Identification of identical twins in police procedures

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Purpose:

The aim of the study was to review the treatment of identical twins in crimes and to determine to what extent people notice the switch of identities, to what extent they can distinguish between twins, and what factors are related to the ability to distinguish them.

Design/Methods/Approach:

We carried out an analysis of literature and a case review about identification of identical twins in police procedures and for the purpose of the article, an online survey was conducted among the general public.

Findings:

In line with existing research, the survey showed that age, but not gender or length of acquaintance, was related to the ability to distinguish between twins. The ability to distinguish between twins is positively correlated with the observation of confusion between them. Our survey of the public found that the most common indicators for distinguishing between identical twins were facial features, behavior, a distinctive voice, and recognizable accessories.

Research Limitations/Implications:

A review of the literature on the identification and treatment of twins in relation to criminality reveals several gaps in knowledge. More attention should thus be paid to the problem in the future, possibly to establish criteria for prosecution and to raise awareness that such deviant behavior can occur. In our research, we conducted survey among general public in the future maybe a survey of the experts should be conducted for more comprehensive view of the issue. Among the proposals for further research, it would be reasonable to consider the analysis of cases of identical twins in police practice.

Originality/Value:

In our own research, we examined the factors associated with identity swapping among identical twins.

Keywords: identical twins, distinction, identity switch, fraud

UDC: 343.525

Identifikacija enojajčnih dvojčkov v policijskih postopkih

Namen:

Namen prispevka je pregled obravnavanja enojajčnih dvojčkov pri kaznivih dejanjih in prikaz ugotovitev raziskave, v kolikšni meri ljudje opazijo zamenjavo identitete dvojčkov ter kateri dejavniki so povezani s sposobnostjo razlikovanja med njimi.

Metode:

Opravili smo analizo literature in pregled primerov o identifikaciji enojajčnih dvojčkov v policijskih postopkih, za namen prispevka pa smo izvedli tudi spletno anketo med širšo javnostjo.

Ugotovitve:

Ugotovili smo, da več kot polovica ljudi opaža zamenjavo identitete dvojčkov ter da je s sposobnostjo ločevanja med dvojčki povezana njihova starost, ne pa tudi trajanje poznanstva. Ravno sposobnost ločevanja med dvojčkoma je povezana z opažanjem zamenjave identitete, ne pa tudi spol dvojčkov. Raziskava je pokazala, da so najpogostejši identifikatorji razlikovanja med enojajčnimi dvojčki obrazne poteze, vedenje, značilen glas in drugi prepoznavni identifikatorji.

Omejitve/uporabnost raziskave:

Pregled literature o identifikaciji in obravnavi dvojčkov v povezavi s kaznivimi ravnanji razkriva več vrzeli v znanju. Problemu bi bilo zato treba v prihodnje posvetiti več pozornosti in morda vzpostaviti merila za pregon in ozaveščanje, da do tovrstnih deviantnih vedenj ne bi prišlo. V prihodnje bi bilo treba izvesti tudi raziskavo med strokovnjaki za bolj celovit pregled problematike.

Izvirnost/pomembnost prispevka:

V naši raziskavi smo preučili dejavnike, povezane z zamenjavo identitete med enojajčnimi dvojčki.

Ključne besede: enojajčni dvojčki, ločevanje, zamenjava identitete, goljufanje

UDK: 343.525

1 INTRODUCTION

The problem of swapping and subsequent identification of twins involved in crimes could become increasingly important. According to experts (Vošnjak, 2018), the number of twins has almost doubled in recent years. The reasons for this are the increasing number of fertility treatment users and the increasing age of mothers. With identical twins, there is the possibility of fraud to gain advantages or avoid penalties. An example of this type of cheating is when one of the twins has a driving licence and the other does not, but they both use the same one. Identical twins are difficult to prosecute because of their identical DNA and appearance, and because of the law in Slovenia on the protection of human

rights and fundamental freedoms. Various methods such as facial recognition, fingerprint and palmprint matching, voice recognition, handwriting and iris recognition can be used to separate twins (Informacijski pooblaščenec [IPRS], 2013).

