What is it and how quickly you can guess?

Żaneta Demarczyk, Katarzyna Spyra, Adrian Trojanowski
Faculty of Applied Mathematics, Silesian University of Technology
Kaszubska 23, 44-100 Gliwice, Poland
zaneta.demarczyk93@gmail.com, katarzyna.spyra@interia.pl, adtrojanowski@interia.pl

***Abstract*—This article presents research on human interactions by using a methodology of gradually revealed images for recognition. The idea we measure here it to compare results of interactions while guessing on the image. In the results we show and discuss differences between sex of the participant and category of the quiz.**

Keywords—image composition, interactions, human behavior, sociology of decisions

I. INTRODUCTION

Interactions are driven by many factors. During decision processes our brain is focusing on some aspects of the reality which can be easily associated with the things we have in our memory or which surround us. This interactions are driven by some factors which we can associate and use for conclusions. Very often we must decide under pressure or under limited time. For these we can find some differences between man and woman, since not only a brain but also a sociology of decision is important. There are many articles presenting results from decision processes, where humans were asked to describe reactions from various inputs like sounds, images, unexpected situations, etc. In [1] was presented how humans react to the sound of aircraft. Authors measured reactions and described them in relation to the user. In [2] was presented how humans react to rewards and punishments in various situations, where as an exemplary social model was realized theory of Gray's personality. In [3] was presented how humans react to uncontrolled results of situations they participate in, the authors were especially interested on relation of interactions to superstition. Very often in the research on human interactions are used images. From an image we are able to evaluate many emotions and also knowledge about the content. In [4] were discussed reactions to images, eg. by facial or behavioral features. In [5] authors discussed both reactions to images and also motivations that were diving people to interact in each way. In [6] were presented differences between man and woman reactions to children facial images, while in [7] differences were discussed on example of animals. An interesting aspects of psychological tendencies in our brains during choices were discussed in [8]. Image processing and interactions between machines based on human behavior are widely discussed in recent times. New articles present interesting ideas for selecting objects from images or to used models of human interactions to proceed communications between robots and autonomous systems. All these ideas are helpful in the research on human behavior. In [9] was discussed how to use a composition of neural networks and heuristic methods to detect some features of fruits from images, while in [10] was proposed a method for automatic selection of bacteria. On the other hand there are many research on object oriented programming where cognitive aspects are modeled to increase code efficiency. In [11] authors proposed some complexity metrics based on cognitive models, while in [12] were presented research results on reactions to vocalization of dogs and their emotional aspects. Results of using human behavioral models are very important for autonomous systems, where groups of unmanned robots are set to perform complex tasks, but communication between them is based on human behaviors. In [13] was discussed how to model a self-organizing strategies for autonomous group of robots in changing environments, while in [14] these were compared to performance of interactions between working agents. The aim of this project is to show interactions between human and computer. For this reason we have developed a program which presents images to users and measures their choices basing on the category. The program takes the form of a game and selects one of the available images from given field and shows a part of randomly chosen pixels. The number of pixels which are discovered increases with passing time, until all pixels are shown and whole picture is presented. In this time user is asked to guess what in his opinion is presented in the revealed image. In our program we have three available categories: buildings, famous people and animals. Of course, user knows the categories, but he doesn't see the images in advance. In every field there are 5 pictures, which are selected randomly. In our opinion, such games have a very good effect on people. They examine perceptiveness and knowledge from various fields (eg from geography, history) therefore we have decided to present some research results in this field of human interactions to images.

II. DETAILS OF THE PROGRAM

This project is written in Wolfram Mathematica 10 for research purposes. Now, we talk a bit about the code. In the program, we used the fact that every image can be presented as a pixel's matrix. The algorithm randomly selects and show from 5% to 50% of pixels of each row with the step 5%. At the last stage the whole picture is exposed. Sample visualization of the process is presented in Fig. 1.

