universität wien

Diplomarbeit

Titel der Arbeit

Austria's „Who's Who?"

Exploring representations of famous faces in an Austrian student sample – a quantitative approach

Autorin

Johanna Palcu

Angestrebter akademischer Grad

Magister der Naturwissenschaften (Mag. rer. nat.)

Wien, im November 2011

Studienkennzahl: 298

Studienrichtung: Psychologie

Betreuer: Univ.-Prof. Dr. Helmut Leder

Not only in the course of this work, but also throughout the whole length of my study, I have been accompanied and supported by my parents, my partner in life and my friends, who always gave me guidance, strength and good advice.

They were my critics when it was necessary and my pillar of strength when I needed it the most. For this I would like to thank them sincerely.

Last but not least, I would also like to acknowledge my supervisor, Professor Dr. Helmut Leder for his support, patience and advice and for always leaving me the freedom to express my own ideas.

Thank you!

Table of content

It is the common wonder of all men, how among so many millions of faces, there should be
Thomas Browne

1 Introduction

There is probably no object in our environment that is of greater biological and social importance than the human face. A person's face provides information about his or her gender, age, ethnicity, cultural background, health or emotional state. It allows judgments about a person's identity and socioeconomic status, facilitates and conveys social interactions and forms the foundation for our liking judgments and contact or avoidance decisions. There is reason to assume, that no other objects are judged as frequently as are faces, which are habitually categorized as being "attractive", "ugly", "nice", "friendly", "grim", "old", "young" etc. Moreover our language offers distinct vocabulary items for describing the different features of a face in detail (e.g. "hooked nose"; Bruce & Young, 1998, p.151) Faces therefore seem to be objects we considerably tend to devote our attention to, in order to read the versatile messages they transmit.

Beside its significance, the human face is also found to be among the more complex stimuli to be processed in every-day life. Imagine that with each dimension an object of a category can differ in, its recognition becomes more and more complicated. Faces with their many dimensions therefore form an extremely complex set of features (nose, ear, moth, eyebrows, chin etc.), becoming even more complex considering the different arrangements they can form. Nevertheless, the human brain is capable of recognizing and identifying a great amount of faces under changing conditions, such as different light conditions, expressions or after changes in appearance (e.g., new haircut, glasses etc.) or age (e.g., Bruce, Burton, & Craw, 1992).

In view of the great importance of faces as a source of information, it can be expected that mechanisms for accurate processing of facial information have evolved early in evolution. The amount of individual identities our early ancestors had to recognize was, however, confined to the few people who were sharing ones

tribe or who were part of neighboring populations. But as evolution has advanced the background of human's social interaction and communication has changed. Nowadays, especially in modern western societies, the shared social community does not only consist of our family or "tribe", as it used to do thousands of years ago, but has been extensively widened, not least due to the ongoing globalization and the novel means of global communication and socialization. Every day, we encounter hundreds of different people - on our way to work, in the bus or metro, when shopping in a supermarket, when eating at a restaurant or simply when walking down the street. In the year 2010, there were 8,387,742 people living in Austria, with an estimated increase to 8,993,464 inhabitants by the year 2030 (Statistic Austria). In 2009, 1,692,067 people, that is, 20.23% of the total population lived in the capital Vienna alone (Statistic Austria). However, our contact to other individuals is not limited to our daily face-to-face contact, but is also crucially influenced by the modern communication media. When we turn on the television or open the newspaper, we face people we have become familiar with by following up their stories and reported life events, without ever really meeting them in person. The total number of famous people we are confronted with seems endless. It is not surprising, then, that the Austrian publisher Hübner is releasing a list of biographies of important Austrian people ("Who is Who") in annual intervals in order to keep up with the growing number of people who gain fame through e.g. media and newspaper reports.

Previous research has mainly concentrated on the processes (the *how*) underlying the storage and recognition of facial and identity information. Although researchers often argue, that we are capable of memorizing "hundreds, if not thousands" (O'Toole, 2011, p.15; Gordon & Tanaka, 2011, p.884) or even a "virtually unlimited number" (Haxby, Hoffman, & Gobbini, 2000, p. 223) of previously seen faces, up to now there have been no specifications what the actual number of stored faces might be. Therefore, the aim of the present work is to provide a first quantitative approach to face representations of human faces in the context of our changing social environment. Although, faces are found to be recognized fast (e.g. Carey, 1992) and accurately (e.g. Bruce, Doyle, Dench, & Burton, 1991) the question of how many of the faces we daily encounter are actually stored has, to my knowledge, not yet been approached empirically. How many faces are represented in our memory? And what

effects could our changing social environment have on the type and number of face representations in human memory? More specifically, do people who belong to a rather homogenous group (e.g. students) differ in the amount and type of faces they know?

Results are discussed in the context of early and present scientific findings and ideas for future research are formulated. Moreover, with respect to the various studies using familiar faces to assess the processes underlying face perception and recognition, the difference between familiar and unfamiliar faces is being discussed and norms for the use of celebrity faces are provided for future research.

Man's face as a rule says more, and more interesting things, than his mouth, for it is a compendium of everything his mouth will ever say, in that it is the monogram of all this man's thoughts and aspirations.

Arthur Schopenhauer

2 Theoretical Background

In order to understand how people's perception of human faces is influenced by their changing social environment, it is important to first get a better insight into the significance of face processing and recognition and its underlying mechanisms.

The significance of facial stimuli is based on both, our exceptional ability to process them and the power of attraction they possess. Therefore, the first questions that need to be answered are, why faces represent a visual structure receiving enhanced processing and how we are capable of evaluating such complex objects under differing conditions. Secondly, a widely accepted model of face processing and recognition and its extensions are presented. Finally, the processing of familiar faces compared to unfamiliar faces is being discussed, completing the theoretical framework, which is necessary to understand why human faces are structures that can be assumed to form stable representations in our memory.

2.1 A developmental approach to face recognition – from early childhood to adult expertise

2.1.1 Developmental studies in newborns

Research on the development of facial processing skills has been motivated by the question of whether adult face perception abilities mostly derive from ontogeny (experience-based development) or phylogeny (evolutionary adaptation) (Johnson, 2011). Do we possess an innate ability to process and recognize faces or do we develop these skills as an active response to our environment?

Results on the processing of faces or face-like stimuli in early childhood have been inconsistent. While some researchers point out that infants are born with a natural interest for face-like compared to non-face patterns (e.g. Fantz, 1963; Goren, Sarty,

& Wu, 1975; Johnson, Dziurawiec, Ellis and Morton, 1991), other studies indicate that a robust ability to process faces is first found at a later stage, at approximately two months of age (e.g. Maurer & Barrera, 1981). Goren et al. (1974), for instance, tested their assumption that humans have an inborn ability to perceive faces differently from other objects, by presenting face- like stimuli and scrambled face stimuli to newborns with a median age of 9 minutes. Measuring the newborn's eye movements and the degree to which they turned their heads toward the presented stimuli, they found that infants showed a greater interest for face-like patterns compared to patterns that didn't resemble human faces. Since then, these findings were repeatedly replicated. According to contrasting studies, however, the reason for an early preference for face-like patterns is rather perceived to lie in the characteristics and configurations of the presented stimuli (*structural hypothesis*) or the newborns' sensory preferences (*sensory hypothesis*; for an overview see: Johnson, 2011; Johnson, Grossman, & Farroni 2008), than in an inborn face perception mechanism.

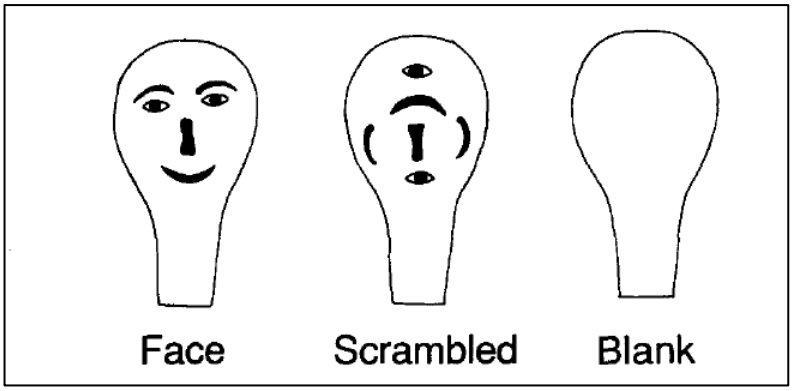

Figure 2.1. Face-like and non-face stimuli used by Johnson et al. (1991). Newborns showed a greater interest for face-like patterns (left) compared to scrambled-face (middle) or non-face patterns (right).

In attempt to resolve the conflicting results of previous studies, Morton and Johnson (1991) provided an alternative model discriminating between two different devices that play an important role in face perception of early infancy. Whereas the CONSPEC mechanism, which is available directly after birth, provides first structural information on human faces, the CONLEARN mechanism, which replaces the CONSPEC device at about 2 months of age, enables the child to gain new information

about facial features and their typical characteristics. While the first mechanism (CONSPEC) predicts that ‘‘infants possess some information about the structural characteristics of faces from birth’’ (Morton & Johnson, 1991, p. 164), the latter improves through exchange with perceived faces and their attributes.

Neonates’ preference for facial stimuli was also observed with regards to their interaction with real faces. At approximately 4 days after birth for instance, children devote more attention to their mother’s face than to a stranger’s face (Bushnell, Sai, & Mullin, 1989). Moreover, Bushnell (2001) found that this preference required only a short exposure time (max. 5.5 hours) to develop and was not impacted by a 15-minute delay of presentation of the mother’s face. These results provide evidence, that children are already able to form stable representations of familiar faces shortly after birth. A logical explanation for this instance intuitively crosses one’s mind. As newborns are in need of protection, they might have formed the adaptive ability to recognize their caretakers and detect important signs of affection very rapidly in order to insure their survival (Nelson, 2001).

Regardless of the inconsistencies mentioned above, research on face processing in infancy shows that, even if the ability to process faces might not be existent directly after birth, it emerges early in life and improves dramatically between the age of 4 and adolescence in terms of both, its behavioral and its neural aspects (e.g., Bruce et al., 2000; Carey & Diamond, 1977; Chung, & Thomson, 1995; Jeffery & Rhodes, 2011; Leder, Schwarzer, & Langton, 2003; Nelson, 2001). Bruce et al. (2000), for example, systematically examined face processing and identification skills in children between the age of 4 and 10. They found a rapid increase in different facets of the children’s face processing abilities (e.g., face identification, expression reading, gaze processing, lip-reading abilities).

The developmental period of face processing skills in early adolescence is of particular interest, because it represents a phase in which children are increasingly exposed to new faces, making the development of a special face and identity processing mechanism very likely. However, some researchers have argued that the improvement of face processing skills is not experience-driven, but may rather be connected to a general improvement of visual and memory mechanisms (e.g., Mondloch, Maurer, & Ahola, 2006).

Returning to the initial question, whether the ability to process faces is inherent or obtained during an active engagement with the environment, the answer can, in my opinion, be best approached by taking into account aspects of both perspectives. It seems most likely, that humans are born with a special face processing ability, enabling them to interact with their social environment, consequently improving this ability very rapidly up to an adult level of expertise in face perception and identification.

2.1.2 Humans as "face experts"

The previous chapter has demonstrated that children develop exceptional face processing skills allowing them to become real experts in face perception and identification in adulthood. Researchers from various disciplines have long been concentrating on generating technical and computational devices that are able to copy this capability (for an overview see: Smeets, Claes, Vandermeulen, & Clement, 2010; Zhao, Chellappa, Phillips, & Rosenfeld, 2003). Up to now, the challenge of matching the human expertise in face processing was not completely resolved. Adult face expertise seems to incorporate a specialization and consistency automatic face recognition devices are only able to reproduce or optimize, if the conditions the faces are presented in are optimal (e.g. Burton, Miller, Bruce, Hancock, & Henderson. 2001). But in a real-world experience with faces this is seldom the case.

As Bruce, Burton and Craw (1992) noted, our "everyday task of face recognition involves the retrieval of identity-specific semantic codes from faces that vary from moment to moment (as lighting or expression change), from day to day (as health, haircut or cosmetics change) or from year to year (as age changes)" (Bruce et al., 1992, p. 121). Moreover, in real life, faces represent visual structures that are usually in motion and perceived from varying viewpoints, in changing contexts, or with differences in quality. In fact, several studies have succeeded in demonstrating the efficiency of human face processing, even under differing conditions (c.f. Bruce & Young, 1998). Burton, Wilson, Cowan, & Bruce (1999) for example, found that participants were able to recognize familiar faces from security device images regardless of their poor quality.

