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Memory Errors in Eyewitness Identification Testimony

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Abstract--- Purpose. *The history of forensics knows a great number of misidentifications of suspected criminals. Certain attempts to study the reasons for identification errors were made in psychology, some phenomena were even described, but the whole range of such errors has not been established yet.*

Methodology. *We used collages showing famous people (Saddam Hussein, Britney Spears, Mireille Mathieu, Leonardo DiCaprio) with two identification-significant features altered, such as hairstyle (for men and women) and facial hair (for men). Human subjects had to identify the people shown in the collages. The first phase of the study took place in 2003, the second one in 2015, each with different groups of subjects. The time interval enabled to determine how time and decreased or increased popularity affected identification accuracy.*

Results. *It is found that eyewitness identification accuracy is affected by the verbalization of identification features. Verbalization is a demand to formulate the identifying features the witness relies upon during the identification process. Recognition of previously familiar and unfamiliar faces is based upon different principles, as in addition to recognizing individual features of a familiar face, the witness also perceives their specific configuration. In cases with a considerable time lapse between the face identification sessions, the memory image that serves as the basis of identification loses its distinctive features, leading to resemblance-based errors when a person is mistaken for a similar-looking individual.*

Conclusion. *It was found that face identification procedure has to take into account a number of factors which can affect identification accuracy.*

Keywords--- *Human Face Perception, Eyewitness Memory, Identification Error, Justice, Wholeness of Perception, Image Perception, Holistic Perception.*

I. INTRODUCTION

The topic of detecting and eliminating identification errors is important for different professional spheres: in operations control centers (for preventing potential mistakes while identifying the object of tracking), anti-terrorist work (for identifying dangerous cases), and criminal investigations (during criminal identification), etc. In criminal investigations, the identification of persons has legal constraints and procedures which are regulated by law. There is evidence that unintentional identification errors have led to thousands of wrongful convictions. It was only after the introduction of DNA testing that some of the miscarriages of justice were rectified and innocent people exonerated. However, identification of persons is still considered to be one of the most difficult ways of collecting evidence in criminal proceedings, partly because DNA tests may not always be objectively suitable or possible [Steblay, 2013]. These constraints, we believe, make psychological research important for specifying identification errors.

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The first scholars to study criminal identification errors from a psychological perspective were Karl Marbe and his colleagues. They found that a child, for example, can make a mistake even while identifying their parent, whose appearance the child is expected be familiar with. Their further studies, however, were only focused on proving children's high-level suggestibility and its influence upon identification accuracy [Brusilovskiy, 1929].

Marbe and his colleagues' findings were reflected in the existing regulations for presenting a suspect for identification. For example, criminal procedure law in the Russian Federation prohibits second-time identification by the same people under the same conditions (Part 3 Article 193 Criminal Code RF) to prevent the effect of self-suggestibility, and today's criminologists generally agree with this rule [Belkin, 2012]. Moreover, Smith [2015] found that presenting the same individual for identification repeatedly does not increase the accuracy of the procedure.

However, Marbe's idea that first identification is the most reliable has been disproved by judicial practice. Mlodinow [2012] gives the following example of a judicial error: a rape victim was trying to memorize her attacker's face (throughout the incident) in order to be able to reliably identify him later, but during the first identification episode she pointed at a similar-looking man, who was convicted. Later, when the actual rapist was arrested and presented for identification along with the man the victim had previously identified as her attacker, the woman still made the same choice. The misidentified man was exonerated after DNA-testing but by that time he had already been in prison for several years.

This example suggests that face identification errors may not be linked to the specific psychological characteristics of individuals (high suggestibility, for example). They could be determined more generally by human peculiarities in perception.

Modern psychological studies of perception revealed some general principles of face perception. It was found that children's recognition patterns are based upon the perception of mainly outer facial features (the contour of the face), whereas adults' perception is based on the inner facial features (the nose, the eyes, etc.) [Campbell, Walker, Baron-Cohen, 1995]. Studies of gender identification by photograph found that the difference in the location of eyebrows on men's and women's faces facilitates gender identification [Campbell et al., 1999].

