42		P092
43		P098
44		P070
45		P011
46		P046
47		P048
48		P031
49		P010
50		P043
51		P014
52		P072

Ranking	Point Symbol	Reference No.
53		P094
54		P020
55		P061
56		P065
57		P040
58		P003
59		P057
60		P085
61		P078
62		P041
63		P004

Ranking	Point Symbol	Reference No.
64		P076
65		P088
66		P016
67		P047
68		P096
69		P086
70		P042
71		P087
72		P064
73		P022
74		P033














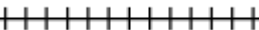

Ranking	Point Symbol	Reference No.
75		P038
76		P013
77		P075
78		P018
79		P032
80		P077
81		P012
82		P045
83		P008
84		P058
85		P095


















Ranking	Point Symbol	Reference No.
86		P052
87		P007
88		P021
89		P015
90		P019
91		P025
92		P023
93		P056
94		P079
95		P051
96		P030

Ranking	Point Symbol	Reference No.
97		P066
98		P050
99		P044
100		P024

3.2 Best perceived Linear Symbols when applied in tactile maps

The list of best perceived tactile Linear symbols when applied in maps is presented below.

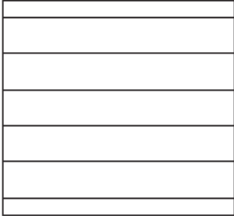
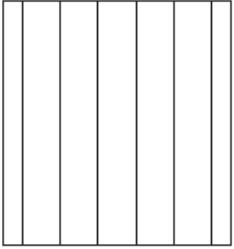
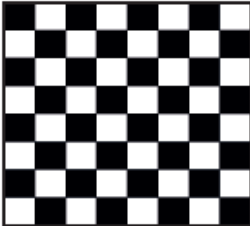
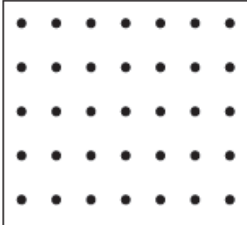
Ranking	Areal Symbol	Reference No.
1		L02
2		L01
3		L03
4		L23
5		L10
6		L09
7		L35
8		L30
9		L14
10		L22
11		L39
12		L12
13		L20
14		L34
15		L15

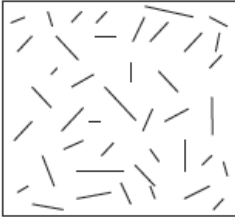
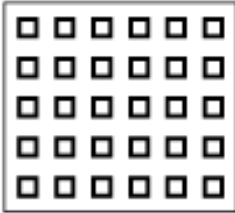

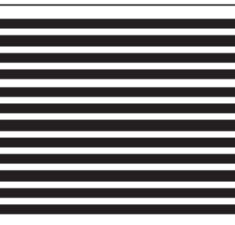
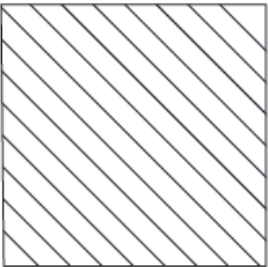
Ranking	Areal Symbol	Reference No.
16		L32
17		L40
18		L21
19		L38
20		L29
21		L11
22		L06
23		L18
24		L16
25		L04
26		L25
27		L26
28		L36
29		L33
30		L24
31		L31
32		L28

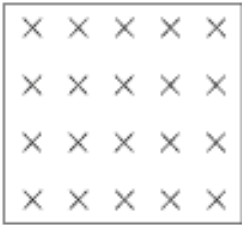
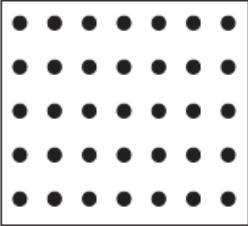
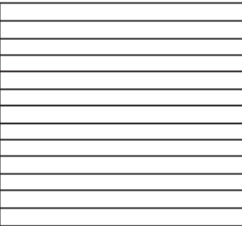