The formation of identical and fraternal twins is influenced by various genetic and environmental factors. Identical twins occur in 3 to 4 cases per 1,000 births worldwide. Most cases of identical twins are not caused by genetic factors, although there are more cases of identical twins than usual in individual families (Spiro, 2015d).

The issue of swapping and treatment of identical twins in criminal proceedings is poorly researched. There is little literature on the subject in Slovenia and in wider Europe. There are also gaps on this topic in the Criminal Code (»Kazenski zakonik (KZ-1-UPB2)«, 2021) or other laws. In our research, we therefore want to find out whether identical twins swap their identity to gain an advantage or escape sanctions, and whether this is related to the gender of the twins. We are interested in whether the ability to separate twins is related to the length of time the observer has known them, or to the age of the twins and the observation of the identity switching itself. We would like to identify the most common indicators that can be used to distinguish between identical twins. To this end, a survey among the general public and an analysis of media articles reporting on the confusion of twins in criminal cases were conducted. Biometrics is a science that deals with identifying people by their unique personal characteristics. The most common biometric distinguishing feature is the fingerprint, a snapshot of the papillary lines of the finger, and others are the individual characteristics of the eye (iris and retina), DNA, face, ears, and characteristic posture (IPRS, 2013), but individuals can also be distinguished on the basis of other physiological or physical characteristics and biological processes (these can, for example, also be based on other physiological and biological characteristics, such as the distance between parts of the face, papillary lines on hands and feet, shape of auricles, smell, body shape, height and weight, hair colour, shoulder width, leg shape) and behavioural characteristics (such as the way a person moves, walks, his/her tone of voice) (Pogačnik, 2013).

Identical twins usually have very similar anatomy and appearance, but greater differences in appearance between them may also be the result of behavioural and epigenetic influences. Genetically, identical twins are identical – they have identical DNA because they are the result of the division of a single zygote (fertilised egg) at the beginning of pregnancy (after division, both fertilised eggs have identical DNA) (Juefei-Xu & Savvides, 2013). Biometric technology is known as a reliable and efficient identification and separation system, which is a product of technological development and represents a significant advance towards greater safety (Pogačnik, 2013).

With our research, we wanted to take a first step towards exploring the above-mentioned issues in order to draw attention to possible shortcomings in the police process and contribute to their elimination in practice. The aim of the work is to highlight and investigate the frequency of the confusion of identical twins in

various criminal proceedings, and the ability to distinguish identical twins in the general population.

2 DISTINCTION BETWEEN IDENTICAL TWINS

Biometric verification is an increasingly common method of identifying individuals in the context of public safety, enterprise systems, and consumer electronics. It is used to verify the authenticity of certain characteristics of a person. Biometric data is data that relates to a specific or at least identifiable person. Fingerprints, for example, always belong to a specific person. Biometric data is stored in a central database, which often depends on local data collection methods. Gillis et al. (n. d.) explains that the main purpose of biometrics is security. Biometric security is a security mechanism that authenticates a person and secures access to a system or facility. It assesses a person's biological data or physical characteristics and is seen as the most seamless and strongest security technique for verifying a person's identity (Gillis et al., n. d.). It is primarily used in environments where higher critical physical security is required, or that are vulnerable to potential identity theft. Biometric security systems use various immutable characteristics of the human body. The physical characteristics of each person are stored in the biometric security system and can only be viewed by authorised personnel. When a person wants to access the system or enter a facility, the biometric scanner reads and evaluates the person's physical characteristics and matches them with the data stored about them. If this data matches, the system allows the person to access the system or enter the building or premises (Rouse, 2016).

A very important feature of any biometric verification is its convenience, as users do not need a password or security token to use it. The components of any biometric device include a reader that verifies and records the presence of the biometric factor and software that converts the scanned biometric data into a standardised digital format and allows the comparison and matching of the captured data with the database where all biometric data is stored. A person is identifiable by means of an identification number or by means of one or more specific characteristics of their physiological and physical identity, the means of identification themselves being reasonably accessible not only to the controller but also to other persons.