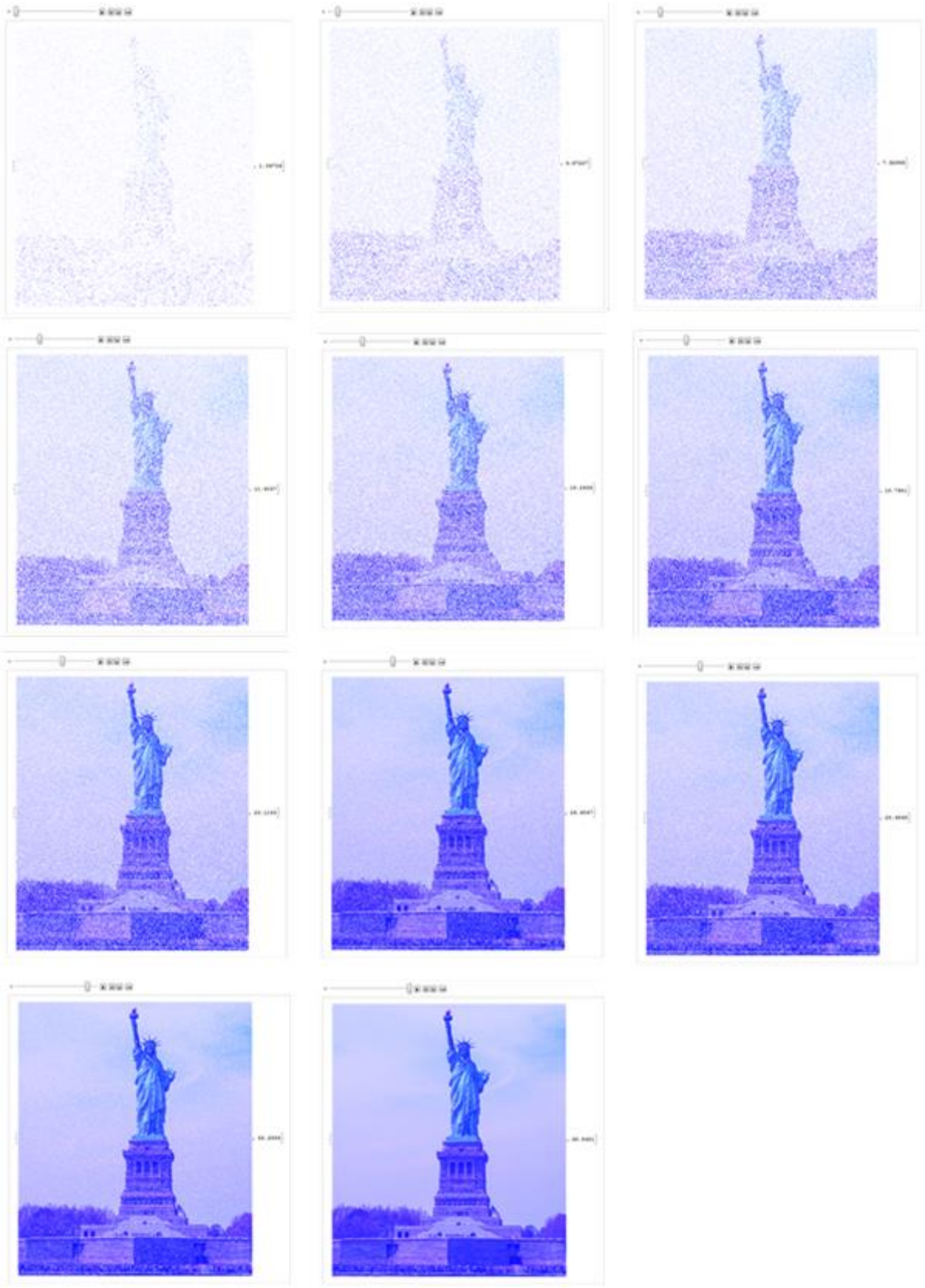


Fig. 1 A sample sequence of the images during quiz shown starting from 5%, while the user is asked to guess what is presented in the image.

```
buildings = {ba, bb, bc, bd, be};
people = {oa, ob, oc, od, oe};
animals = {za, zb, zc, zd, ze};
WhatIsIt[dziedzina_] := Module[{dzie = dziedzina},
  If[dzie == "buildings", h = RandomChoice[buildings, 1][[1]],
   If[dzie == "people", h = RandomChoice[people, 1][[1]], If[dzie == "animals", h = RandomChoice[animals, 1][[1]]]]];
  b = ImageData[h];
  z = Table[1, {i, 1, Length[b]}, {j, 1, Length[b[[1]]]}, {k, 1, 4}];
  m = Table[0, {i, 1, 11}];
  For[g = 1, g ≤ 10, g++,
   For[i = 1, i ≤ Length[b], i++, lista = {RandomInteger[{1, Length[b[[i]]]}]};
    For[j = 1, j < Length[b[[i]]] * 10, ++j, randomowy = RandomInteger[{1, Length[b[[i]]]}];
     powiekszona = Append[lista, randomowy];
     lista = Union[powiekszona];
     If[Length[lista] == Floor[0.05 * g * Length[b[[i]]]], wynik = lista; Break[]];
    Do[ z[[i]][[wynik[[k]]]] = b[[i]][[wynik[[k]]]]; m[[g]] = z; m[[11]] = Image[b], {k, 1, Length[wynik]}]];
  Animate[{Image[m[[n]], ImageSize → Large], a}, {n, 1, 11, 1}, AnimationRunning -> False, AnimationRate → 0.25, AnimationRepetitions → 1,
   AnimationRunTime → Dynamic[a]]]
```

Fig. 2 Part of the code of the program in Mathematica 10 student edition.