The fact that we are able to identify familiar faces despite the varying conditions they are perceived in, shows that the human visual ability to comprehend and identify facial stimuli is amazing, yet it seems to work automatically and effortless. Imagine you meet an old classmate you haven't seen for a few years. Although you might not immediately remember the name, you normally get an instant feeling of knowing the person usually accompanied by a spontaneous recall of other information, like, for instance, the context you know him from or the people you are both connected to. According to Carey (1992) it takes only 0.5 seconds to identify a familiar face. Moreover, adults are particularly good at memorizing new faces from briefly depicted pictures (e.g. 50 pictures shown for 5 seconds each), notwithstanding the high complexity of faces and the subtle differences between different facial features. Additionally, Bahrick, Bahrick and Wittlinger (1975) found that adults were able to recognize and name former classmates from presented yearbook pictures with an accuracy of 90% after 15 years. And what is even more surprising, participants still succeeded in recognizing 60% of the presented faces after almost 50 years, this indicating that adults are still able to access faces that have once been stored as being familiar, even after a very long period of time.

But why do we become such experts and what are the mechanisms underlying our face expertise?

2.2 Are faces „special“ objects?

Discussions on the origin and nature of a human face processing expertise are mainly based on the question, whether faces represent a special category of objects that requires an alternate processing mechanism compared to other object categories. As Schwaninger, Carbon and Leder (2003) wrote:

> Everyday object recognition is often a matter of discriminating between quite heterogeneous object classes that differ with regard to their global shape, parts and other distinctive features such as color or texture. In contrast, face recognition relies on the discrimination of examples of a very homogenous category (p. 92).

If faces are special objects, than they should be perceived and processed differently.

Biederman and Kalocsai (1998) discussed several behavioral and neuronal differences between face and object recognition, some of which are subsequently reviewed taking additional and more recent results into account.

2.2.1 Behavioral differences between face and object recognition

Behavioral evidence on an experience-routed expertise for human faces mainly comes from various studies on the processing of configural face information, as well as on the perception of inverted faces.

2.2.1.1 Configural effects and holistic face processing:

Imagine you have to select a specific object, like a car model, for instance, out of a category of structurally similar objects (set of cars). According to Biederman’s recognition-by-components-theory (1987), we tend to segment objects into simple geometric parts (e.g., cones, wedges etc.) in order to be able to recognize them properly. Finding a certain car model in a group of cars would therefore require a segmentation and comparison of single features in order to detect the differences that distinguish between objects of a defined object category. With faces, however, this has not been found to be the case.

Several researchers have argued that configural information, that is, the spatial relationship between different parts or features of the face (e.g. distances between the eyes), plays an important role in the visual representation of faces but not in that of other objects (e.g., Diamond & Carey, 1986; Maurer, LeGrand, & Mondloch, 2002; Tanaka & Farah, 1993). In an early attempt to define the different information types used to discriminate between individual faces and objects of other object classes (e.g., landscapes) Diamond and Carey (1986) differentiated between *first-order* and *second-order relational properties*. First-order relational properties refer to the differences "in the spatial relations among similar parts" (p. 110), like for instance, the distance between a tree seen in the foreground and the mountains seen in the background of a landscape. These relations can differ considerably between members of the same object class. In the particular case of faces, however, these relations are rather constrained. It is conceivable that all members of this "special" object class share the same configuration, showing only subtle differences in the relations between individual parts of the face, referred to as second-order relational properties. The latter seem to play an important role in face, but not in object recognition.

Configural processing of facial features is contrasted with a face processing based on single components or features (Maurer et al. 2002). Whereas the ability to recognize non-face objects (e.g., a house) is likely to benefit from an isolation of distinct features (e.g. large baroque windows), faces are more likely to be perceived as a whole, making the extraction of subtle differences in feature configurations possible. As an extension to the distinction proposed by Diamond and Carey (1986), Maurer et al. (2002) divided the configural processing of facial stimuli into three processes:

(1) A face is recognized for being a face, because a common arrangement of the facial features is detected (position of eyes over nose, over mouth; sensitivity to *first-order relations*).

(2) The distinct features are combined to form a gestalt (*holistic processing*).

(3) The relations among individual facial features are observed (sensitivity to *second-order relations*).

Moreover, they argue that all three processes play an equally important role in the recognition of human faces.

The fact that first-order information of facial stimuli is of great importance in face perception has been discussed in chapter 1.1 with reference to newborn's ability to detect face-like stimuli directly after birth (for an overview, see: Johnson, 2008; Johnson et al., 2011).

The holistic processing of faces as compared to non-face objects and the superiority of configural information over information derived from isolated facial features has previously been examined by Tanakah and Farah (1993). If a single part of an object is processed individually, it should be easily recognized as being a part of that stimulus, even if it is presented in isolation from its usual context. Conversely, assuming that faces are processed holistically, the recognition of a facial feature should be facilitated when it is displayed as part of the whole face. Tanaka and Farah (1993) tested these predictions, by asking their subjects to memorize either intact or scrambled faces, consisting of displaced facial features (Figure 2.2).

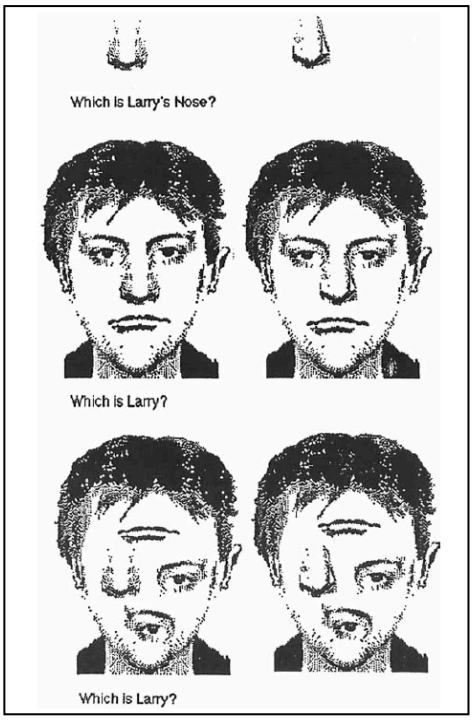

Figure 2.2. Examples of the test items used by Tanaka and Farah (1993). From top to bottom: isolated features, intact faces, differing in one feature (here: nose) and scrambled faces. Features were recognized best, when presented as part of a previously learned face (middle).

Participants were then either requested to identify which isolated facial component (e.g. a nose) belonged to a previously studied face ("Which is Larry's nose?"), or to select the face that has earlier been learned out of two presented faces ("Which is Larry"), respectively. Under the assumption, that face perception and recognition are based on a rather holistic representation of faces as wholes, it can be expected that recognition performance should be better if features are shown as part of a corresponding face relative to an isolated presentation. This should not be the case for scrambled faces, as these are not regarded as being "real" faces. Consistently, facial components were recognized best, when they were imbedded in a previously learned face.

As mentioned above, a still ongoing debate in research on holistic and configural face perception pertains to the question, whether it is based on a special face processing mechanism, which is exclusively limited to human faces, or whether it can be applied to other object groups a person might gain expertise with (e.g., Diamond & Carey, 1986; Gauthier & Tarr, 2002; McKone, Kanwisher, & Duchaine, 2007; Tanaka & Farah, 1993; Wong, Palmeri, & Gauthier, 2009). If the latter is true, than expertise with non-face stimuli should yield similar results. Moreover, training participants to discriminate between other, non-face objects that belong to a homogenous object group should lead to a more holistic processing of these objects, as well. This assumption has been previously confirmed with natural stimuli (e.g. cars; Gauthier, Curran, Curby, & Collins 2003) and even artificial objects (e.g., "greebles"; Gauthier & Tarr, 2002) that share similar properties. In a recent study, Wong et al. (2009) trained participants to individuate artificially generated 3D-objects ("ziggerins") differing in style, shape, aspect ratios, and size. They found that sensitivity to configural information depended on the type of training participants underwent. Sensitivity to configural information was only found following an *individuation training* (where subjects were told to name, verify and match the depicted objects), but not after a *categorization training* (where objects had to be assigned to one of six categories). The results indicate that holistic processing develops as a response to the requirements demanded by a specific object class.

The question about whether holistic processing of configural information is exclusively confined to face perception is still widely discussed. Nevertheless, Richler, Cheung and Gauthier (2011) recently demonstrated that holistic processing directly predicts face recognition abilities as measured with the Cambridge Face Memory Test (CMFT; Duchaine & Nakayama, 2006), thus emphasizing the important role it plays in the perception of human faces.

2.2.1.2 Inverting objects vs. inverting faces

If face perception, relative to the perception of other objects, is characterized by a holistic processing of feature configurations, than faces should be more susceptible to changes in spatial orientations.

In an attempt to provide evidence, that face inversion is the result of a disruption of a rather configural processing of facial components, Leder and Bruce (2000) found that inversion-effects mainly occurred when relations between facial elements were changed, but not when local facial features, like the color of the eyes, were altered. Also, Leder, Candrian, Huber and Bruce (2001) demonstrated that the sensitivity to changes in feature relations (e.g. interocular distance) is strongly impaired for inverted faces and that these configurations are processed rather locally, independently from other available features.

Face inversion effects might provide evidence for both, a human face expertise and a face-specific processing mechanism.

As previously discussed, humans specialize in their ability to process other people's faces as a result of their interaction with their environment. However this increase in face processing abilities is done at the expense of its flexibility (*schema hypothesis*; Goldstein & Chance, 1980). Consistent with this hypothesis, Carey and Diamond (1977) previously found that children under 10 years of age were able to remember inverted faces almost as well as faces that were shown in an upright orientation, but for adults it is particularly hard to identify faces that are presented in an upside-down position. As Diamond and Carey (1986) showed, this effect does not occur for the processing of other object categories. Face inversion was found to have an effect on the recognition of human faces, but not on that of dogs. For dog experts, however, this difference disappeared. With growing face expertise the perceptual system

underlying the processing of human faces (and other object categories?) seems to become more narrowed.

Assuming that faces and objects are processed on the basis of different mechanisms, Haxby et al. (1999) found that perception of an inverted face is accompanied by an increase in the activity of brain regions that are normally responsible for the processing of non-face objects. Though activation in face-selective areas like the lateral fusiform gyrus and superior temporal sulcus was still present, the results indicate that object-specific mechanisms were added to facilitate the recognition of inverted faces.

But do object and face recognition actually differ in their underlying neural mechanisms?

2.2.2 Neuronal differences between face and object recognition

Knowledge about the neural mechanisms of face recognition is of particular interest, since it can be expected that our brain has evolved as a constant adaptation to the requirements of our surroundings. If a specialized face-specific system exists in the human brain, than this would constitute another argument for the exceptionally significant role human faces play in everyday life.

The neural systems that mediate the recognition of human faces and their location in the human brain are still controversially discussed. Acknowledged approaches are subsequently presented, including evidence that comes from the analysis of patients that show a clinical impairment to recognize and identify individual faces.

2.2.2.1 What we learn from selective impairments in face recognition

A possible approach to detect differences in the neural systems underlying face compared to object perception and recognition is to observe patients with a naturally occurring brain damage involving a selective disability to recognize familiar faces but not other objects.

Conditions characterized by an inability to visually recognize objects after focal brain damage are termed *agnosia.* Prosopagnosia represents a special form of associative agnosia limited to human faces. More precisely, it can be described as "the inability to recognize faces despite intact intellectual functioning and even

apparently intact visual recognition of most other stimuli" (Farah, 2004, p. 92). However, prosopagnosia does not affect the processing of first-order information, that is, the categorization of a perceived object or pattern as being a face (Damasio, Tranel, & Damasio, 1990), nor the recognition of a person on the basis of his voice or a verbal description (Kanwisher & Yovel, 2006). Moreover, patients with prosopagnosia show an intact ability to judge other people's sex, gender or basic expressions. Observed impairments are rather limited to the detection of individual differences between faces, leading to the inability to judge a face as being familiar (Damasio, et al. 1990; Farah, 2004).

An early experimental approach to demonstrate the face specificity of visual impairments in prosopagnosia was provided by McNeil and Warrington (1993; as cited in Farah, 2004). They assessed recognition abilities of a patient suffering from prosopagnosia as compared to those of healthy subjects, using faces and sheep as stimuli to be recognized. McNeil and Warrington found that, while for normal subjects face recognition was easier to achieve than sheep recognition, for the prosopagnostic patient this was not the case. Being a sheep farmer, he was able to recognize a great part of the presented sheep, though face recognition capabilities were severely diminished.