Biometric data can also be used to distinguish between identical twins. For example, identical twins do not have identical fingerprints (Spiro, 2015a). While the correlation of whorls, loops, and ridges between identical twins is high, there are differences where skin ridges meet, branch or end. Spiro (2015a) attributes the differences in fingerprints of identical twins to the interaction of different genes in the developmental environment of the uterus. Fingerprints have an important genetic component, but they also reflect the non-genetic environment of early pregnancy, an important time for tissue differentiation and organogenesis. In fact, the embryo begins to develop fingerprint patterns in the first weeks of gestation (Tao et al., 2012), and fingerprints are permanently configured before the twentieth week of gestation.

In addition to fingerprints, twins can also be distinguished by voice recognition. However, previous research suggests that the error rate in automatic voice recognition is higher in identical twins than the general population. Armour et al. (2014) stated that identical twins have similar vocal frequencies because the gross anatomy of the larynx and vocal cords is genetically determined. Similarities in speech production may have both genetic and developmental components due to proximity in childhood. Therefore, we would predict that identical twins would be more difficult to distinguish from each other in an identical environment than unrelated individuals (Van Gysel et al., 2001).

Another of the biometric features used to verify identity is a person's handwriting. In addition to genetics and environment (Spiro, 2015c), several random factors influence a person's handwriting. Handedness, the tendency to write with the right or left hand, is genetically determined. Parents who are left-handed are more likely to have left-handed children. However, this is truer for siblings than identical twins. Many twins have opposite preferences for dominant use of a particular hand in writing.

Srinivas et al. (2012) found that of all the ways to distinguish identical twins through biometric recognition and discrimination, facial recognition has received the most attention. Facial markers and the use of facial regions that develop with the twins' age are the most commonly used. This is because identical twins can look increasingly different as they age, since they are exposed to a more diverse environment (Spiro, 2015b). The results of a study by Mahalingam and Ricanek (2022) suggest that it is easier to distinguish identical twins by parts of the face rather than by the whole face. This is independent of gender (i.e., it works almost equally well for men and women), but is related to age. Research has shown that facial recognition becomes easier as twins get older.

In the scientific literature, surprisingly little attention is paid to distinguishing identical twins with the naked eye. Given the results of biometric procedures for twin discrimination, we were interested in whether the distinguishing of twins is also possible with the naked eye, and whether it is related to the duration of acquaintance, age, and gender of the twins.

3 TWINS AND CRIMINAL TENDENCIES

The topic is situated in various aspects of criminology, of which the biological perspective is the most important. The differences in the propensity to crime between identical and fraternal twins have already been researched in detail (Criminal Justice, n. d.). One of the first twin studies to genetically determine criminality was conducted in the 1920s by Johannes Lange (1929). He studied 30 pairs of identical twins. He found that in 10 out of 13 pairs of twins, both twins were known criminals. Subsequently, extensive studies were carried out to investigate whether at least one of each pair of twins had committed a crime. In 1974, Karl O. Christiansen (1974) studied the criminal behaviour of 3,586 pairs of twins born in Denmark between 1881 and 1910. He found that the probability of one twin being a criminal when the other twin was a criminal was 50% for identical twin pairs, but only 20% for pairs of fraternal twins. The correlation between the genetic

proximity of biological relatedness and criminality was especially true for serious violent crimes and for longer criminal careers.

These findings were confirmed by the results of a study of twin criminality in the 1980s and 1990s by Rowe (1983). This study showed that identical twins were more likely to be involved in criminal activity than fraternal twins. In addition, identical twins reported more criminal peers than fraternal twins (Rowe, 1983). The work of Rowe and his colleagues supports the genetic component of criminality, but also provides evidence of a social component. Although twin studies have provided some evidence for a genetic component in behaviour, it is difficult to separate the influence of genetics from that of social factors. This conclusion was also reached by Adler et al. (1998), who found delinquency in 32% of identical twins and in 12% of fraternal twins. Christiansen (1977) complemented the biological (genetic) view of deviant behaviour with an explanation from a psychological and social perspective. Meško (2016) agreed, and explained that delinquency is not necessarily the result of a person's genetic predisposition, but can also simply be a disposition that develops in a certain environment.