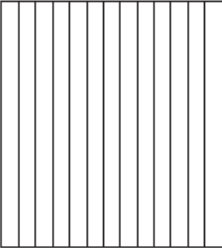
Ranking	Areal Symbol	Reference No.
33	—▲—▲—▲—▲—	L17
34	■ ■ ■ ■ ■ ■ ■ ■	L19
35	● ● ● ● ● ● ● ● ● ●	L13
36	- - - - -	L08
37	▼▼▼▼▼▼▼▼▼▼	L37
38	- - - - -	L07
39	- - - - -	L05
40	▶▶▶▶▶▶▶▶▶▶	L27


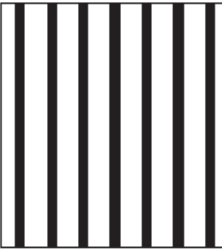
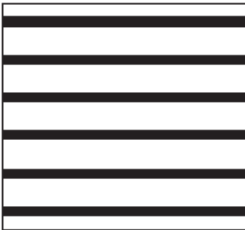

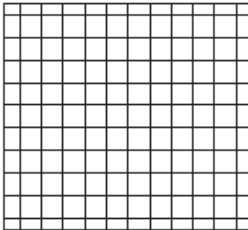
3.3 Best perceived Areal Symbols when applied in tactile maps

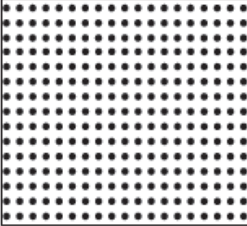
The list of best perceived tactile Areal symbols when applied in maps is presented bellow.

Ranking	Areal Symbol	Reference No.
1		A03
2		A07
3		A19
4		A12

Ranking	Areal Symbol	Reference No.
5		A17
6		A18
7		A15
8		A02
9		A09

Ranking	Areal Symbol	Reference No.
10		A16
11		A11
12		A01
13		A14
14		A05











Ranking	Areal Symbol	Reference No.
15		A06
16		A08
17		A04
18		A10
19		A20













Ranking	Areal Symbol	Reference No.
20	 A square grid of small black dots, arranged in approximately 15 rows and 15 columns, centered within the cell.	A13













4. OVERALL BEST PERCEIVED TACTILE SYMBOLS













4.1 Overall best perceived Point Symbols













The list of overall best perceived tactile Point symbols is presented bellow.













Ranking	Point Symbol	Reference No.
1		P001
2		P009
3		P099
4		P036
5		P100
6		P027
7		P059
8		P005
9		P081
10		P091













Ranking	Point Symbol	Reference No.
11		P028
12		P054
13		P002
14		P026
15		P037
16		P060
17		P039
18		P029
19		P035
20		P067
21		P055
22		P090













Ranking	Point Symbol	Reference No.
23		P034
24		P063
25		P098
26		P053
27		P068
28		P093
29		P049
30		P006
31		P074
32		P092
33		P062
34		P040







Ranking	Point Symbol	Reference No.
35		P080
36		P043
37		P072
38		P071
39		P073
40		P014
41		P089
42		P082
43		P097
44		P004
45		P083
46		P069

Ranking	Point Symbol	Reference No.
47		P070
48		P084
49		P048
50		P085
51		P046
52		P031
53		P032
54		P011
55		P003
56		P077
57		P010
58		P047

Ranking	Point Symbol	Reference No.
59		P017
60		P096
61		P094
62		P033
63		P087
64		P065
65		P042
66		P038
67		P095
68		P058
69		P041
70		P013


















Ranking	Point Symbol	Reference No.
71		P020
72		P075
73		P061
74		P076
75		P064
76		P078
77		P018
78		P088
79		P086
80		P057
81		P007
82		P025





Ranking	Point Symbol	Reference No.
83		P016
84		P079
85		P012
86		P015
87		P052
88		P045
89		P050
90		P021
91		P023
92		P066
93		P044
94		P030

Ranking	Point Symbol	Reference No.
95		P022
96		P051
97		P019
98		P056
99		P008
100		P024

4.2 Overall best perceived Linear Symbols

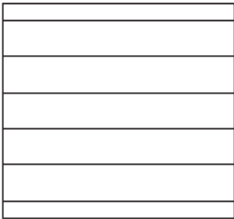
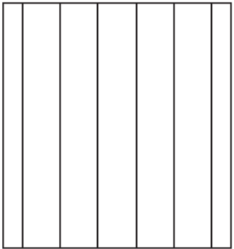
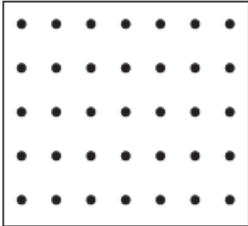
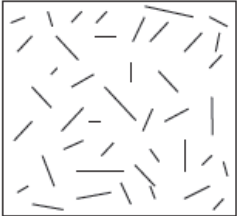
The list of overall best perceived tactile Areal symbols is presented bellow.