The fact that face recognition can be selectively damaged, leaving the recognition of other object classes unaffected points to the existence of specific face-responsive brain regions.

2.2.2.2 Neural systems associated with face recognition and identification

In fact, many researchers have aimed to discover the secrets that lie within the neuronal pathways of face perception and recognition. With the possibility to rely on functional brain imaging as new methodological approach, this attempt has led to a large number of results, some of which are discussed here.

Showing pictures of human faces to their subjects under functional magnetic resonance imaging (fMRI), Kanwisher, McDermott and Chun (1997) were able to detect an area in the fusiform gyrus that responded solely to faces, even when those were varied in viewpoint or color, but not to other objects, consequently termed

fusiform face area (see also Kanwisher & Yovel, 2006; McCarthy, Puce, Gore, & Allison, 1997).

Haxby, Hoffman and Gobbini (2000, 2002) proposed a more complex system of neural responses to human faces based on the functional model of face recognition suggested by Bruce and Young (1986). In addition to a core system, which is found to be active during the perception of invariant as well as changeable aspects of faces, like facial expressions, eye gaze or identity-specific face characteristics, Haxby et al. (2000, 2002) suggested an extended system, which is thought to be involved in the retrieval of biographical information, attention direction, speech perception, as well as the activation of emotions related to the person to be recognized. The particular neural pathways that are expected to constitute these systems are displayed in Figure 2.3.

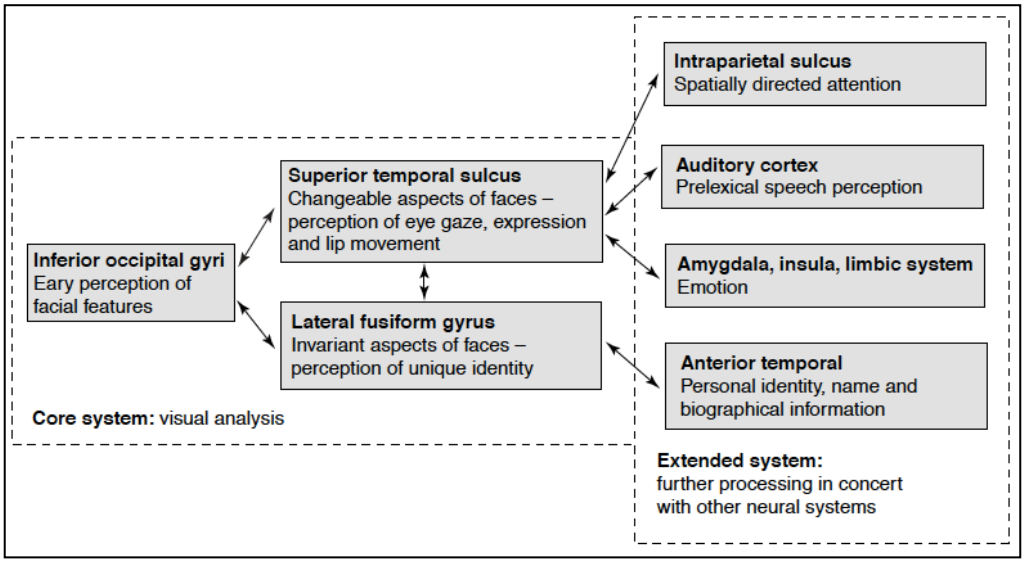

Figure 2.3. Neural systems involved in human face perception (Haxby et al., 2000)

As will be discussed later in this work, face perception and especially face recognition in the case of familiar faces are ultimately based on more than just the mere perception of a visual stimulus. Considering, that the recognition of individual faces and the interpretation of the messages faces express is an important part of our daily social interaction, it can expected that our responses to an individual's face include emotional as well as attributional aspects that guide our reaction and behavior toward that particular person.

Recently O'Toole and Natu (2011) provided an overview of the neural areas that have been previously suggested to be active during familiar relative to unfamiliar face perception. Distinguishing between neural systems that respond to unfamiliar, personally and visually familiar, as well as famous faces, they come to the conclusion, that a clear identification of face-specific neural mechanisms is particularly difficult. The ways in which we become familiar with individual faces are versatile. Therefore, the neural activities observed during face perception might be critically influenced by the stimuli presented and the situation they are perceived in.

2.2.3 Special attention for faces – Why we are attracted to facial stimuli

The previous chapters have addressed the subject of face perception and identification primarily focusing on the structural characteristics of human faces and the mechanisms we have developed as a response to them. The social significance of facial stimuli and the messages they convey has remained unconsidered up to this point.

2.2.3.1 Social significance of human faces

Thinking of the structural similarities between individual faces and the frequency with which they are processed in everyday life, it is not surprising that we readily tend to perceive facial patterns in everyday objects, as soon as they resemble the first-order relations of human faces (two eyes over a nose, both positioned over the mouth; c.f. Carbon, 2002; Little, Jones, & DeBruine, 2011; Figure 2.4).

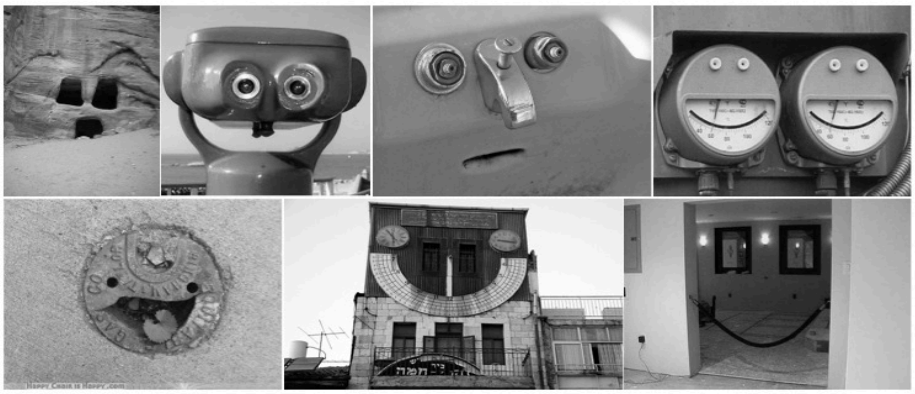

Figure 2.4. Facial structures in everyday objects. (google search result on "faces in objects", retrieved 28.10.2011).

The reason for human's special attraction to face-specific structures might be a result of the signal function faces have adopted throughout evolution. According to Zebrowitz's (2011) ecological approach, the function of our perceptual system is "to guide actions that serve to solve specific adaptive problems or to facilitate other goal attainments of individuals (p.32)". Faces convey a great number of socially important messages that we are supposed to read in order to be able to communicate with our social environment. A person's face is the first and most obvious information that is available in a first encounter. Furthermore, it can be acquired rapidly, allowing us to draw some initial conclusions about individuals we perceive for the first time (Little et al. , 2011).

Socially relevant information that can be extracted from human faces relates to a person's sex, age and race, as well as his or her attractiveness (for an overview, see Rhodes, 2006) and emotional state (for an overview, see Ekman & Rosenberg, 2005). Because research on each of these (rather complex) aspects has lead to a broad number of results, there is unfortunately no room in this work for a detailed description. Further deliberations therefore concentrate on the ability of human faces to capture our attentional resources.

2.2.3.2 The role of attention in human face processing

Considering, that the capacity of the human perceptual system is rather limited, it may be presumed that attentional resources are primarily allocated to those objects that are of particular interest. Therefore, the level of sensitivity for facial stimuli is likely to be higher than that for other, more irrelevant objects (Palermo & Rhodes, 2007). In fact, evidence has shown that we are attracted by facial stimuli even when we do not actively turn our attention to them. Bindemann, Burton, Hooge, Jenkins, and DeHaan (2005) tested a possible attention retention bias for faces, that is, the assumption that faces draw substantially more attention to their selves than differing objects, by adopting a simple go/no go classification task. Subjects were asked to make speed judgments on the orientation of a line target presented on the left or right of a screen and to ignore distracting stimuli (faces, inverted faces or fruits), which were displayed in the center. If faces served as distractors, reaction times were significantly increased compared to an interference produced by inverted faces or fruits, irrespective of whether familiar or unfamiliar faces were

used. Similarly, Jenkins, Lavie and Driver (2003) found that participants were able to accurately remember task-irrelevant distractor faces, but only if the overall cognitive load produced by the respective task was low. However, Bindemann, Burton, & Jenkins (2005) demonstrated that distractor effects occurred especially when both, the presented target and the interfering distractor were faces, indicating that face processing capacity may be limited to the processing of a single face at one time.

Previous findings have yield strong support to the notion that we not only devote our attention preferentially to human faces, but we often do this unconsciously and in a very rapid and mandatory way (for an overview, see Palermo & Rhodes, 2007). Still, the resources we invest in face processing might depend on the particular task requirements (e.g. cognitive load), the type of facial information encoded (e.g. facial expression, identity), and individual differences (e.g. level of anxiety).

2.3 A functional model of face processing

In 1986, Bruce and Young proposed a first functional model of face processing attempting to explain the recognition of familiar faces and the cognitive and perceptual processes underlying it. Their original model is of great significance because it provided a first theoretical basis for the early empirical attempts to understand, how human faces are perceived, stored and recognized. The postulated processes and components are still widely accepted and, since its publication, this theoretical framework has motivated a large body of empirical research.

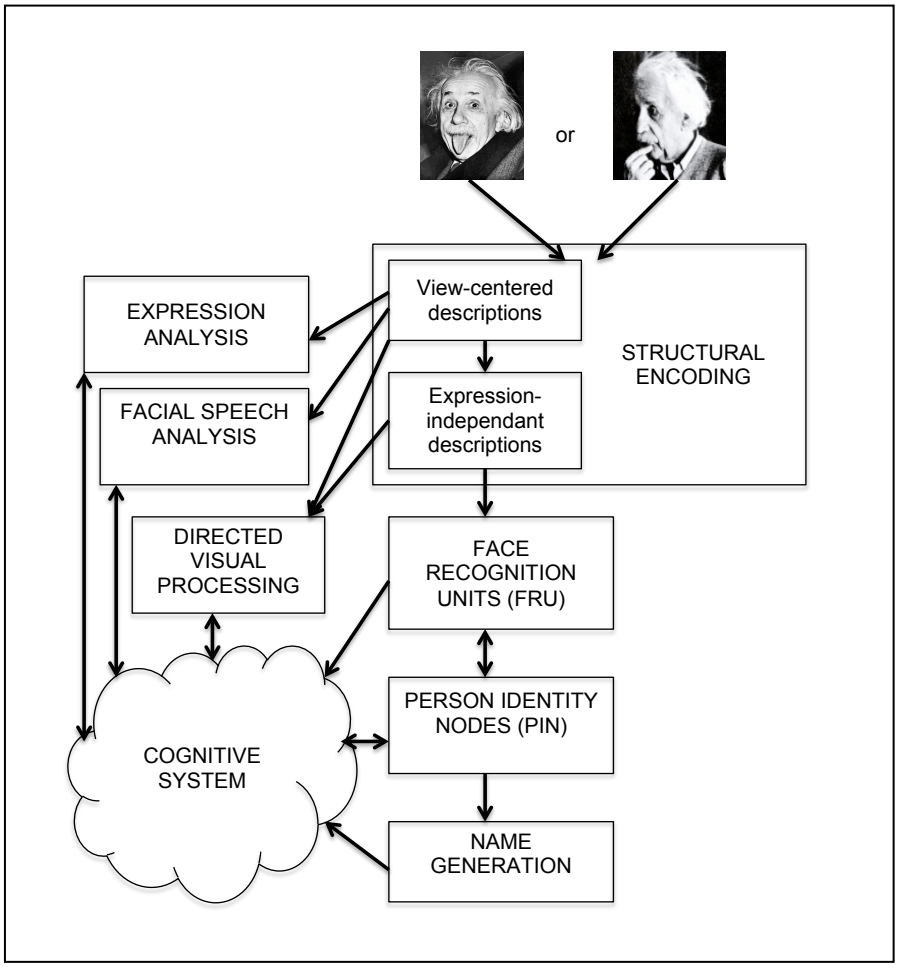

Figure 2.5. A functional model of face recognition (adapted from Bruce & Young, 1986)

The following chapter focuses on the originally suggested model and its functional components, which are displayed in Figure 2.5. This early postulated model is furthermore complemented by recent considerations and suggestions for future research (Young & Bruce, 2011).