The influence of the family on later criminality (due to the influence of parents on child development) still belong in the realm of heredity in relation to criminality, but it is important to complement them with a psychological view of criminology, where, for example, social learning theory assumes that criminality is learned. Through observation, individuals can shape their own behaviour by imitation and reducing inhibitions about criminal behaviour, and if the latter is encouraged and rewarded, the effect is all the greater. Learning of behaviour through observation, direct exposure and various incentives (such as approval of such behaviour) occurs through the processes of identification and socialisation. In this process, the child identifies with their parents and adopts moral and other norms from them (Meško, 2016).

There is also a theoretical problem with the assumption that twins who grow up in the same parental home are exposed to the same treatment and social environment. Even scientists who study the link between criminal behaviour and genetics are cautious in their conclusions, arguing that these types of studies only show that similarities between twins influence behaviour. Whether these similarities are genetic or social, or a combination of both, and which of these explanations (broader social aspects based on similarity and socialisation, or individual-centred biological explanations involving genetic and psychological aspects) has a greater influence, is still controversial (Criminal Justice, n. d.; Newburn, 2007).

Based on research findings, in our study we were interested in the extent to which crimes committed by identical twins were reported. To this end, we examined media coverage of the issue. Dealing with a crime committed by an identical twin is complicated by the strong resemblance and possible collusion between the twins (for reasons of protection or even intentional identity swapping). In this research we were therefore also interested in the extent to which the public observes identity swapping between twins to gain an advantage or avoid punishment, and whether the observed identity swapping between twins is in any way related to the gender of the twins.

4 METHODS

4.1 Data collection

To address the research objectives, an online survey was conducted. The survey was voluntary and anonymous. The sampling was non-random, more specifically snowball and purposive.

The questionnaire consisted of two parts. The first set of questions was related to information about knowing and being able to distinguish between identical twins, and what the respondents knew about identity swapping in this group. When filling out the survey, the respondents were asked to refer to the identical twins they knew best. In the questionnaire, we also wanted to know if the respondents had ever been able to distinguish identical twins, and what were the most common characteristics they used to identify or distinguish them. The ability to distinguish between identical twins and the observation of identity swapping between them were measured by replies to statements using a five-point Likert scale of agreement. The ability to distinguish between twins was measured using seven (7) statements, namely the extent to which the respondents were able to distinguish between identical twins based on different styles of dress, different hairstyles, differences in facial features, differences in the rest of the body, differences in behaviour, handwriting, and voice. Perceptions of identity swapping or confusion between identical twins were measured using four statements and a five-point Likert scale of agreement. The following statements were included: I have observed identical twins swapping identities (for example, at school during tests, social events, in a car); I have thought (suspected) that identical twins have swapped identities; I have heard that identical twins have swapped identities; and It is known that identical twins have swapped identities. The last section of the questionnaire collected demographic information.

4.2 Sample description

The sample comprised 223 respondents, of which women outnumbered men (there were 73.1% (163 respondents) women in the sample). Most (48.9%) of the respondents had a university degree (pre-Bologna and Bologna colleges and universities), while the fewest respondents had a PhD (1.3%). A total of 22.9% of respondents had completed secondary education, 13.9% of respondents had completed a pre-Bologna undergraduate degree or Bologna Master's degree, 9.4% had completed post-secondary education, and 3.6% had completed a master's degree.

The average age of respondents was 34.7 years with a standard deviation of 13.7 years. The minimum age was 18 years, and the oldest respondent was 66 years old at the time of the survey.

4.3 Statistical analysis

The validity of the measurements was checked by factor analysis, and the reliability by Cronbach's alpha. Factor analysis was performed using the principal axis method, applied separately for each set of statements on the ability to identify identical twins and on the observation of twin swapping. We calculated the composite variable as the average of the statements with high weights on each factor. Descriptive variables were represented by frequencies and proportions and numerical variables by the arithmetic mean and standard deviation. Chi-square test and multiple linear regression were used to test the hypotheses. All hypotheses were tested with a significance level of $\alpha = 0.05$.

A content analysis of news reports on the topic of fraud with identical twins was also conducted Newspaper and website articles on the topic of fraud with identical twins were reviewed. The articles were searched for in the Slovenian database of Google with the keywords *»enojajčni dvojčki, goljufanje, ločevanje, zamenjava identitet«*. We searched for data on such fraud abroad using the keywords *identical twins, fraud, separation, change of identity*. All the search results were examined and only those reporting the criminal act of identical twins and accompanying police procedures were included in the analysis. The analysis of the articles included information about the country and year in which the offence of the identical twins was committed, gender of the identical twins and the provability of the offence, and summarised the content of each case of the offence.