Special judicial psychology studies were conducted to detect witnesses' perception errors and define their determinants. If the identified person's face has no distinctive marks or features, identification accuracy is approximately 40% [Myers, 2009], which is considered statistically unreliable in court proceedings. Another described phenomenon was that of verbal overshadowing, i.e. recalling the identified person's additional characteristics some time after the initial identification procedure, with such information sometimes being incorrect [Brown, Lloyd-Jones, 2008]. Studying how witnesses identified a suspected robber while watching a video of a simulated bank robbery, Foster et al. [2004] found that the accuracy of the witnesses' testimonies depended on the preliminary identification instructions given to them.

According to judicial psychology data, eyewitness identification reliability and accuracy also depend on the position of the identified person in the perceptual field. O'Connell [2009] found that the probability of correct identification increases significantly if the identified person is positioned on the right side of the line-up (70%

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correct identification). Gruza [2010] experimentally proved that if a line-up includes just three people, the witness is likely to point out the person in the center, increasing the number of faulty identifications. This research resulted in an amendment to Polish law that an identification line-up must include four people (for example, in Russia there must be no fewer than three). Other studies showed that simultaneous presentation of identified people produces more reliable and accurate results than sequential presentation [Pryke, Lindsay, Dysart, 2004].

It seems likely that forensic science has adopted an erroneous approach to defining the criteria of accurate eyewitness identification. It is this study's contention that the standard procedure does not take into account the holistic nature of perception. The perception of human faces is holistic, as it has been proven experimentally. As a rule, a person perceives their surroundings, including people and other elements, simultaneously, which is the opposite of successive reproduction that characterizes the way an eyewitness is asked to report what they have seen [Bondarko, Shelepin, 1996; Budyakova, 2014]. According to the rules of identification procedure the eyewitness is asked to verbalize the identifying features, i.e. to compose the suspect's verbal portrait, before seeing the actual line-up.

Meanwhile, it has been quite long-established in juridical and psychological studies in the USA that in the psychology of suspect identification, *description accuracy* and *recognition accuracy* need to be clearly distinguished [Wolfskeil, 1984]. There is also evidence in the psychology of perception of the difference between the verbal portrait of a person and the accuracy of that individual's identification [Kitagami, Sato, Yoshikawa, 2002; Schooler, 2002]. In judicial practice cases quite often arise when a witness claims to be able to identify the person of interest, but finds it difficult to name that person's particular identifying features. Crime detection scientists and juridical psychologists have not yet reached a unanimous agreement on the reliability of such testimony [Gapanovich, 1979]. Russian lawmakers, however, have adopted the position of those researchers who are skeptical about the reliability of witness testimony where witnesses are unable to verbalize the suspect's identifying features.

Recapping the literature overview, it must be said that there is still a number of disputable points that need further research.

II. METHODOLOGY

2.1. Research Participants

Of a total of 180 participants, half took part in the first stage of the research, the other 90 in the second stage. Of the first stage participants, 30 were aged 18–20, another 30 were aged 21–40, and the other third group of 30 were over 40. To guarantee the accuracy and validity of the compared results, the participants of the second research stage were selected according to the same age quotas. As the research has not revealed any significant gender- or status-based correlation, we do not provide the subjects' gender and status data.

2.2. Research Method

The study was planned as an experiment.

2.3. Research Stages

The first stage took place in 2003, the second in 2015. The decision to set the two research stages apart in time was based on the idea that the 12-year time gap would considerably reduce the popularity of some of the people

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shown in the collages. The intention was to find out how face identification was affected by a decrease in a person's popularity.

2.4. The Research Hypotheses

1. The identification of familiar people and of those who a person knows considerably less well is based upon different psychological mechanisms. While identifying a familiar face, a person correlates the current image with the holistic memory-stored facial image, the latter being a specific configuration of a limited number of identifying features. While identifying someone the witness knows considerably less well, they only notice a limited number of identifying features that do not constitute any individual configuration.
2. Over time, one's memory-stored image becomes less distinctive, only preserving its typical identifying features but losing the specific configuration phenomenon.
3. A detailed verbal portrait may not correlate with the accuracy of identification.