2.3.1 The original model: Understanding face recognition

Let's assume we are looking at a picture showing the face of a well-known celebrity, like Albert Einstein for instance. What visual information do we extract and how is it stored in our memory? And more important, how do we access this information at a later point in order to recognize individuals that are familiar to us?

2.3.1.1 Types of information involved in human face processing

According to Bruce and Young (1986) there are seven types of information *codes* that can be visually extracted from human faces.

A first glance at the photography of a face generates a *pictorial code*, representing an integration of first visual information, like the color, orientation, the quality or first static expressions of the depicted face. This pictorial code can probably be best compared to a mental "screen shot" of a perceived picture that is likely to be part of the visual perception of any pattern or picture. However, this basic-level of information does not account for the human ability to recognize faces despite changes in viewpoint, age, lighting etc.

Therefore, a more abstract form of visual information, termed *structural code* needs to be extracted. Structural codes are expected to moderate the recognition of familiar faces by providing facial information necessary to discriminate between different identities. In terms of the nature of structural codes Bruce and Young argue, based on the computational 3D-model proposed by Marr (1982), that the encoding of familiar faces is characterized by an interlinked set of codes, consisting of configural information related to the whole face on the one hand, and rather detail-specific feature information on the other hand. Moreover, for the recognition of familiar faces, this stored set of structural codes is expected to contain separate expression-independent representations of different head angles, allowing it to compare an actually processed face code with information that has been obtained in previous situations. Considering that in everyday life faces are seldom viewed from only one angle and under stable conditions, these expression-independent representations are an essential precondition for face recognition.

Beside the types of information that are important for the recognition and discrimination of familiar faces, there is also individually distinct information that

can be obtained from unfamiliar faces, Bruce and Young refer to as *visually derived semantic codes*. These codes are formed very rapidly, creating a first visually derived semantic impression of a person that can be used to remember faces that are unfamiliar at first. We are able, for instance, to judge a person's age and sex or to attribute certain properties to unfamiliar individuals (e.g. intelligence, sincerity) on the basis of distinct facial characteristics.

In contrast, semantic knowledge about a familiar person, like his or her usual social network, family background or occupation is stored in form of *identity-specific semantic codes*. Whereas visually derived semantic codes are mainly based on physical information derived from the human face (How does the person look like?), identity-specific semantic codes shape the identity of a person going beyond his or her appearance (Who is this person?). This relationship can be best compared to "the relationship which holds between the semantics of a word in relation to its spelling (Bruce & Young, p. 309)." According to Bruce and Young, the feeling of knowing a person is largely based on identity-specific semantic codes. Also, the difference between face and object recognition lies within these identity-specific semantic codes. Whereas object classification can be simply achieved on a visual basis (e.g., discriminating an apple from a pear), for reliable person distinction additional semantic information is needed. Distinguishing between a schoolteacher and an investment banker is not possible merely on the basis of their appearance.

Attaching a name to a familiar individual is enabled through a separate *name code*. As semantic knowledge about an individual is of greater significance for social interaction than an uninformative name code, it is assumed that this is formed earlier in the processing of a person's identity.

Finally, Bruce and Young describe two forms of information that are important for the interaction with others, rather than for their recognition. They consist of instant view-centered descriptions, which are formed and continuously restructured during an early visual processing of human faces. The first refers to the perception of facial shapes and features *(expression codes*) allowing us to read and interpret the numerous messages faces can transmit. The second consists of representations of lip and tongue movements that are perceived during speech (*facial speech code*). Both components play a role in familiar and unfamiliar face processing.

2.3.1.2 Functional components involved in human face processing

The way, in which the types of information codes described above are thought to interact, forming the basis for human face recognition is depicted in Figure 2.5. Returning to the example of Albert Einstein, viewing a picture of this familiar face first produces structural codes that can include view-centered descriptions, like information about face expressions (e.g. outstretched tongue) or analyses of facial speech, or more abstract expression-independent descriptions. The latter contain information necessary to activate so-called *face recognition units* (FRU's). Bruce and Young assume that each face recognition unit includes a representation of the face of a familiar person. The greater the similarity between the actually perceived structural code and the corresponding face descriptions stored in a certain face recognition unit, the stronger the signal send to the cognitive system underlying face recognition. Moreover, a face recognition unit can activate a specific *person identity node* (PIN's), which contains semantic associations for each person, providing the basis for his or her identification. Seeing the face of Albert Einstein, for instance, might activate a specific face recognition unit to the extent to which it represents previously stored pictures of him, as well as biographical information about him being a scientist and the originator of the theory of relativity. The assignment of a proper name to the perceived face is the last step to be accessed in person identification. Bruce and Young strictly discriminate between face and person recognition. Whereas the first can be affected by a lack of facial cues or certain face recognition impairments (e.g. prosopagnosia), the latter can still remain intact (e.g. recognizing a person by recognizing his or her voice).

The main function of the cognitive system underlying face recognition is to provide episodic and associative information which can be accessed through the just mentioned face, person identity and name units, as well as to selectively direct a persons attention to important distinctive features of faces to be recognized, termed as *directed visual processing*. Finding Albert Einstein's face under a number of presented faces might involve a selective attention for individually distinct features, which can support an accurate recognition.

Bruce and Young originally suggested that face recognition units (FRU's), person identity nodes (PIN's) and name codes are activated sequentially. Furthermore, name retrieval is not a necessary condition for person recognition.

2.3.2 Recent extensions: Understanding person perception

Recently, 25 years after the publication of the above described functional face recognition model, Young and Bruce (2011) provided a new view on their originally proposed model. While they emphasize and still acknowledge the broad perspective they used in describing face recognition and its relation to other functions of face perception, they admit that specific components (e.g. emotion recognition, eye gaze perception, interrelations between different social cues in face perception) were considered rather insufficiently.

According to the authors, future attempts must point at integrating face perception and recognition in a more general understanding of person perception. This requires a multimodal approach, considering an interaction of face perception with other socially significant signals, like body language, personal voice or emotion recognition. Moreover, Young and Bruce claim that face recognition and perception are not based on a static system that can be expected to be common to all people or to remain constant over time. Therefore, individual differences in face processing operations, as well as long-term changes in adulthood should be considered in future research.

2.4 The processing of familiar vs. unfamiliar faces

The superiority of face recognition compared to object recognition that has been discussed in the course of this work is considered to be moderated by the familiarity with a presented face. Whereas recognition of familiar faces has been found to work accurately and effortless despite changes in situational (e.g. light, viewpoint) as well as internal factors (e.g. expression, age, changes in appearance), recognition abilities for unfamiliar faces have proven to be rather poor (Hancock, Bruce, & Burton, 2000). But especially the latter has gained increased attention in the context of identity proofs and eyewitness testimony (Jenkins & Burton, 2011). Though matching a person's face to an ID photo is a routine task performed by security personnel and police officers on a day-to-day basis, identification performance was found to be highly inaccurate. Considering that eyewitness judgments additionally include the retrieval of images from memory, identifying previously perceived suspects at a later point in time has turned out to be even more inaccurate. Errors in face identification and the reliance on eyewitness testimonies have caused severe problems for legal processes. However, the commonly accepted assumption that people are able to remember even subtle aspects of faces that have been perceived only once, has often been shown to be wrong (Jenkins & Burton, 2011). Bruce et al. (1999), for example, demonstrated in four experiments how changes in viewpoint, expression or picture quality, may influence people's recognition and identification abilities. When participants were asked to indicate, whether a presented array of faces included a face depicted above, recognition judgments were strongly susceptible to modest changes in viewpoint, lighting or expression. The same was true when short video sequences of unfamiliar faces were shown, even when participants were free to decide how long they wanted to view the presented images. Moreover, performance was worst when only internal or external features of a certain face were presented. As has been noted earlier, recognition performance for famous faces was found to be much more accurate (Burton et al., 1999).

Consistently, Bruce and Young (1986) argued that information codes used for the recognition of familiar faces are qualitatively different to those active in unfamiliar face recognition. They differentiate between the components and processes that play a role in the comparison and the memory for unfamiliar faces (e.g. pictorial

codes, directed visual processing), and those that are used to identify familiar individuals (e.g. structural codes, face recognition units). In their view, familiar faces are mainly processed on the basis of structural codes, which are thought to be composed of abstracted face representations that have been formed and refined during several encounters with a specific face.

Johnston and Edmonds (2009) suggest that familiarity vs. unfamiliarity with a person is a matter of quantitative, as well as qualitative differences in the way a person is recognized. Whereas quantitative differences depend on the frequency with which a face has been encountered in various situations, qualitative differences reflect the kind of representations we form as a result of our experience with familiar and unfamiliar faces. Additionally, they provide a summary of the factors that were found to positively and negatively affect face recognition performance for familiar and unfamiliar faces in previous experimental tasks (Figure 2.6).

	Hurt		*Help*	
Manipulation	*Unfamiliar*	*Familiar*	*Unfamiliar*	*Familiar*
View	✓	×	–	–
Expression	✓	×	–	–
Context	✓	×	–	–
Lighting	✓	✓	–	–
Negation	✓	✓	–	–
Inversion	✓	✓	–	–
Movement	–	–	✓	✓
Distinctiveness	–	–	✓	✓
Caricaturing	–	–	×	✓
Salience of internal features	–	–	×	✓

Figure 2.6. Factors that can positively or negatively affect familiar and unfamiliar face perception (Johnston & Edmonds, 2009)

As has already been noted in chapter 2.2., differences in the processing of familiar compared to unfamiliar faces have also been found with regards to the brain activity accompanying their perception. When we met somebody we personally know, we are also interested in his mental and emotional state. Moreover we retrieve knowledge about his or her personal traits and background, as well as our previous experiences with that particular person. It is conceivable then, that familiar face recognition is likely to incorporate neural processes that are qualitatively and quantitatively different from those used in unfamiliar person perception. Indeed,

previous research has found that familiar face processing was accompanied by an increased activation especially in the amygdala, which is involved in emotion processing, as well as in the medial frontal cortex, which plays an important role in social behavior (for an overview, see Natu & O'Toole, 2011).

2.4.1 Stable face representations for familiar individuals

According to Burton, Jenkins and Schweinberger (2011), the newly emerged possibility to apply brain-imaging techniques in order to detect the neural pathways of face perception and recognition, has lead to a shift of attention away from the question of *what* aspects are represented in human face recognition toward an attempt to describe the processes (*how*) underlying it. But if we manage to understand what kinds of representations of a person's face are build up in memory, we might be able to draw conclusions about the way in which we achieve our ability to correctly recognize familiar faces.

The question that follows the previous deliberations on the processing of human faces is how differing images of a person are integrated and represented in memory to form a stable foundation for person recognition and identification.

With their postulation of face recognition units (FRU's), Bruce and Young (1986) made a first attempt to explain how information derived from human faces might lead to abstract, view-invariant representations of faces in memory. With increased familiarization, these stored representations become less constrained by different face images of one person and less susceptible to changes in light, expression, viewpoint, age etc. and identification becomes more reliant on structural codes than on pictorial codes. But how is this transition from unfamiliarity to familiarity achieved? Is familiarization a quantitative or rather a qualitative process? More precisely, do we increase the number of stored face images related to a particular individual or do we steadily improve an existing representation of this person's face?

Jenkins and Burton (2011) propose that the formation of stable face representation involves the averaging of facial images of a particular person. An example of face averaging from 14 pictures, partially differing in image-capture conditions (e.g.

lighting), as well as in person characteristics (e.g. age, haircut), is presented in Figure 2.7.

Familiarization with a face is achieved through a continual refinement of an average representation, shaped by each new visual experience with the respective person. With increased familiarity (and increased abstractedness), information, that is of no relevance for the identification process is eliminated from a person's face representation and identification becomes less image bound. Hence, comparing a picture with an increasingly averaged representation becomes easier, as similarity is expected to be higher (Jenkins & Burton, 2008, 2011).

Figure 2.7. Pictures of Mike Burton differing in image-capture conditions (e.g. lighting), as well as in person characteristics (e.g. age, haircut) with averaged picture in the center.

Jenkins and Burton (2008, 2011) provided evidence for this account, by demonstrating that the accuracy of automatic face-processing devices was dramatically improved when a previously unseen picture was compared to an averaged version of the same face. Moreover, the more pictures were incorporated to build the average, the higher the improvement in face recognition ability was.