Tab. 1 Results obtained from 20 players.

Observation number	Sex	Category	Picture	Time [s]	Observation number	Sex	Category	Picture	Time [s]
1	Male	buildings	Sphinx	24,2173	11	Female	buildings	Colosseum	19,2601
		people	Karol Wojtyła	0			people	Enrique Iglesias	21,3165
		animals	Elephant	12,575			animals	Squirrel	26,093
2	Male	buildings	Tower of Pisa	5,35274	12	Female	buildings	Sphinx	18,4756
		people	Robert Lewandowski	12,6457			people	Robert Lewandowski	16,7513
		animals	Squirrel	34,4054			animals	Flamingo	15,46
3	Male	buildings	Tower of Pisa	19,3325	13	Female	buildings	Eiffel Tower	0
		people	Enrique Iglesias	not guessed			people	Rihanna	15,0165
		animals	Gorilla	28,9175			animals	Squirrel	23,51922
4	Male	buildings	Statue of Liberty	0	14	Male	buildings	Eiffel Tower	3,9064
		people	Robert Lewandowski	21,3615			people	Marilyn Monroe	0
		animals	Flamingo	16,7			animals	Elephant	7,71992
5	Female	buildings	Sphinx	not guessed	15	Male	buildings	Tower of Pisa	5,9608
		people	Enrique Iglesias	26,6507			people	Marilyn Monroe	4,71504
		animals	Squirrel	33,4138			animals	Elephant	6,647
6	Female	buildings	Colosseum	29,9062	16	Female	buildings	Colosseum	not guessed
		people	Marilyn Monroe	4,14567			people	Rihanna	9,1617
		animals	Horse	25,9206			animals	Horse	19,8639
7	Female	buildings	Eiffel Tower	4,48744	17	Male	buildings	Eiffel Tower	0
		people	Marilyn Monroe	7,78586			people	Enrique Iglesias	31,05
		animals	Gorilla	23,0975			animals	Flamingo	17,4206
8	Female	buildings	Colosseum	23,14	18	Female	buildings	Eiffel Tower	5,61302
		people	Rihanna	8,40952			people	Enrique Iglesias	20,2053
		animals	Elephant	9,15681			animals	Elephant	5,21907
9	Male	buildings	Tower of Pisa	0	19	Female	buildings	Tower of Pisa	0
		people	Rihanna	not guessed			people	Karol Wojtyła	12,564
		animals	Horse	23,6915			animals	Squirrel	22,5378
10	Male	buildings	Eiffel Tower	0	20	Male	buildings	Statue of Liberty	13,3166
		people	Karol Wojtyła	8,47303			people	Robert Lewandowski	15.2067
		animals	Horse	24,60212			animals	Squirrel	20,7439

Tab. 2 Results obtained from 20 players.