5 RESULTS

5.1 Recognition of identical twins

5.1.1 Validity and reliability of measurement

Factor analysis revealed that two factors could be identified: the ability to identify identical twins, measured by seven (7) statements on the Likert scale, and the observation of identity confusion, measured by four (4) statements on the Likert scale. Due to the small sample size, factor analysis was conducted separately for each set of statements. These statements were combined into two factors or composite variables that were averaged across the statements with high weights on each factor and used in the rest of the study.

The data on the first set of statements about the ability to distinguish between twins are suitable for factor analysis (KMO = 0.86; $\chi^2(21) = 937.2$; $p < 0.001$). All statements have a high weight (0.69–0.82) on a single factor explaining 63.6% of the variability of the measured variables. Reliability, as measured by Cronbach's alpha for the discrimination factor, is 0.90.

The KMO measure and Bartlett's test for sphericity indicate that the data related to the observation of identity confusion are suitable for factor analysis ($KMO = 0.75$, $\chi^2(3) = 620.7$; $p < 0.001$). Two statements are perfectly correlated (I suspect swapping and I notice swapping), so we include only one, I suspect confusion, in the analysis. All statements have a high weight on a factor (0.88–

0.94). The reliability of the measurement of the factor »I notice swapping« was 0.93.

5.1.2 Identical twins and how to distinguish between them

Respondents were mostly friends with identical twins (43%), followed by acquaintances (23.1%), and least likely »other« (7.3%) and (former) colleagues (2.7% of respondents). Under the option »other«, respondents named ex-friend, I am an identical twin, partner, neighbour, ex-boyfriend, teacher, child of an acquaintance, know from kindergarten, brother, father, and brother of a friend (two times each).

Table 1 shows that the average age of acquaintances of identical twins is 11.81 years, with a standard deviation of 9.42 years, and the average age of twins is 29.71 years, with a standard deviation of 13.69 years. Almost two thirds of the respondents know female identical twins (data not shown).

	Average value	Standard deviation
Years of acquaintance	11.81	9.42
Age of twin	29.71	13.69

Table 1: Years of acquaintance and age of twins (n = 221)

The survey found that the most common indicators for recognising identical twins are facial features, behaviour and voice, and distinctive accessories (Graph 1). Other possible identifiers include weight, tattoos, stature, different body sizes when standing together, different points on the hands, knowledge, scar, small mole on the face, and brow ridge injury or scar over the eye, and birthmarks. The average agreement on the ability to distinguish between twins (factor or composite variable) was 2.93 and the standard deviation was 0.96. The average on a five-point scale shows that respondents were quite uncertain about their ability to distinguish between identical twins.

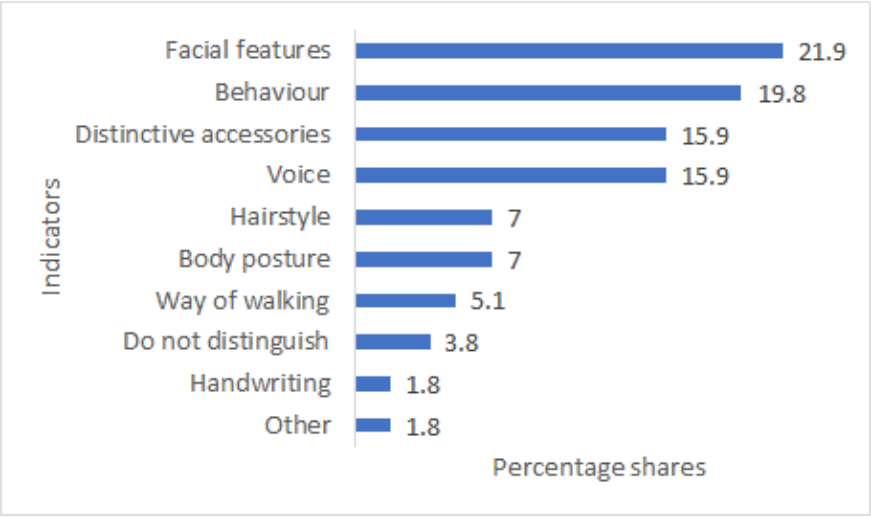

Figure 1: Identification indicators for identical twins (n = 221)