2.4.2 Being famous as a special form of being familiar?

The previous chapter provides an overview of the differences in the recognition of unfamiliar compared to personally familiar faces. Considering that in our everyday life, media are among the most significant sources we retrieve our information from, a special form of familiarity needs to be acknowledged here, namely the familiarity with faces that are famous to the broad majority of the population.

Because familiarity with famous faces can be expected to incorporate visual as well as semantic long-term memory factors (Natu & O'Toole), one might argue that the recognition of famous faces is not qualitatively different from the recognition of personally familiar faces. However, although both, famous and personally familiar faces are learned as a result of frequent visual encounter with a respective individual, familiarity with famous faces is mostly acquired from pictures or through the media. What effects could this lack of personal encounter have on the way they are represented in our memory?

One possibility is that famous faces are stored on the basis of a specific, most common representation that is tied to the particular person. Although Jenkins and Burton(2011) state that familiarity with a person and the increased averageness linked to it leads to an elimination of features that are irrelevant for face identification from mental representations, for famous faces this might be different. Let's assume, for instance, that Marilyn Monroe would have changed her hairstyle (an external feature that is rather variable and therefore less important for recognition), would she still be recognized as accurately as before?

In fact, Carbon (2008) showed that recognition performance for famous faces was highly affected when slightly changed versions of a celebrity were used in a recognition task. The reason for this might lie in the fact that famous faces are likely to be processed on the basis of an *iconic representation* corresponding to the picture a famous individual is associated with most strongly.

I always have trouble remembering three things: faces, names, and - I can't remember what the third thing is.

Fred Allen

3 Empirical Studies

3.1 Relevance of the present study

The previous chapters aimed at describing why facial stimuli are important social cues, we preferably devote our attention to and how we have developed special mechanisms making us able to adjust to the visual and cognitive requirements faces impose. Though researchers still argue about whether faces represent a special object category, they mostly agree in the fact that faces are objects of study deserving special consideration. It is not surprising then that a large body of research has addressed the topic of face perception, recognition and identification using methodologically different approaches to understand the processes that are active when we perceive, store and retrieve information about human faces that are or are not familiar to us. Most of these attempts start with the assumption that humans are capable of memorizing hundreds, thousands or even an unlimited number of previously encountered faces. But up to now an actual estimation of the number of faces that are represented in memory has not been made.

The best way to approach this topic is to explore face representations for a class of faces that are likely to be familiar to a large part of a particular culture, namely famous faces. Famous faces are probably most suited to assess face representations, because it can be expected that individuals are able to judge quickly and intuitively if a face corresponding to a specific celebrity is represented in memory.

Following previous considerations of stable face representations (see chapter 2.4.), this work is mainly concentrated on assessing the way in which famous faces are represented in memory, but not, as has been previously suggested from a qualitative, but rather from a quantitative perspective. Because the main focus of this study does not lie on a qualitative description of face representations, the just

mentioned restrictions for the processing of famous faces proposed by Carbon (2008) do not play an important role for the present work. The question of interest is how many face representations are build up in memory, considering the amount of faces we perceive everyday and not how these representations might actually look like.

Another aspect that needs to be taken into consideration is the influence our changing social environment might have on the type, as well as the number of faces we successfully generate stable representations of. The fact that we see hundreds of faces every day, some even repeatedly, must have an effect on the face representations we form. The question addressed here is how this effect might reveal itself in the context of our globalized and media-dependent world.

Finally, a third aim of this work is to provide representation likeliness norms for future research on face recognition. The likeliness that a face representation of a specific face is existent in memory might be equivalent to the familiarity with the respective face. As has been stated above, familiarity plays an important role for our ability to readily recognize other people's faces. But up to now, familiarity has mostly been treated as a dichotomous category, describing individuals as being exclusively familiar/famous or exclusively unfamiliar. With this study a degree for familiarity for each individual is offered, facilitating future research on familiarity, as well as the transition from unfamiliarity to familiarity in face recognition. Surprisingly, only few researchers have attempted to collect norms for different types faces (e.g. Bonin, Perret, Méot, Ferrand, & Mermilot, 2008; Minear & Park, 2004; Smith-Spark, Valentine, & Sherman, 2006). However, determining the degree of knowledge for famous names and faces might help to control for variations in recognition performances caused by different degrees of familiarity in future research.

3.2 Generating first hypotheses: The Glasgow Face List[1]

The idea for the present work was initiated by an attempt to quantitatively approach face representation for famous faces recently made at the University of Glasgow (Jenkins, unpublished work).

In the course of several weeks, Jenkins and his colleges collected the names of celebrities that were expected to be famous in Great Britain. This list, consisting of 3436 names of British and worldwide celebrities has found its way to Vienna. In an attempt to provide a cultural comparison for famous face representations, it was presented to 9 students at the University of Vienna, asking them to judge, for each name, if a face corresponding to the particular name could be visualized.

Because of the small sample size, the results were not interpreted in detail. They rather served as an impulse guiding the observations of the present work. Therefore, only a short summary is given here.

For the 3436 names presented, an average of 538 faces (SD=138) could be visualized. Given that the majority of the offered names were those of British politicians, royals, athletes, TV stars etc., this number cannot be interpreted as an individual ability to form face representations of famous faces that are (or were) frequently perceived. It suggests, however, that Austrian students might be able to recognize 16 percent of the faces that are highly familiar in a culture different from their own. Surprisingly, all participants commonly visualized the faces of only 118 celebrities, the majority of which were movie stars (52%), musicians (23%), politicians (12%) or athletes (7%). However, by including the faces that were visualized by 80% or more of the participants, this number increased dramatically to 284 shared face representations. Considering that mean imagination rates for all presented names were 538, this number seems quite high. It indicates that individuals having the same cultural background share the majority of the famous faces they represent in memory.

However, many of the faces people from Great Britain consider familiar are likely to be unknown in our society and vice versa.

---

[1] Results presented in agreement with Rob Jenkins, University of Glasgow

[2] In this work, the originally proposes category *comics* (Bonin et al., 2008) is replaced with the

With regards to our knowledge of famous faces that don't belong to our cultural area, two effects are conceivable: Either only few people know them, because their visual appearance is mainly limited to the country they come from, or they are familiar to a great majority of people, because they are likely to be famous worldwide. This might explain why the intersection of face knowledge found in the Glasgow Face List was relatively high, just as the number of faces that were not familiar to any of the participants (65.90%).

But what happens, when the names that are presented belong to individuals that are perceived to be famous in our own culture?

3.3 Research Hypotheses

For individuals that are considered famous in our society, differences in familiarity and therefore in the likeliness of face representations should be much more differentiated than has been observed in the Glasgow Face List. Considering the amount and the variety of famous faces we perceive every day, the following hypotheses can be formulated:

H1: Individuals are able to process an extensive number of previously encountered faces.

H2: The type and number of famous faces that are represented in memory depend on the categories celebrities are linked to, and, as can be derived from it, on the frequency with which they are likely to be perceived.

However, because people differ in the type of faces they preferably devote their attention to, it can be expected that:

H3: Individuals, though belonging to the same social and culture group, share only a small amount of mental representations of famous faces.

Moreover, although this work is largely concentrating on providing a quantitative approach to face representations, there is at least one qualitative aspect that can additionally be explored. Following Carbon's (2008) considerations on the iconic processing of famous faces, it can be anticipated that some famous faces contain very striking internal, as well as external facial features, generating a corresponding mental image even if it is unlikely that it represents an accurate reflection of an actual person (e.g. Jesus, Cleopatra, Cesar). This special class of famous faces is subsequently referred to as faces with a high *iconic potential*.

H4: Faces with a high iconic potential are likely to generate mental representations, even if these representations are not based on an actual facial image of that person, but rather on an iconic version of it.

3.4 Is asking for familiarity without visual presentation appropriate?

The most simple way to explore face representations for famous faces is to ask participants whether they can build up a mental image of a face when presented a particular name. One might argue that participant's statements that they are able to visualize a face must not necessary reflect an actual representation of this face in memory. However, previous research has suggested that mental images can elicit similar mechanisms that are active in the visual processing of physically present stimuli, though activation was found to be lower for imagery compared to actual perception (O'Craven & Kanwisher, 2000). It can be expected that asking participants to visualize a face should correspond to a retrieval of a visual representation from memory. The difference might be a quantitative rather than a qualitative one.

Another aspect that needs consideration is whether the presentation of individual names is strong enough to activate a matching face representation. Although Bruce and Young (1986) argue that knowing a proper name doesn't have any relevance for the social interaction with the corresponding person, for a celebrity, this may be different. Because celebrities "sell" their identity to a general public, their name is to be seen as a trademark, constituting their fame status in the first place. Therefore, it can be assumed that the connection between a celebrity's name and face is more stable than it would be for other moderately familiar individuals. Moreover, Gordon and Tanaka (2011) recently discussed evidence that underlines the importance of personal names in the formation and retrieval of stable face representation, indicating that the link between a person's name and his or her appearance is much stronger than controverting research has suggested.

3.5 Prestudy: Selection of celebrities to be presented

Before face accessibility for famous people could be assessed, it was necessary to identify which individuals are actually perceived to be famous in Austria, in the first place. Therefore, the aim of the prestudy was to collect names of persons that are considered famous in Austria. Whether the faces corresponding to the recalled names were familiar was thereby of no interest. Moreover, an additional short questionnaire was added aimed at determining which mode of presentation of the final face list would be the most adequate.

3.5.1 Participants

Of the 273 participants who originally completed the questionnaire, 26 had to be excluded because they didn't meet the criterion of being a student. The remaining 247 (194 female, 53 female) had a mean age of 25.21 years (SD= 4.74). 161 participants (65.2%) were Austrian citizens, 75 (30.4%) originated from Germany and only 11 came from other countries not further specified. 54 (48.2%) of the 112 participants with no Austrian citizenship stated that they had continuously been living in Austria for at least three years.

Only 203 participants (160 female, 43 male) with a mean age of 25.86 (SD=4.85) completed the additional questionnaire assessing the appropriate question type for the final face list. Since the two parts of the questionnaire can be regarded as independent from each other, subjects who didn't fill out the additional questions were not excluded from the main analysis.

3.5.2 Procedure

Students from the University of Vienna, the Medical University of Vienna and the Economic University of Vienna received an email invitation to participate in an online study. They were randomly assigned to one of four possible questionnaires resulting from the combination of the two conditions in the main part of the questionnaire and the two presented answering formats in the additional questionnaire.

After completing a demographic section with items regarding age, gender, education, nationality and the period of time they had been living in Austria,

participants were either instructed to reflect and list the maximum number of names of Austrian or German people, who they thought were considered famous in Austria in one condition, or the maximum number of names of world-wide famous people, in the other condition, respectively. German celebrities were included because, due to the common language and shared German and Austrian television programs, literature and cultural overlap it is reasonable to expect that people famous in Germany are likely to be well-known in Austria, as well.

In order to ensure that the mentioned famous names have a high diversity and cover as many professional and artistic categories as possible, participants were provided with 10 categories previously suggested by Bonin et al. (2008), namely actors, singers, athletes, TV stars, politicians, comedians[2], scientists, novelists, painters and historical figures.

The second part of the questionnaire was used to determine which mode of presentation should be applied for the final face list. Based on the assumption that the participant's believe that they can retrieve a familiar face from memory can easily be confounded with a general feeling of familiarity participant's responses to the question whether they are able to visualize a famous person's face were compared when two different response formats were used. Therefore, subjects were presented with the names of ten celebrities, differing in age, category and gender and were asked to state whether they were able to visualize the faces belonging to the given names. Names were selected from the Glasgow Face List, out of those that activated face representations for 50% or more of all participants.

In one condition, the answer was to be given in a simple yes/no format, whereas in the other condition, participants were asked to state for each celebrity, whether they know the presented name and to indicate if they can visualize the corresponding face. The latter should eventually lead to a separate retrieval of facial and name information referring to the presented celebrities.

[2] In this work, the originally proposes category *comics* (Bonin et al., 2008) is replaced with the category *comedians*.

3.5.3 Results and Discussion

Over 9400 names were extracted from the questionnaire. All names were reviewed for repetition and, if unknown, verified for their actual existence with the help of online research. In order to ensure that celebrities were not mentioned incidentally, only those names that were stated more than once were considered for the final face list. Moreover, several names had to be excluded because of one or more of the following reasons:

- Online research didn't confirm the person's identity or fame status (e.g. "Adrian Krasta").