2.5. Research Materials

Collages of famous people were Collage A: Leonardo DiCaprio; Collage B: Saddam Hussein; Collage C: Britney Spears; Collage D: Mireille Mathieu. The collages used in the research were published in newspaper *Komsomolskaya Pravda* in 2003. In the collages, the appearances of the featured people were changed by altering their hairstyles (both for men and women) and facial hair (for men). A hairstyle is typically the most important identifying element of suspects' verbal portraits, as well as a beard and/or moustache or their absence in men's portraits. This fact determined the choice of the research material.

2.6. Research Procedure

The research procedures both in 2003 and 2015 included three series.

Series 1: The subjects were asked to recognize people shown in the printed black-and-white collages. The aims of the first experimental series were: a) to define how changed hairstyle and facial hair affect identification accuracy; b) to define any other factors that influence face identification accuracy; c) to find out the psychological reasons for decreasing identification accuracy over time.

Series 2: The subjects were asked to recognize the same people in their regular photographs published in the mass media. The photographs we used were also printed black-and-white images. The aims of the second experimental series were: a) to define any other factors determining face identification accuracy; b) to find out the psychological reasons for decreasing identification accuracy over time.

Statistical analysis of the obtained data was carried out using Pearson's χ^2 criterion.

III. RESULTS

3.1. Results of the First Experimental Series

In the first experimental series the subjects had to identify four famous persons presented in the collages. They were Saddam Hussein, Britney Spears, Mireille Mathieu and Leonardo DiCaprio.

In 2003, the people shown in the collages were quite well-known because of extensive media coverage. In that year, the coalition forces invaded Iraq and thus made Saddam Hussein a highly recognizable figure. George W.

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Bush, who initiated the military operation in Iraq, was President of the USA at that time, so his portraits were also widely-known in the media. Photographs of Leonardo DiCaprio and Britney Spears were demonstrably popular in Russia, their photographs were often seen on the covers of school notebooks, bookmarks, calendars, etc.

The astonishing result of the 2003 experiment was that, in spite of the hairstyle changes made in collages, DiCaprio was recognized by 100% of the subjects. Britney Spears also had high recognition averages – 92% (see Table 1). Such results meant that a hairstyle was not a significant identifying feature for recognizing people shown in collages A and C.

The 2015 experiment showed decreased popularity these public figures. Britney Spears was recognized by 68% of the subjects and Leonardo DiCaprio by 98%. To find the statistically significant differences in the decrease of recognition accuracy (lower in 2015 as compared to 2003), we used Pearson's criterion (χ^2control < χ2experim; χ2experim = 49.03. χ2control =13.28, the point of significance p=0.05).

Saddam Hussein and Mireille Mathieu were not recognized, neither in 2003 nor in 2015 (series 1); none of the subjects identified either of them (100% recognition failures) (see Table 1). After losing the war, Saddam Hussein was hiding while being actively searched for, so the collage made in 2003 (collage B) suggested how he might have changed his appearance in order not to be recognized. The collage only showed a different hairstyle and hair color, but those were enough to make him totally unrecognizable for the experiment subjects. When asked about the nationality of the person in the collage, they would say: a Frenchman, an American, a Russian, an Englishman, a Pole, but never an Arab.

The results of the first experimental series showed that such a feature as hairstyle may both be a significant and insignificant for identification.

3.2. Results of the Second Experimental Series

In the second experimental series the subjects were asked to identify the same people, as featured in the first series of collages, but by looking at their real-life photographs (see photographs 1–4).

When they were shown the regular images of the famous people, almost all the subjects (about 100%) identified them correctly in 2003. The only exception to that nearly absolute identification correctness was Mireille Mathieu with 92%, which was still high, as she was rather popular in Russia in that period (see Table 2). The mistakes in identifying Mireille Mathieu arose from the fact that in the photographs she looked very young for her age (she was 57 in 2003), so, knowing Mireille Mathieu's actual age interfered with the subjects' recognition in the image shown. Using Pearson's criterion, we found the differences in the absolute value of the decrease in the recognition accuracy displayed in 2015 as compared to 2003 while recognizing the famous people by their regular photographs (χ2experim = 205.82; χ2control =13.28, χ2experim > χ2control, the point of significance p=0.05).