5.1.3 Factors associated with the identification of identical twins

Multiple linear regression was used to determine the relationship between length of acquaintance with identical twins, age of identical twins and ability to identify (distinguish) identical twins. The results of the regression analysis are shown in Table 2. The years of acquaintance are not statistically significantly related to the ability to distinguish between twins ($p = 0.32$). However, controlling for the length of acquaintance with identical twins, we find that there is a statistically significant relationship between the age of the twins and the ability to distinguish between them ($p < 0.001$). The positive value of the regression coefficient indicates that the older the twins, the greater their ability to distinguish between them.

Table 2: Correlation between the length of acquaintance, the age of the identical twins and the ability to distinguish between them ($n = 221$)

	Regression coefficient	Std. error	p
(Constant)	0.87	0.14	<0.001
Years of acquaintance	0.01	0.01	0.32
Age of twin	0.03	0.01	<0.001

$R^2 = 0.17$

5.1.4 Observation of swapping of identical twins and factors related to the observation of swapping

We were interested in the proportion of people who notice identity swapping between identical twins. We wanted to check whether more than half of the people noticed such a case with identical twins. The analysis included the statement »I have noticed identity swapping between identical twins«, where respondents were classified as not noticing if they chose the answer »I do not agree at all« and as noticing if they chose other answers on the agreement scale. We found that 73.5% of the respondents had noticed the swapping of identical twins. This proportion is statistically significantly different from 50% ($\chi 2$ (1) = 48.4; $p < 0.001$).

Observation of identity swapping (composite variable as the average of statements measuring observation of the swap) is not statistically significantly ($p = 0.66$) associated with twin gender (Table 3), but is statistically significantly associated with the ability to distinguish between twins ($p < 0.001$). Individuals who rated themselves as having a better ability to distinguish between twins also observed identity swapping to a greater extent.

Table 3: Relationship among gender, the ability to distinguish identical twins, and observation of identity swapping ($n = 221$)

	Regression coefficient	Std. error	p
(Constant)	0.86	0.17	<0.001
Male twins	0.05	0.10	0.66
Ability to distinguish	0.32	0.07	<0.001

$R^2 = 0.12$

5.2 Content analysis of the cases of fraud and dealing with criminal offences of identical twins

Table 4 shows some of the characteristics of the articles that reported on identity swapping between identical twins. Two of the articles were from Slovenia, and one each from Bosnia & Herzegovina, China, Sweden, and France. All articles discussed male twins, and only in two cases were the investigating authorities able to prove their guilt.

Table 4: Analysis of cases of fraud and the treatment of identical twin crimes in Slovenia and abroad (newspaper articles)

Country	Year of criminal activity (CA)	Form of CA	Gender of identical twins	Age of identical twins	CA has been proved / has not been proved
Slovenia	2011	Theft	Male	Unknown	Not proved
Slovenia	2005	Causing serious injury	Male	Unknown	Not proved
China	(year unknown, fraud lasted for 20 years)	Identification fraud (both twins used one driving licence)	Male	Unknown	Proved
Sweden	2012/2013	Suspicion of murder	Male	Unknown	Not proved
Bosnia & Herzegovina	2019	Suspicion of murder	Male	67	Not proved
France	2012/2013	Three rapes and three attempted rapes	Male	Unknown	Proved (one of the identical twins has confessed to the crimes, but it is not certain if he is the right offender, due to both men having the same DNA)

All these cases involved only the above-mentioned offences and not identity fraud. In Slovenia, two cases of offences involving one or both twins were reported. In the case of the trial of identical twins E.E: and A. E. they were charged with burglary and theft in a commercial building. The burglars were intercepted by police and then fled, leaving behind a car with several burglary tools. Forensic investigators found a biological trace in the perpetrator's car belonging to one of the twin brothers. The lawyers for the twin brothers claimed that criminal proceedings can only be initiated and carried out against a specific person, whereas in the brothers' case it is not known and cannot be established which of them is supposed to have left the biological traces. This is »an extremely unusual case arising from the fact that Alen and Edin Eljezi are identical twins who are believed to have identical STR profiles, i.e. repeating DNA strands« (Predanič, 2016). This case shows how complicated criminal proceedings can be when identical twins are in the dock. In Slovenia, we are also familiar with the case of the trial of an identical twin, the security guard B. L., who allegedly inflicted serious bodily harm to the head of a nightclub guest. Criminal proceedings have been initiated against Lesjak, who denies his guilt and claims that he was at another location on the night in questionand was not working at the club. On the day of the trial,