- Names belonged to fictional or cartoon characters (e.g. "The Simpsons", "The Three Musketeers" etc.).

- Frequent names could, in some cases, not be clearly assigned to a specific person, because only the last name (or first name) was mentioned (e.g., "Becker": athlete "Boris Becker" or actor "Ben Becker" etc.).

- No specific character or actor could be assigned, if movies or shows were mentioned (e.g. "Scrubs").

- Only the lead singer (if existing) was included, if bands or groups were mentioned (e.g. "Die Ärzte", "Die Hektiker").

- First or last name were wrong or written incorrectly. Names were only included if identity could still be clearly confirmed (e.g. "Albert Dürer" instead of "Albrecht Dürer").

- Repeated naming was a result of the selective sample (especially psychology students at the University of Vienna) and not a reflection of the person's actual fame status (e.g. Professors at particular universities; "Claus Christian Carbon", "Klaus Kubinger" etc.).

3.5.3.1 Final selection of celebrity names

With respect to the repetitions and the above mentioned exclusions 891 names were finally extracted. The 10 most frequent responses are displayed in Table 3.1.

Table 3.1. *Celebrities Mentioned Most Frequently With Corresponding Category*

Name	Category	Frequency
1. Angela Merkel	politicians	143
2. Albert Einstein	scientists	118
3. Gustav Klimt	painters	92
4. Josef Hader	comedians	92
5. Hermann Maier	athletes	91
6. Pablo Picasso	painters	86
7. Thomas Gottschalk	TV stars	86
8. Adolf Hitler	politicians	85
9. Alfred Dorfer	comedians	84
10. Werner Fayman	politicians	83

Given that the participant's responses were based on the 10 categories suggested by Bonin et al. (2008), it is of importance to mention that the frequency of every response can only be interpreted in the context of each specific category. More precisely, Angela Merkel is not the most famous individual in Austria, but the best-known *politician*.

With the exception of Pablo Picasso, all celebrities with the highest occurrence were of German or Austrian origin and, except for Angela Merkel, of male sex.

The total number of stated celebrities and the overall response frequencies (regardless of repetition) for each category are shown in Table 2. Of the 891 reported celebrities, 33 could not be clearly assigned to one of the 10 provided

categories, forming an eleventh category termed *others*. This category mainly contains movie directors, screenwriters, fashion designers and religious figures.

Overall, except for the category *TV stars,* male celebrities were mentioned more frequently than female celebrities. This could possibly be the result of the unequal distribution of male (21%) and female (79%) participants or simply lie in the fact that male celebrities might in general be overrepresented in some of the presented categories (e.g. politicians, scientists, athletes). According to a study which was conducted in the year 2009 by the Austrian Institute of Parliamentarism and Democracy Questions, for instance, only 36 percent of the Austrian government members in the year 2009 were female and only one country in the EU, namely Germany, was represented by a female head of government. The same distribution might also apply for other categories, where, for example, men might still be more often represented in media reports (e.g. athletes), historical records (e.g. scientists, historical figures) etc.

The variability of responses can be assessed, by comparing the number of finally collected names to the overall response frequencies for each category (Table 3.2). The variability is lowest for the category *politicians* and highest for the category *actors*. This would be in accordance with the assumption that our knowledge for famous people depends on the frequency with which we perceive them. It can be expected that actors are viewed more frequently and in more varying contexts (movies, tv-reports, advertisements, newspapers, magazines) compared to, for example, politicians. Also, the number of politicians in a country is very probably smaller then the number of actors.

3.5.3.2 Answering format for final face list

The second part of the questionnaire was used to assess the appropriate answering format for the final face list. If the assumption is true that the accessibility to information about a person's appearance can be confounded with the knowledge of a person's name, than mean ratings of face accessibility should be lower if information about a celebrity's name and face are retrieved separately. Consistent with this assumption, means for the yes/no answering format were higher (M=4.88, SD=2.46) than for the separate retrieval of name and face knowledge (M=4.30, SD=2.22), but the difference was not significant (t(201)=1.63, p=.105). Nevertheless,

it is safe to conclude, that the separate assessment of the knowledge of a celebrity's name and the imagination of his or her face, might force participants to discriminate actively between facial and semantic information when asked if they can visualize a celebrity's face.

Table 3.2. *Total Number of Stated Celebrities and Overall Response Frequencies (Regardless of Repetition) for Each Category Separated by Gender*

	number of celebrities mentioned			number of overall responses		
Category	male	female	total	male	female	total
scientists	54	4	58	466	14	480
historical figures	28	11	38	309	181	490
TV stars	23	29	52	423	154	577
comedians	52	6	58	706	42	748
painters	49	5	54	701	72	773
novelists	94	23	117	667	173	840
athletes	82	19	101	844	166	1010
singers	89	59	141	615	479	1058
actors	89	77	166	686	489	1175
politicians	74	21	95	1042	262	1304

3.6 The "Vienna face list"

After having collected the names of individuals that are perceived to be famous in Austria, the next step was to present these names to a quite homogenous group in order to assess individual as well as commonly shared representations of famous faces. Choosing a rather homogenous group permits a reliable comparison of the number of individually build face representations to those shared by a specific group on the basis of a relatively small sample size.

3.6.1 Participants

The sample consisted of 42 students (9 male, 33 female) with a mean age of 26.10 years (SD= 4.03) either attending the University of Vienna (73.8%), the Medical University of Vienna (4.8%), the University of Economics (16.6%) or the Technical University of Vienna (4.8%). The majority of the participants were Austrian citizens (66.7%). The rest indicated, that they had been living in Austria for at least 3 years (M=5.7, SD=2.79).

3.6.2 Procedure

Subjects received a list of 1220 names of Austrian as well as worldwide celebrities. Because an additional aim of this study was to provide familiarity norms for famous people, the presented list contained 891 celebrities collected in the prestudy, as well as 329 additional names that were adapted from the initial Glasgow Face List. The latter consisted of those celebrities whose faces were judged to be familiar by 50 percent or more of the participants.

The names extracted in the present study combined with the names derived from the Glasgow Face List were presented in alphabetical order. This was thought to be helpful as participants were allowed to interrupt their work and return to it later, ensuring that the high cognitive demands would not affect their accuracy. Presenting the names in alphabetical order should provide a reasonable entry point after interruption, guaranteeing that none of the names was accidentally overlooked when the task was resumed.

Moreover, because name-face connections are expected to be formed as a result of them being presented together, for actors, who are likely to be strongly linked to their role character, role names were included in addition to their real names.

For each presented name participants were asked to judge separately if they know or recognize the particular name and if they can visualize the corresponding face. They were instructed to give a positive answer to the question of whether they can imagine the face belonging to a presented name only in the case that the name triggered a concrete image of the respective person. Following the denominations similarly proposed by Bonin et al. (2008), the knowledge of a persons name and the ability to imagine the corresponding face are subsequently termed as name agreement and face agreement, respectively.

3.6.3 Results and Discussion

3.6.3.1 Fatigue effects and name/face comparison

Before the actual response frequencies could be analyzed, it was essential to determine whether participant's accuracy might have changed over time as a consequence of the increasing cognitive and attentional demands, or a possible loss of motivation. Therefore, mean responses for the first and the second half of the questionnaire were compared. Results show that participant's responses in the first half were not significantly different from those in the second half, neither for the name (M_{first}=428.23, M_{second}=428.07; t(41)=0.05, p=.957) nor for the face task (M_{first}=251.10, $M_{second=}$252.05; t(41)=0.166, p=.869). This indicates that there were no negative effects of task length and duration on the subject's concentration and motivation.

The next step was to test whether the initial decision to separately ask for name and face knowledge can be supported by the data in the main study. If so, than the previously made assumption, that accessibility to information about a person's appearance might be confounded with a general feeling of familiarity activated through the knowledge of a person's name, would be confirmed.

Accordingly, participant's responses regarding the 10 celebrities used in the prestudy differed significantly from the 50 percent response frequency obtained in the Glasgow Face List (M=0.35, SD=0.19, t(9)=2.49, p<.05). This effect was

strongest for some of the celebrities whose names can be expected to be well known, but whose faces might not be perceived very often in Austria (e.g. designer Jean-Paul Gaultier, former president Jimmy Carter, TV star Jay Leno). However, for celebrities that are likely to be viewed more frequently (e.g. actress Diane Kruger, singer Leona Lewis) results were close to the 50 percent face knowledge rate observed in the Glasgow Face List.

Moreover, with regards to the total number of names adapted from the Glasgow Face List, results on the ability to visualize famous faces differ substantially from those that were initially obtained. Name agreement results seem to correspond more closely to the face agreement judgments of 50 percent and higher that were found in the Glasgow Face List compared to the face agreement results obtained in the present study, as can be seen in Figure 3.1. This could again be interpreted as a confusion of face knowledge with a general feeling of familiarity that is activated through a familiar name most likely accompanied by an activation of semantic knowledge linked to that name.

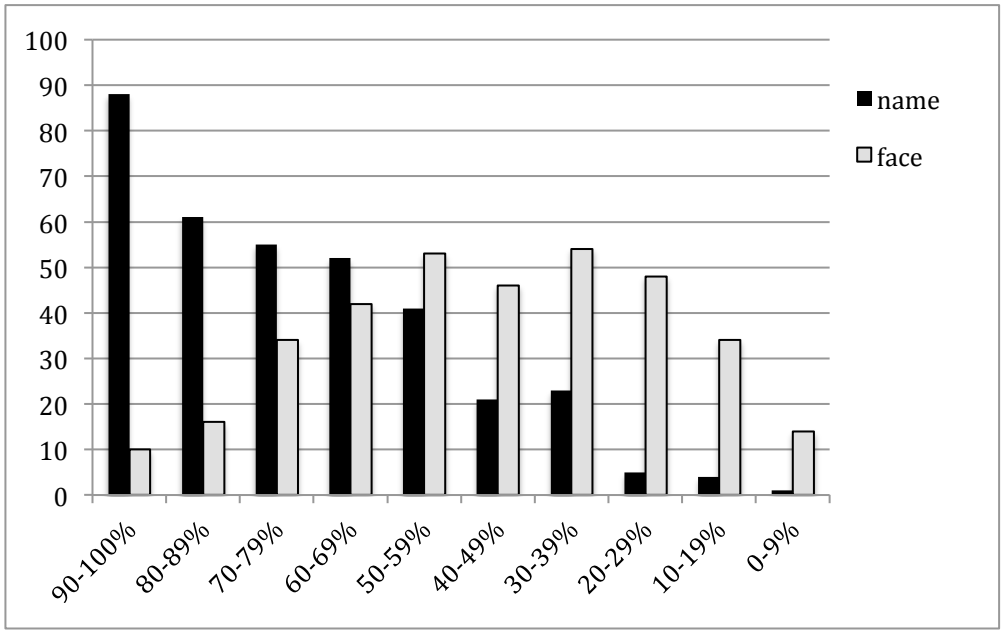

Figure 3.1. Percentages of overall frequency of name and face agreement for the names adapted from the Glasgow Face List.

3.6.3.2 *Individual face representations*

On average, participants were able to recognize 855.56 (SD=140.43) of the presented names and to imagine 515.41 (SD=158.26) of the corresponding faces. Because the main objective of the present study was to explore the extent to which people are capable of building face representations of individuals that are commonly found to be famous in our society, face agreement was regarded with reliance to name agreement. More specifically, it was not of importance to determine how many of the 1220 presented names could be actually visualized, but to assess how many faces were mentally represented relative to the number of famous names known.

The relation of name agreement and face agreement for each participant is depicted in Figure 3.4. Individual name and face recognition abilities were highly correlated (r=0.74, p<.001), indicating that the more names a participant knew, the more mental face representations he or she was able to activate.