The outcome of the first stage of the experiment (series 1, 2003) allowed making the following conclusions. Changing hairstyle made it almost impossible to recognize only those people who were commonly recognized by their hairstyles. The fact that some people were unmistakably (almost 100%) recognized even despite having different hairstyles, made us suppose that their identification was based on some other identifying features.

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The second stage of the 2015 experiment (series 1–2) included some subjects who were 6 to 8 years old in 2003 (the first age group of the 2015 experiment subjects). They knew the people shown in the collages less well than their experiment peers back in 2003 as at that time (when they were 6–8 years old) they were not interested in politics, the mass media and popular art, which are typical interests of older age groups. It was this age group that showed the worst identification results, both in the collage and the regular photograph series (see Tables 3–6). Pearson's criterion indices show that the correlation between the subjects' age and the percentage of the depicted people's identification was most significant for the second 2015 experiment series (recognizing a person by a regular photograph): χ^2experim = 15.57; χ2control = 15.15; χ2experim > χ2control; the point of significance p=0.05.

The way this group memorized the experimental objects was specific, as the subjects were guided solely by the most general identifying features that did not reflect the identified persons' individuality. It referred to the identified people to a general group, such as being a blonde, a brunette, a younger/older person, etc.

In 2015, two other age groups also showed worse results as compared to those obtained in 2003. In 2003, memorizing the people presented in the collages was easy as they were frequently appearing in the media. Over time, a memory-stored holistic image of a person becomes average, only preserving its typical identifying features but losing the phenomenon of their specific configuration. We believe that the phenomenon of specific configuration of identifying features is a factor of identifying a person not only by their typical discrete identifying features, but also by their peculiar arrangement within a unity. This is what cases of misrecognition in our daily life seem to be based upon. A typical example of that is the following: walking in the street or being in any other place, a person thinks they see their acquaintance in a distance, but, on coming nearer, the person realizes that it is a different man/woman. Such mistakes arise from the fact that the person's recognition judgment is based just on perceiving the common, general features, which in reality proves wrong because their individual configuration turns out to be different. So, when a certain person no longer appears that much in the media, they not only become less recognizable by the public, but they also develop a different recognition mechanism. The public comes to identifying formerly famous people by one or two features that, in fact, can be commonly shared by hundreds of other people, which leads to identification errors. A very familiar face, on the contrary, is recognized not only by its individual distinctive features but by the specific configuration of the features as well. Losing it causes a holistic face image to become an average one, i.e. average/typical for a large group of people who have similar general features. This evidence is also supported by other studies. Maurer et al. [2002] described three stages of recognizing a face. The first stage is characterized by the general recognition of a stimulus and referring it to some larger group, in our particular case recognizing a certain stimulus as being a face. At the second stage a person distinguishes general identifying facial features, i.e. the nose, the eyes, etc. And it is only at the final stage that the mind forms and processes the information about the configuration of the identifying features. Apparently, over time the information received at the third recognition stage 'gets lost'.

IV. DISCUSSION

Moroshkina [2012] demonstrated that the principles of perception unity are also true for the perception of representations of the face. The researcher found that subjects perform equally well when recognizing a person by

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their whole-face and part-face photographs. The dominance of the unity phenomenon in face perception was also found in other studies. Our research experiment offers additional evidence that can further specify the existing data. It is true that some face features, for example, a moustache or a hairstyle, even viewed separately, enable a person who sees it to generate the whole image or to identify the person by the shown distinctive feature. Identification accuracy, however, depends on the degree of knowing the person whom the witness is going to identify, i.e. identification of familiar people follows different principles. In such cases the identifying features are perceived by the witness as being united into a specific configuration.