Boštjan's identical twin brother appeared in court instead of him and made a false statement. Forensic identification during the investigation revealed that the victim had identified Boštjan Lesjak as his attacker. The investigators did not find any DNA on the perpetrator that would have enabled a reliable identification in a conventional DNA analysis. However, experts consider DNA analysis of identical twins to be a grey area, as they have the same DNA profile. However, since the accused had an identical twin who looked very similar to him, it would also be difficult for the prosecution to gather enough evidence for a conviction, which in fact they failed to achieve in this case (Furlan Rus, 2014).

Examining data from around the world, we came across the case of the Yan identical twins in China, where the brothers held the same Class B driving licence for 20 years (A. P., 2019). In France, we came across the case of the Gomis trial against identical twin brothers who were convicted of several offences. They were charged with three counts of rape and three counts of attempted rape. Forensic experts did their best, but because the brothers had almost identical DNA the French police took them both into custody. The brothers were very close, lived in the same flat, wore the same clothes, used the same car and phone, and shared a Facebook profile. The rape victims were able to identify the perpetrator in court, but they were unable to identify the perpetrator or distinguish which of the brothers was the actual perpetrator. One witness identified Yoan as the perpetrator based on his type of speech. Meanwhile Elvin was released, as there was not enough evidence to convict him. After ten months in prison, Yoan broke down and regretted being the 'evil twin' and thus saving his brother (G. G., 2017).

In Sweden (Furlan Rus, 2019), there was a trial of identical twins who were in custody on suspicion of murder. Since they shared DNA it was not possible to identify them from the DNA traces found at the crime scene on a gun cartridge and on cigarette butts found in a jar in the murdered man's car. Since it was never discovered whose DNA was found, the pair of twins were never convicted. Moreover, if it was only one of the twins then clearly they cannot both be tried, because then one of them would be wrongly convicted. Elsewhere there are further cases of identical twins with identical DNA suspected of serious crimes. While researching newspaper articles, we also came across the case of the Stanković identical twins, who are on trial in Bosnia & Herzegovina for the murder of a dentist by shooting him in the chest. A DNA trace was found at the crime scene that is believed to belong to the killer. The trace matches the DNA profile of the arrested brothers. Since they are identical twins, and have the same DNA, it remained to be clarified which of them committed the crime. Dejan is suspected of being the murderer, but the investigation is still ongoing. Later in the court proceedings, the authorities could not prove the guilt of either one or the other of the identical twins (Milinković & Subota, 2015).

6 DISCUSSION

The cases of trials of identical twins show that there are repeated reports in the media about the confusion of male identical twins, and that both investigators and prosecutors face obstacles in establishing the identity of the perpetrator in

such cases. The problem here is because identical twins have identical DNA. However, there are certain techniques, such as biometrics, that make it possible to establish identity based on other characteristics. IPRS (2013) states that the most used biometric characteristics are fingerprints, DNA, iris and retina, ears, face and characteristic body posture. The characteristics of a person include physiological body features and behavioural traits such as movement, gait, eyes, and voice (Pogačnik, 2013). In the case of identical twins, it is impossible to determine the true identity of a person just by looking at a document, since they will have the same photo, same date of birth, and often the same residential address. The main challenge in face recognition for identical twins is to find an approach for feature extraction and to formulate the separation of identical twins in space. It is important to find out which facial components – such as the eye area, nose, or mouth – are the best distinguishing features. A study (Mahalingam & Ricanek, 2022) has shown that recognition performance based on eye area almost equals or even surpasses recognition performance based on the whole face.