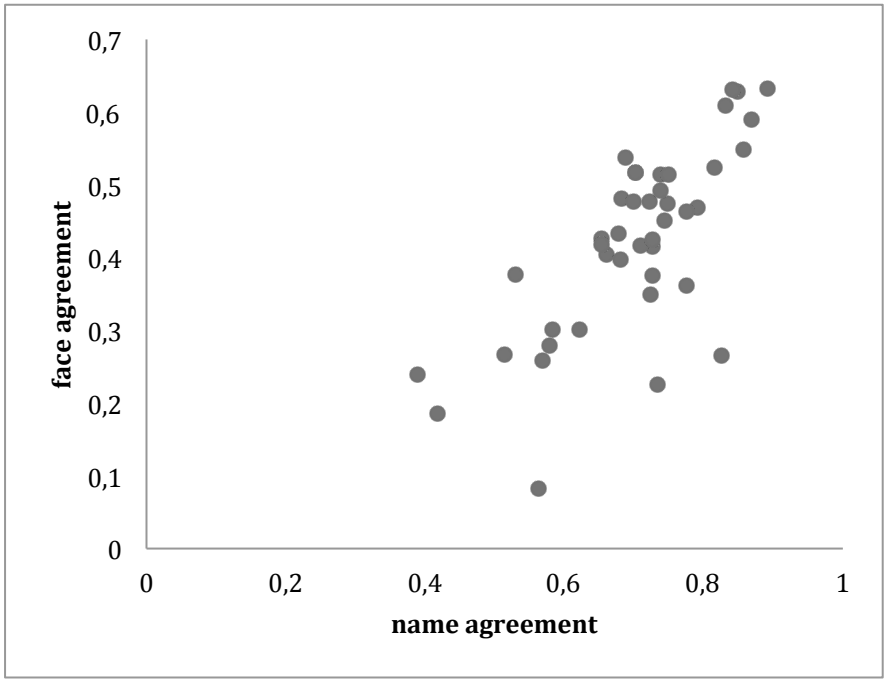

Figure 3.2. Relation of name agreement and face agreement judgments for each participant given in percent.

These results support the assumption generally accepted by the majority of researchers in the area of face processing, recognition and identification that

people are able to process hundreds, if not thousands of previously encountered faces. On average and with only minor exceptions, participants were able to activate face representations to approximately 60 percent of the names that were familiar to them. Given that the names presented in this study represent only a fraction of the number of famous individuals that are perceived in the course of life, the actual amount of representations built in human memory might be much higher. Moreover, the missing 40 percent might be caused by a lack of visual face information mainly as a result of the domain a specific celebrity is known from, rather than by an inability to represent the faces of these celebrities in memory.

3.6.3.3 Category comparison

To investigate the assumption that the inability to mentally represent faces of famous individuals observed in this study is shaped by the extent to which visual face information is provided, name knowledge and face imagination ability for each category were regarded. As can be seen in Table 3.3, differences between name agreement and face agreement were highest for those famous individuals that are not likely to be perceived very often (e.g. novelists, scientists, painters) and lowest for those celebrities that are mainly known from media sources that provide visual information more frequently (e.g. TV stars, actors, singers).

Table 3.3. *Name Agreement and Face Agreement Judgements for Each of the Ten Provided Categories*

	Degree of knowledge	
Category	Name	Face
TV stars	73%	59%
actors	72%	54%
singers	74%	48%
politicians	74%	46%
athletes	67%	45%
comedians	53%	41%
historical figures	77%	20%
scientists	55%	11%
novelists	59%	10%
painters	48%	10%

For a more detailed illustration, 4 indices were formed, describing the difference between name and face knowledge for each of the presented celebrities. Indices range from an equal knowledge of names and faces to a difference higher than 70 percent. Results are shown in Figure 3.3. Again, equality of name and face knowledge was mainly found for those domains that provide frequent visual images of the particular celebrities.

However, these results are not surprising. As has been discussed in detail in the course of this work, representations of faces are formed and continually refined with each visual encounter of a particular person. On contrast, the fame status of novelists, scientist and painters is mainly based on a specific product or object they have created, whether it is an idea, an invention, a book, an artwork etc. The face behind this creation does not necessarily have to be familiar.

Nevertheless, these results highlight once more people's ability to build up face representation of frequently perceived faces by demonstrating that the discrepancies of name knowledge and face imagination ability observed in this study were merely the result of the type of faces presented.

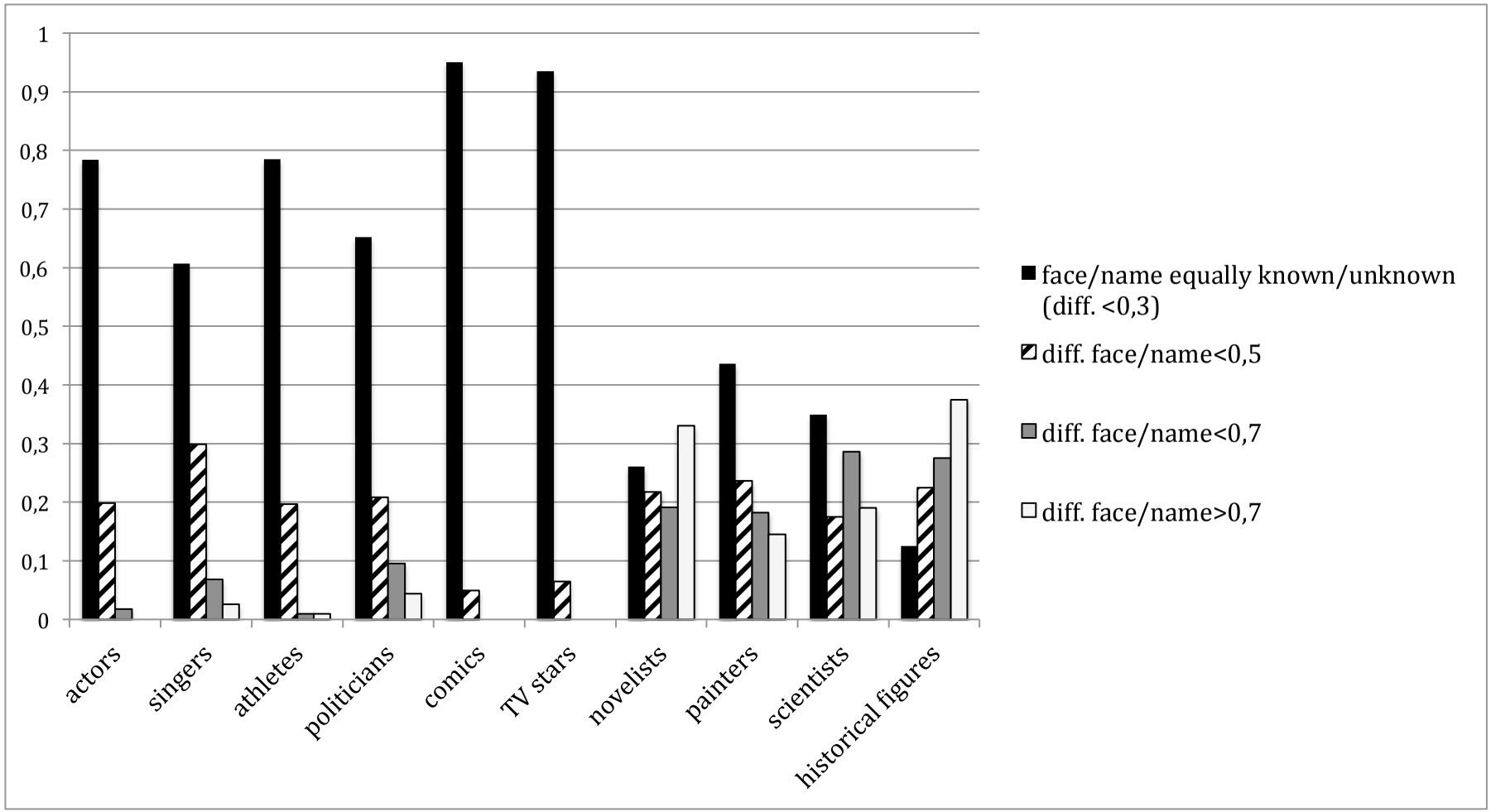

Figure 3.3. Differences in name agreement and face agreement abilities separately for each of the ten categories presented.

3.6.3.4 Collective face representations

The next step after the assessment of individual differences in the participant's ability to mentally represent frequently seen famous faces was to explore how many imagined faces were shared by members of a quite homogenous group, more specifically Austrian students that were living in Vienna at time of study. When regarded individually, participants were found to be able to imagine a large number of faces of famous individuals. Therefore, the impact of our media-guided social environment and the high cognitive demands it entails, might rather reveal itself in the number of commonly shared face representations. With account to a possible error in the participant's answers, common face agreement was defined as the amount of mental face representations shared by 90 percent or more of all participants.

In accordance with the hypothesis, face agreement intersections of 90 percent or more were only achieved for 89 of all presented celebrities. In contrast, common name agreements were considerably higher, with 390 names shared by 90 percent or more of all participants. The distribution of shared face agreements across the ten categories is depicted in Table 3.4. Moreover, figure 3.4 shows face agreement shared by 90 percent of the participants relative to the total number of celebrities presented for each of the 10 categories.

Table 3.4. *Distribution of Shared Face Agreements Across the Ten Categories*

Categories	Number of face images	Total number of celebrities
actors	36	338
singers	23	234
TV stars	10	62
politicians	8	115
athletes	5	107
comedians	3	61
scientists	1	63
painters	0	55
novelists	0	115
historical figures	0	40

Again, shared face representations were mainly built for individuals famous in domains with a high visual impact most probably leading to an increased likeliness that the respective faces might actually be visually processed (e.g. TV stars, actors).

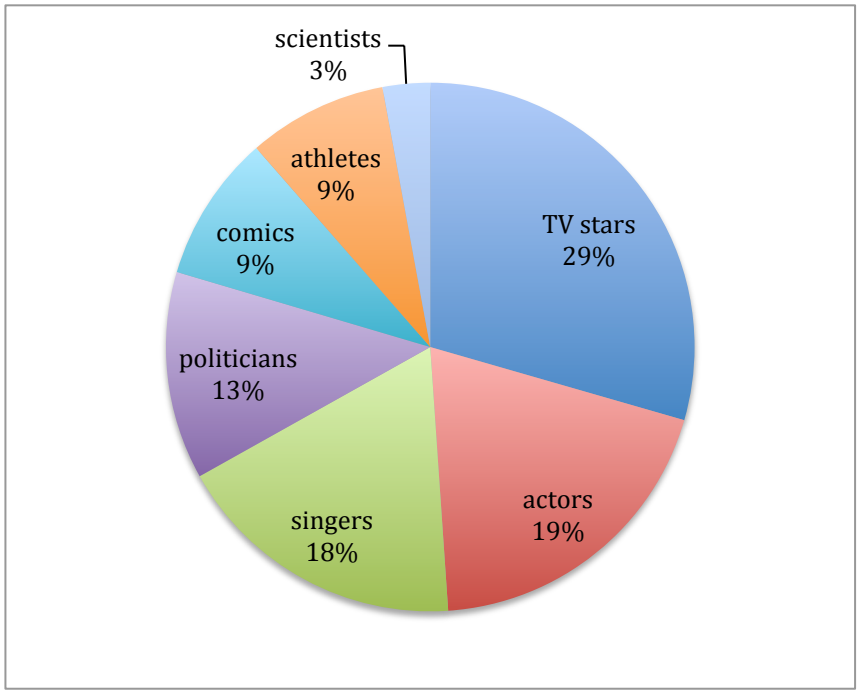

Figure 3.1. Ninety percent common face agreement relative to the total number of celebrities presented per category.

The reason for the relatively small number of face representations shared by individuals belonging to a homogenous social and cultural group may lie in the inter-individual diversity of personal interests and characteristics leading individuals to turn their attention to areas of particular importance to them and to neglect those information they consider irrelevant. It is not surprising than, that participant's differences in their underlying interests and intentions led to the small number of collective face agreements observed in this study.

3.6.3.5 Iconic processing of famous faces

Celebrities do not only differ in the domain they became famous in, but they may also vary in the iconic potential of their appearance. The iconic potential of famous faces can manifest itself in two possible ways: A celebrity's appearance can be mainly associated with a specific well-established and commonly known portrait of the person (e.g. Ernesto's Che Guevara; Carbon, 2008) or it can imply certain external or internal features unmistakably linked to this appearance (e.g. typical

wreath worn by Ceasar). The first could be explored by simply conducting an online research of a famous person. If the iconic potential is high, than a specific picture should repeatedly show up in the search results. However, the method in this present study does not allow any conclusions from participant's subjective face agreement judgments to the nature of the mental representations they form.

The second might be reflected in participant's face agreement judgments on famous individuals whose faces are unlikely to be accurately represented in memory (e.g. historical figures like Caesar or Cleopatra). If face agreement judgments for these famous persons are high, than the mental images formed are likely to represent abstracted 'icons', rather than realistic images of the particular faces. The four historical figures with the highest face agreement are shown in Table 3.5.