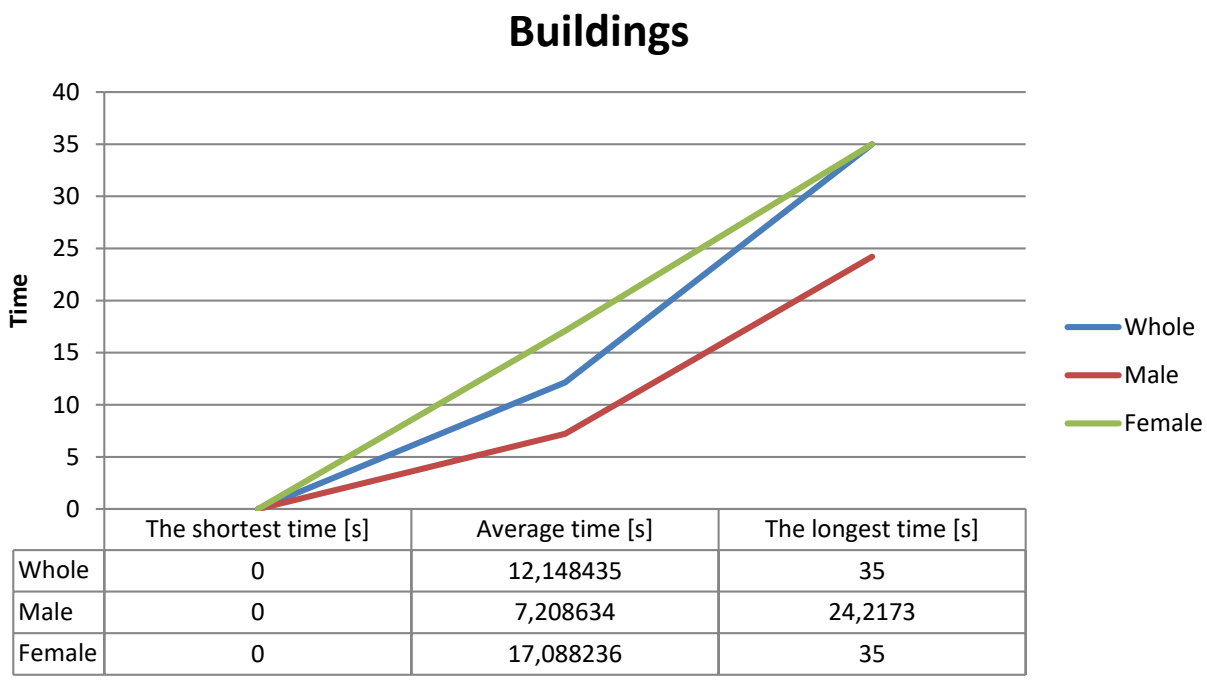
	Whole			
	Number of observations	The shortest time [s]	Average time [s]	The longest time [s]
Everything	60	0	14,18525341	35
Buildings	20	0	12,148435	35
Sphinx	3	18,4756	25,89763333	35
Tower of Pisa	5	0	6,129208	19,3325
Eiffel Tower	6	0	2,334476667	5,61302
Statue of Liberty	2	0	6,6583	13,3166
Colosseum	4	19,2601	26,826575	35
People	20	0	15,27643789	35
Robert Lewandowski	4	12,6457	16,9195	21,3615
Karol Wojtyła	3	0	7,012343333	12,564
Rihanna	4	8,40952	16,89693	35
Enrique Iglesias	5	20,2053	26,8445	35
Marilyn Monroe	4	0	4,1616425	7,78586
Animals	20	5,21907	19,885232	34,4054
Elephant	5	5,21907	8,26356	12,575
Horse	4	19,8639	23,51953	25,9206
Flamingo	3	15,46	16,52686667	17,4206
Squirrel	6	20,7439	26,78552	33,4138
Gorilla	2	23,0975	26,0075	28,9175

Tab. 3 Results for male participants.

	Male			
	Number of observations	The shortest time [s]	Average time [s]	The longest time [s]
Everything	30	0	14,26739828	35
Buildings	10	0	7,208634	24,2173
Sphinx	1	24,2173	24,2173	24,2173
Tower of Pisa	4	0	7,66151	19,3325
Eiffel Tower	3	0	1,302133333	3,9064
Statue of Liberty	2	0	6,6583	13,3166
Colosseum	0			
People	10	0	16,47169667	35
Robert Lewandowski	3	12,6457	17,0036	21,3615
Karol Wojtyła	2	0	4,236515	8,47303
Rihanna	1	35	35	35
Enrique Iglesias	2	31,05	33,025	35
Marilyn Monroe	2	0	2,35752	4,71504
Animals	10	6,647	19,342294	34,4054
Elephant	3	6,647	8,98064	12,575
Horse	2	23,6915	24,14681	24,60212
Flamingo	2	16,7	17,0603	17,4206
Squirrel	2	20,7439	27,57465	34,4054
Gorilla	1	28,9175	28,9175	28,9175