Sharing the same DNA profile also makes it difficult for investigators to biometrically identify identical twins, as they usually only secure DNA traces at the crime scene. When investigating a single crime where the suspects could be identical twins, additional evidence and information must be gathered and the alibis of both twins must be verified. Only through comprehensive investigations is it possible to produce evidence that allows conclusions to be drawn as to which of the twins committed the crime.

When investigating a case where it is necessary to distinguish between two adult twins and to know who is responsible for the crime, the police must look for their fingerprints along with any scars, identifying marks or tattoos, in addition to observing the circumstances of the crime where both or at least one of the identical twins was present (Souza, n. d.).

Our survey of the public found that the most common indicators for distinguishing between identical twins were facial features, behaviour, a distinctive voice, and recognisable accessories. Other distinguishing features included differences in weight, which are usually evident in a difference in stature, and distinctions based on tattoos, different marks on the hands and face, and other signs. It is difficult to distinguish identical twins with the naked eye, as we have found in our own research. Our research has shown that the ability to distinguish between twins is related to the age of the twins, as in some other studies (Mahalingam & Ricanek, 2022), but not to the length of acquaintance. This is in contrast to some research suggesting that greater differences between twins occur in adulthood because they are exposed to a more diverse environment, as well as differences in twins' lifestyles, such as exercise, diet, smoking, alcohol consumption, employment, body size, presence of a spouse, and children (Spiro, 2015b). Siblings often start out with very similar personality traits and intelligence, but slowly drift apart over time. E. Turkheimer, , believes this is because small differences that occur early in life – perhaps due to a chance event or genetic change – somehow increase as we grow up (Hamilton, 2013). As an example, he cites identical twin girls, one of whom is slightly more extroverted than her sister due to a random event, which leads to her meeting different people, making

more extroverted friends and getting a different kind of partner to her sibling. The result is a feedback loop that continuously reinforces this personality trait, and possibly even generates new brain cells. Indeed, Turkheimer conducted a study on mice that showed how small changes in behaviour can lead to larger changes and, as a result, even change the brain (Hamilton, 2013).

In our own research, we examined the factors associated with identity swapping among identical twins. This was noted by more than half of the respondents in the survey, and the result could be generalised to the wider population. Identity confusion was not statistically significantly related to the gender of the twins, but it was related to the ability to tell them apart.

The work of Rowe et al. (1983) supports the genetic component of criminality, but also provides evidence of a social component (social factors) that is difficult to separate. Another study examining criminality among identical twin pairs of the same gender, found that in most cases both twins were known criminals (Lange, 1929). Subsequently, extensive studies were carried out to investigate whether at least one of each pair of twins had committed a crime. It was found that there was a 50% chance that one of the identical twins would get involved in criminal activity, when the other twin was already a criminal, and only 20% for fraternal twin pairs (Christiansen, 1974). The correlation between the genetic proximity of biological relatedness and criminality was especially true for serious violent crimes and for longer criminal careers.

A review of the literature on the identification and treatment of twins in relation to criminality reveals several gaps in knowledge. More attention should thus be paid to the problem in the future, possibly to establish criteria for prosecution and to raise awareness that such deviant behaviour can occur.

Women are now choosing to have children later and later in life, leading to increased use of artificial insemination and higher numbers of identical twins (Spiro, 2015d). Identical twins often exploit their similarity for various purposes, including avoiding punishment. A police officer establishes a person's identity with authority and under certain conditions, and to exercise the power of identification, the police officer must assess whether any grounds for suspicion exist. Based on our research, we conclude that swapping of identity by identical twins in relation to police procedures should be regulated by law. For example, a note could be included in a driving licence stating that the person has an identical twin, as in the case of needing to wearing glasses, which would make it mandatory to identify the person by taking a fingerprint. It would be possible to use an application that scans the fingerprint to identify the person's data and verify the match with the ID document. This would help to identify and distinguish identical twins in police procedures, especially for traffic police better and more easily. This would prevent police officers from being held criminally responsible for improperly conducted procedures resulting from fraud by identical twins. In the future, it would be useful to extend this research to other areas of police investigations, especially criminal investigations where only DNA traces are available, if that. The denial of both identical twins can leave the case open, so the very consideration of this issue would help ensure that proper DNA and other identification would bring the real perpetrators of such crimes to justice.

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