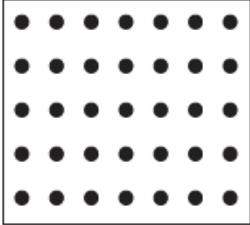

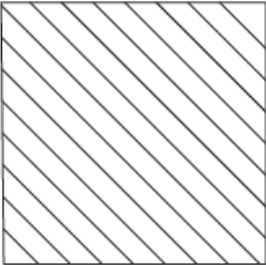
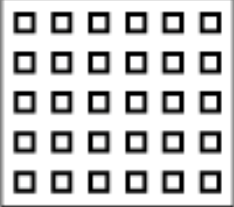
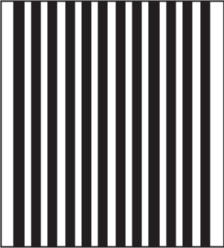
Ranking	Areal Symbol	Reference No.
1		L03
2		L02
3		L01
4		L10
5		L23
6		L09
7		L30
8		L22
9		L20
10		L14
11		L35
12		L11
13		L15
14		L12
15		L21
16		L39
17		L38

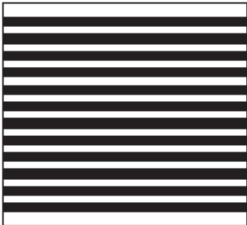
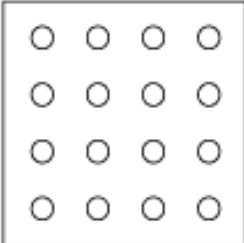
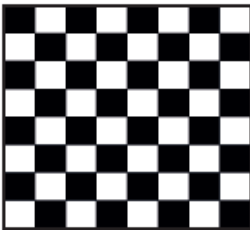

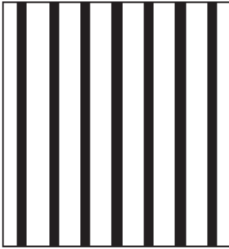
Ranking	Areal Symbol	Reference No.
37		L06
38		L27
39		L07
40		L08

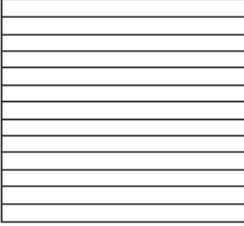
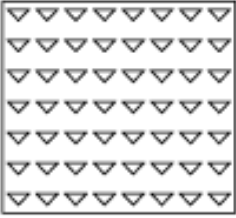

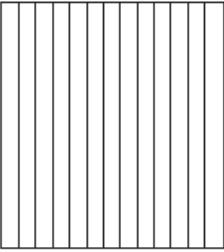
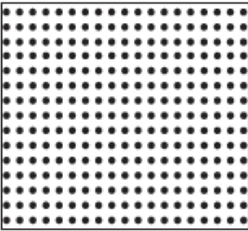
4.3 Overall best perceived Areal Symbols

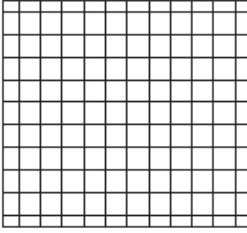
The list of overall best perceived tactile Areal symbols is presented bellow.

Ranking	Areal Symbol	Reference No.
1		A03
2		A07
3		A12
4		A17

Ranking	Areal Symbol	Reference No.
5		A11
6		A04
7		A09
8		A18
9		A06

Ranking	Areal Symbol	Reference No.
10		A02
11		A14
12		A19
13		A10
14		A08

Ranking	Areal Symbol	Reference No.
15		A01
16		A15
17		A16
18		A05
19		A13

Ranking	Areal Symbol	Reference No.
20		A20