Our research showed that the impact that verbalization has on identification accuracy is not related to any of such factors as a subject's gender, social status or age. This is also confirmed by Brown and Lloyd-Jones [2008] who found that even the knowledge and the awareness of the verbalization phenomenon, which a special group of witnesses (for example, police officers) may have, still cannot neutralize its negative impact.

Studies of visual perception errors demonstrated that the most significant facial identifying element is the eyes. Panferov [1974], whose studies are more closely-related to our research topic, revealed the correlation between one's look in their eyes and the interpretation of their character, e.g. a haughty look means an arrogant person. Our study has experimentally proven that an integral indivisible sign of 'a look in the eyes' is an important face recognition criterion for people whose dominant perception type is holistic.

Hairstyle and hair color were the two main identification criteria that the subjects chose for identifying Mireille Mathieu and Saddam Hussein. According to the data reported by Gapanovic [1979], 50% of all forensic identification tasks are performed by recognizing the hairstyle. Perception psychology also produced some evidence that hairstyle is the most informative identifying feature [Panferov, 1974]. However, to become unusual or unique, hairstyle and hair color must at least possess the quality of being typical. The face of a person, however, becomes almost unrecognizable if their hairstyle changes, and our study proved this idea, too. For example, Saddam Hussein was generally recognized by his 'bright black hair' which made him look special among European leaders but typical among Arabs; Mireille Mathieu was recognized by her signature haircut, which she would not change for years and which, in turn, individualized her. It should be noted that the verbal portrait of Saddam Hussein, composed in 2003, was in fact very schematic, based on typical Arab features, thus rendering it of no use for Saddam Hussein's visual identification; the Iraqi leader eventually being identified by the tooth chart that had been impounded from his private dentist[1].

On the one hand, a limited number of identifying features enables quick recognition but, on the other, becomes the reason for misidentifying a particular person.

V. CONCLUSIONS

Familiar faces are identified by correlating the holistic memory-stored image, which is a specific configuration of a limited number of identifying features, with the image of current perception.

[1] How they identified Saddam Hussein. URL: http://www.1tv.ru/news/world/45300 (date of the application: 06.01. 2019).

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When identifying someone the witness does not know particularly well, one correlates a limited number of identifying features with the current perception image. These features do not constitute any united configuration, which leads to resemblance-based errors. The features that have not been changed for a long time become typical. Altering the features that a person used to be identified by makes that person almost unrecognizable.

Over time, the memory-stored image becomes average, only preserving its typical identifying features but losing their specific configuration phenomenon. This phenomenon is observed when due to different reasons we no longer see a familiar person often.

A detailed verbal portrait does not correlate with the accuracy of identification as, firstly, some witnesses is unable to describe the specific configuration of identifying features. Moreover, additional typical class-based features, that a particular person may not even have, get included into the verbal description (for example, such age signs as wrinkles, greying hair, etc.).

Identification accuracy can be affected by the witness's subjective attitudes.

Further studies of face identification errors should aim at revealing the psychological mechanisms that underlie the process of constructing a holistic image not only of an individual but of a personality as well.

Our study has some limitations as it was conducted with no special regard for the peculiarities of image perception which may be inherent in the representatives of different races and nationalities. All the subjects were Russian and Caucasian, hence we were unable to reveal any possible peculiarities of face perception that people of other races and nationalities may have. This aspect requires further investigation.

Table 1: Number/proportion of subjects who correctly identified the people shown in the collages in 2003 and 2015 (the first experimental series)

Collage	Number of subjects who recognized the person shown in the collage in 2003	Number of subjects who recognized the person shown in the collage in 2015	Σ
Collage A (Leonardo DiCaprio)	90 (100%)	88 (98%)	178
Collage B (Saddam Hussein)	0 (0%)	0 (0%)	0
Collage C (Britney Spears)	83 (95%)	61 (68%)	144
Collage D (Mireille Mathieu)	0 (0%)	0 (0%)	0
Σ	173	149	322
p	$p < 0.05$	$p < 0.05$	

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Table 2: Number/proportion of subjects who correctly identified the people shown in their regular photographs in 2003 and 2015 (the second experiment series)