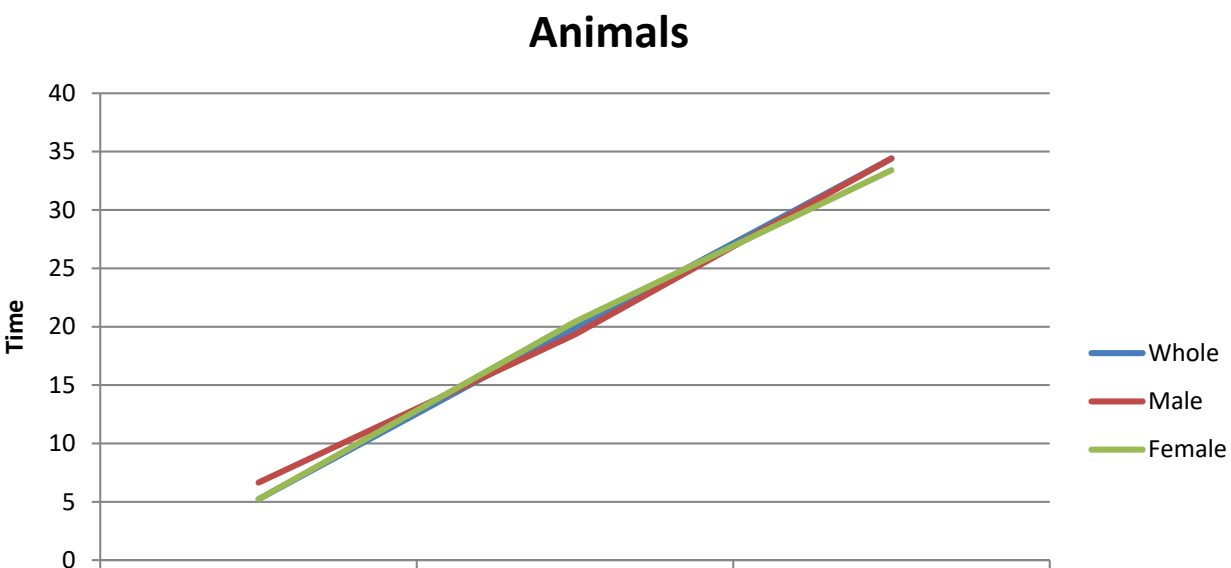
Tab. 4 Results for female participants.

	Female			
	Number of observations	The shortest time [s]	Average time [s]	The longest time [s]
Everything	30	0	17,239037	35
Buildings	10	0	17,088236	35
Sphinx	2	18,4756	26,7378	35
Tower of Pisa	1	0	0	0
Eiffel Tower	3	0	3,36682	5,61302
Statue of Liberty	0			
Colosseum	4	19,2601	26,826575	35
People	10	4,14567	14,200705	26,6507
Robert Lewandowski	1	16,7513	16,7513	16,7513
Karol Wojtyła	1	12,564	12,564	12,564
Rihanna	3	8,40952	10,86257333	15,0165
Enrique Iglesias	3	20,2053	22,72416667	26,6507
Marilyn Monroe	2	4,14567	5,965765	7,78586
Animals	10	5,21907	20,42817	33,4138
Elephant	2	5,21907	7,18794	9,15681
Horse	2	19,8639	22,89225	25,9206
Flamingo	1	15,46	15,46	15,46
Squirrel	4	22,5378	26,390955	33,4138
Gorilla	1	23,0975	23,0975	23,0975



	The shortest time [s]	Average time [s]	The longest time [s]
Whole	0	12,148435	35
Male	0	7,208634	24,2173
Female	0	17,088236	35

Fig. 3 Comparison of results in category buildings.

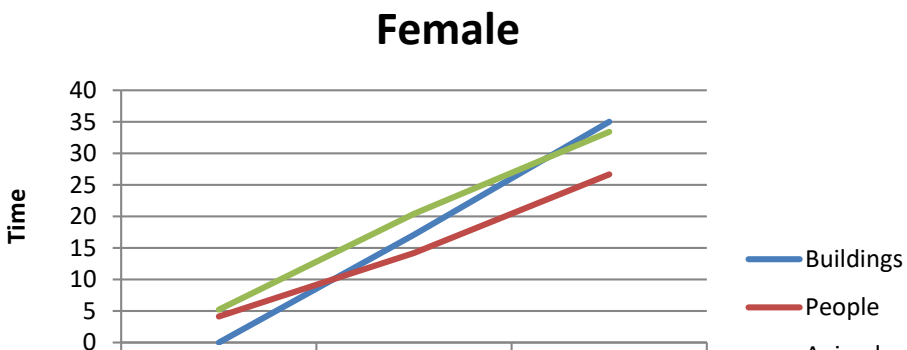


	The shortest time [s]	Average time [s]	The longest time [s]
Whole	5,21907	19,885232	34,4054
Male	6,647	19,342294	34,4054
Female	5,21907	20,42817	33,4138

Fig. 4 Comparison of results in category animals.

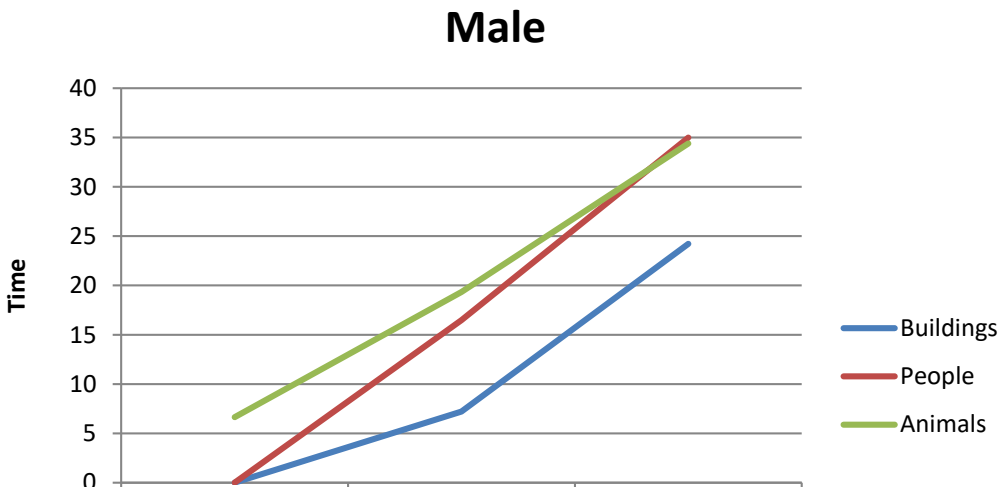
	The shortest time [s]	Average time [s]	The longest time [s]
Whole	0	15,27643789	35
Male	0	16,47169667	35
Female	4,14567	14,200705	26,6507

Fig. 5 Comparison of results in category people.



	The shortest time [s]	Average time [s]	The longest time [s]
Buildings	0	17,088236	35
People	4,14567	14,200705	26,6507
Animals	5,21907	20,42817	33,4138

Fig. 6 Comparison of results due to sex of players.



	The shortest time [s]	Average time [s]	The longest time [s]
Buildings	0	7,208634	24,2173
People	0	16,47169667	35
Animals	6,647	19,342294	34,4054

Fig. 7 Comparison of results due to sex of players.

A. What does the user do?

At the beginning, the user has to select the category of pictures by simply typing one of commands.

```
WhatIsIt["buildings"] or WhatIsIt["people"] or WhatIsIt["animals"]
```

Then the image is being exposed with the passing time. When the user already knows what the picture shows he/she should push “PAUSE”. The part of our code is shown in Fig. 2.

The player who correctly guessed with the shortest time wins, but we know that sometimes it is unfair because of the difficulty of the several images. The algorithm is running as long as the matrix is filled with the proper amount of the pixels without duplicates. In each step algorithm works from beginning- it means that it’s not picking the missing quantity of pixels to the matrix from the previous step. The pictures in Fig. 1 show the next stages of the program’s work on a randomly selected image.

III. Results

We invited 20 people to play our game. Everyone tried his chances in each category and we received the results presented in Tab. 1 – Tab. 4 and depicted in Fig. 3 – Fig. 7:

For example. The sixth user was woman and the shortest time she obtained was in the category – people. She guessed that in the picture was Marlin Monroe.

It can be observed that during our tests the most often displayed building was Eiffel Tower, in category people – Enrique Iglesias and in category animals it was squirrel. The shortest average time needed to guess was for buildings.

Pictures that presented Marlin Monroe and elephant have got the shortest time in their categories.

We can see that differences between man and woman on the charts visible in Fig. 4 – Fig. 5. In the category buildings, men turned out to be better. In the category people better were women. The smallest differences between men's and women's time was in the category animals.

IV. Conclusion

Generally men have shorter time than women. Among men, the shortest average time is for pictures from category buildings. While by the decisions all the users were most convenient with images of nature and calm colors, and where the colors were strict and very light these images were not very convenient to users. Sometimes the images were correctly identified in first 5 second due to some explicit details visible in presented objects. On the other hand these were not much visible for people. In general users were correctly recognizing people in images when some facial details appeared and were not able to recognize in first seconds when only a shape was visible.

In our opinion the research gave us important clues how the people react to various objects. These conclusions will be very useful in our future work, where we can use them for implementing systems oriented communication aspects, where a recognition of the input will be determined by some initial information about the input objects.

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