Photograph	Number of subjects who recognized the person shown in a regular photograph in 2003	Number of subjects who recognized the person shown in a regular photograph in 2015	Σ
Photo 1 (Leonardo DiCaprio)	90 (100%)	90 (100%)	180
Photo 2 (Saddam Hussein)	90 (100%)	33 (37%)	123
Photo 3 (Britney Spears)	90 (100%)	53 (59%)	143
Photo 4 (Mireille Mathieu)	83 (92%)	38 (42%)	121
Σ	353	214	567
p	$p < 0.05$	$p < 0.05$	

Table 3: Number of subjects in each of the three age groups who correctly identified the people shown in the collages in 2003 (the first experimental series)

Collage	Group One (aged 18-24) (number of people)	Group Two (aged 25-40) (number of people)	Group Three (older than 40) (number of people)
Collage A (Leonardo DiCaprio)	30	30	30
Collage B (Saddam Hussein)	0	0	0
Collage C (Britney Spears)	30	27	26
Collage D (Mireille Mathieu)	0	0	0
p	$p < 0.05$	$p < 0.05$	$p < 0.05$

Table 4: Number of subjects in each of the three age groups who correctly identified the people shown in the collages in 2015 (the first experimental series)

Collage	Group One (aged 18-24) (number of people)	Group Two (aged 25-40) (number of people)	Group Three (older than 40) (number of people)
Collage A (Leonardo DiCaprio)	30	30	28
Collage B (Saddam Hussein)	0	0	0
Collage C (Britney Spears)	15	21	23
Collage D (Mireille Mathieu)	0	0	0
Σ	45	51	51
p	$p < 0.05$	$p < 0.05$	$p < 0.05$

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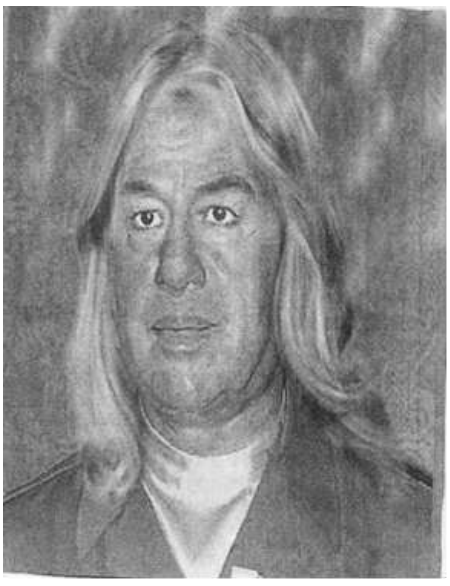
Table 5: Number of subjects in each of the three age groups who correctly identified the public figures by their regular photographs in 2003 (the second experimental series)

Photograph	Group One (aged 18-24) (number of people)	Group Two (aged 25-40) (number of people)	Group Three (older than 40) (number of people)
Photo 1 (Leonardo DiCaprio)	30	30	30
Photo 2 (Saddam Hussein)	30	30	30
Photo 3 (Britney Spears)	30	30	30
Photo 4 (Mireille Mathieu)	25	28	30
Σ	115	118	120
p	$p < 0.05$	$p < 0.05$	$p < 0.05$

Table 6: Number of subjects in each of the three age groups who correctly identified the public figures by their regular photographs in 2015 (the second experimental series)

Photograph	Group One (aged 18-24) (number of people)	Group Two (aged 25-40) (number of people)	Group Three (older than 40) (number of people)
Photo 1(Leonardo DiCaprio)	30	30	30
Photo 2 (Saddam Hussein)	5	12	16
Photo 3 (Britney Spears)	15	18	20
Photo 4 (Mireille Mathieu)	5	14	19
Σ	55	74	85
p	$p < 0.05$	$p < 0.05$	$p < 0.05$

Collage A (Leonardo DiCaprio)



Collage B (Saddam Hussein)

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Received: 20 Feb 2020 | Revised: 28 Feb 2020 | Accepted: 14 Mar 2020

Collage C (Britney Spears)

Collage D (Mireille Mathieu)

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