Table 3.5. *Historical Figures With Highest Face Agreement*

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Buddha	male	100%	79%
Jesus Christ	male	95%	74%
Julius Caesar	male	93%	69%
Cleopatra	female	98%	67%

Consistently, highest face agreement was obtained for those famous historical figures that are likely to be mentally represented on the basis of striking internal as well as external facial features (e.g. Jesus' beard, Cleopatra's typical headdress). Because the mental images that are built for these famous individuals cannot be expected to rely on real-world visual information, faces might have rather been stored in form of 'icons' that are based on a more abstract specific mental image of the person.

He whose face gives no light, shall never become a star.

William Blake

4 Overall Discussion

Previous studies have provided strong support to the notion that humans are capable of integrating visual information of other people's faces, forming face representations that become more stable and refined with each time they are perceived (Burton et al., 2011; Jenkins and Burton, 2008, 2011). At current state of knowledge, however, the topic of mental face representations has not yet been approached from a quantitative point of view. Considering that the implicit notion of an exceptional human memory for faces has frequently constituted the basis for scientific deliberations and empirical studies on face perception and recognition, the absence of an empirical approach on the number of actually stored face representations seems surprising. Therefore, the aim of the present study was to address the widely accepted assumption of an exceptional human ability to memorize a nearly unlimited number of previously seen faces from a quantitative rather than qualitative view point. This objective was approached by assessing how a special class of familiar faces, namely famous faces is represented in human memory. Famous faces are particularly interesting for research on mental face representations. Firstly, they can be expected to incorporate visual aspects as well as to activate semantic knowledge about a person (Natu & O'Toole), although this information has almost solely been retrieved from photographs, media reports or other sources that do not include personal contact with the particular person. Secondly, judgments about the ability to visualize a face corresponding to a celebrity's name are likely to be made spontaneously and without much effort. Finally, famous faces are commonly familiar to a broad public, making it possible to compare face representation judgments among different individuals.

The exploration of face representation ability is of particular importance considering the extraordinary amount of faces we encounter every day and the high cognitive demands imposed by the need of processing them accurately.

Compared to our early ancestors, who only had to distinguish the few people close to them from potential enemies, our growing social environment and the modern means of communication demand much more of our ability to memorize the faces we daily see. The main question that has guided this work was therefore, how these changes in our social environment are reflected in our human face processing ability. There are two principally conceivable effects: The increased cognitive demands could either result in an individually decreased ability to process the faces encountered due to a lack of face processing capacity, or it could lead to a selective attention for those faces that are of particular importance for the perceiver.

Results indicate that the overall capability to mentally represent the faces of individuals famous in Austria can be regarded as good. On average, people were able to visualize the corresponding faces to approximately 60 percent of the names that were familiar to them. The missing 40 percent, that is, the discrepancies of name knowledge and face imagination ability, were merely the result of the different categories presented. One can assume for instance, that we visually process faces of actors such as Brad Pitt or George Clooney more frequently than we see pictures of Edvard Munch or Max Frisch. The knowledge of Munch's painting *The Scream* or Max Frisch's novel *Homo Faber* should be of greater importance to us than the knowledge of how Max Frisch and Edvard Munch might actually look like.

The impact of our media-dependent social environment and the high cognitive demands it imposes was mainly observed with regards of the mental face representations that were commonly shared by members of the same social group (i.e. students from Vienna). Altogether, participants shared the mental face representations of only 89 famous individuals. Considering that individual abilities to build up a mental image of a particular face were found to be good, the number of shared visual face representations is surprisingly small. The reason for this might lie in our selective interest for certain domains and the resulting neglect of other areas.

As has been argued before, facial stimuli constitute a class of objects we are predominantly attracted to, often even unconsciously, unintentional and compulsory (Palermo & Rhodes, 2007).

Still our interests, motivation and personality characteristics may draw our attention to those areas that are of particular interest to us, ignoring other fields that might be less relevant. The movies we preferably see, the sports we are interested in, the museum exhibition we go to – all these interests shape not only who we are but also what individuals we become familiar with. If someone were not interested in politics for instance, he or she would not watch a political talk show. Because there are so many individuals we can devote our attention to, we need to decide, whom we want to know and whom we don't. These are decisions our early ancestors didn't have to make and it can explain why we differ in the type rather than in the amount of faces we represent in memory relative to the individuals we consider famous.

Although the main attempt of this study was to provide a quantitative approach to mental face representations there are also interesting conclusions about the quality of these mental images that can be deduced from the present findings. According to Carbon (2008), the processing of personally familiar faces and famous faces show some discrepancies in the way visual information about the individual is obtained. Whereas representations of familiar faces are formed as a result of our personal experience with a particular person, famous faces are mainly viewed on pictures or in media reports eventually leading to a qualitatively different processing of the visual face information, Carbon refers to as *iconic processing*. Though not explicitly mentioned in the study conducted by Carbon (2008), not every famous face has the same potential to create an iconic mental image in memory. The iconic potential of a famous face might depend on the existence of a well-established and commonly known portrait of the person (see picture of Albert Einstein, p.29), or on the presence of particularly striking external or internal features apparently linked to the appearance of the famous individual (e.g. wreath of Julius Caesar). The second was expected to produce positive face representation judgments for famous individuals whose faces are unlikely to be actually known, because of the ease with which the information can be retrieved from memory. Consistently, participants in this study indicated that they were able

to imagine a concrete mental image of the faces of historical figures, like Ceasar, Cleopatra or Jesus. This finding is in accordance with the results of Carbon (2008), indicating that at least some famous individuals were visualized on the basis of iconic representations rather than on mental images based on real-world pictures of that particular individual.

A question that might arise is, whether the nature of the task could have enhanced a general retrieval of iconic representations of famous faces. Asking participants to visualize an image of a famous person before their inner eye is likely to motivate a spontaneous retrieval of a single typical (iconic) visual image of that person. To test these assumptions and to address further questions on the quality of mental face representations, future research is needed. It would be interesting for instance to assess why some of the individuals belonging to a specific category were memorized and others were not.

It should be noted at this point, that the present study only provides a snapshot of collectively and individually memorized faces at a particular point in time that can be influenced by social and cultural events that were "current" at that time, but that might vary considerably as these events lessen in importance or are replaced by other striking occurrences. To name an example, the name Steve Jobs was familiar to 67 percent of all participants. Given his recent death and the increased media interest in his person, results might be completely different if the study were repeated today. Moreover, the amount of famous names that were presented in the course of this study constitutes only a small fraction of the famous individuals we are confronted with every day. Future research should be therefore directed at providing a much more detailed quantitative approach to mental face representations.

In addition to a quantitative specification of the human ability to form face representations of faces that are perceived and learned in the course of life, the present work was aimed at providing familiarity norms for famous faces as a foundation for future research. A large body of empirical research that has been conducted at the Department of Psychology at the University of Vienna included studies on face perception and recognition, as well as the emotional and cognitive response to familiar faces. Future research on these topics could be facilitated, as

the present work provides familiarity judgments for famous faces that are expected to be shared by the majority of all participants.

Because familiarity is not the only dimension faces of famous individuals can differ in, future approaches should concentrate on collecting additional norms that might also be of interest, like norms on the positive or negative valence of famous faces, for instance. As has been noted above, human faces communicate a great number of socially important messages triggering not only cognitive but also emotional reactions when being perceived. Assessing emotional judgments for famous faces might therefore be of particular interest when it comes to controlling for further aspects that could have an effect on the recognition and perception of human faces.

5 References

Bahrick, H. P., Bahrick, P. O., & Wittlinger, R. P. (1975). 50 years of memory for names and faces: A cross-sectional approach. *Journal of Experimental Psychology-General, 104*(1), 54-75.

Biederman, I. (1987). Recognition-by-components - a theory of human image understanding. *Psychological Review, 94*(2), 115-147.

Biedermann, I. & Kalocsai, P. (1997). Neurocomputational bases of object and face recognition. *Philosophical Transactions of the Royal Society of London B, 352*, 1203-1219.

Bindemann, M., Burton, A. M., Hooge, I. T. C., Jenkins, R., & De Haan, E. H. F. (2005). Faces retain attention. *Psychonomic Bulletin & Review, 12*(6), 1048-1053.

Bindemann, M., Burton, A. M., & Jenkins, R. (2005). Capacity limits for face processing. *Cognition, 98*(2), 177-197.

Bonin, P., Perret, C., Méot, A., Ferrand, L., & Mermilot, M. (2008). Psycholinguistic norms and face naming times for photographs of celebrities in French. *Behavior Research Methods*, *40 (1),* 137-146.

Bruce, V., Burton, A. M., & Craw, I. (1992). Modeling face recognition. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences, 335*(1273), 121-128.

Bruce, V., Campbell, R. N., Doherty-Sneddon, G., Import, A., Langton, S., McAuley, S., & Wright, R. (2000). Testing face processing skills in children. *British Journal of Developmental Psychology, 18*, 319-333.

Bruce, V., Doyle, T., Dench, N., & Burton, M. (1991). Remembering facial configurations. *Cognition*, 109-144.

Bruce, V., & Young, A. (1986). Understanding face recognition. *British Journal of Psychology, 77*, 305-327.

Bruce, V. & Young, A. (1998). *In the eye of the beholder. The science of face perception.* Oxford:Oxford University Press.

Burton, A. M., Jenkins, R., & Schweinberger, S. R. (2011). Mental representations of familiar faces. *British Journal of Psychology, 102*, 943-958.

Burton, A. M., Miller, P., Bruce, V., Hancock, P. J. B., & Henderson, Z. (2001). Human and automatic face recognition: a comparison across image formats. *Vision Research, 41*(24), 3185-3195.

Burton, A. M., Wilson, S., Cowan, M., & Bruce, V. (1999). Face recognition in poor-quality video: Evidence from security surveillance. *Psychological Science, 10*(3), 243-248.

Bushnell, I. W. R. (2001). Mother's face recognition in newborn infants: learning and memory. *Infant and Child Development, 10* (1-2), 67-74.

Bushnell, I.W.R., Sai, F , & Mullin, J.T. (1989). Neonatal recognition of the mother's face. *British Journal of Developmental Psychology, 7,* 3-15.

Carbon, C. C. (2002). Face processing - Early processing in the recognition of faces. (Doctoral Dissertation, University of Berlin, 2002). Retrieved from http://www.diss.fu-berlin.de/diss/content/below/index.xml.

Carbon, C. C. (2008). Famous faces as icons. The illusion of being an expert in the recognition of famous faces. *Perception, 37*(5), 801-806.

Carey, S. (1992). Becoming a face expert. *Philosophical Transactions of the Royal Society of London, 335*, 95-103.

Chung, M. S., & Thomson, D. M. (1995). Development of Face Recognition. *British Journal of Psychology, 86*, 55-87.

Duchaine, B., & Nakayama, K. (2006). The Cambridge Face Memory Test: Results for neurologically intact individuals and an investigation of its validity using inverted face stimuli and prosopagnosic participants. *Neuropsychologia, 44*(4), 576-585.

Fantz, R. L. (1963). Pattern vision in newborn infants. *Science*, *140* (3564), 296-297.

Farah, M. (2004). *Visual Agnosia*. Camebridge, MA: The MIT Press.

Gauthier, I., Curran, T., Curby, K. M., & Collins, D. (2003). Perceptual interference supports a non-modular account of face processing. *Nature Neuroscience, 6*(4), 428-432.

Gauthier, I., & Tarr, M. J. (2002). Unraveling mechanisms for expert object recognition: Bridging brain activity and behavior. *Journal of Experimental Psychology-Human Perception and Performance, 28*(2), 431-446.

Goldstein, A. G., & Chance, J. E. (1980). Memory for Faces and Schema Theory. *Journal of Psychology, 105*(1), 47-59.

Gordon, I., & Tanaka, J. W. (2011). The role of name labels in the formation of face representations in event-related potentials. *British Journal of Psychology, 102*, 884-898.

Goren, C. C, Sarty, M., & Wu, P. Y. K. (1975). Visual following and pattern discrimination of face-like stimuli by newborn infants. *Pediatrics, 56*, 544-549.

Hancock, P. J. B., Bruce, V., & Burton, A. M. (2000). Recognition of unfamiliar faces. *Trends in Cognitive Sciences, 4*(9), 330-337.

Haxby, J. V., Hoffman, E. A., & Gobbini, M. I. (2000). The distributed human neural system for face perception. *Trends in Cognitive Sciences, 4*(6), 223-233.

Haxby, J. V., Hoffman, E. A., & Gobbini, M. I. (2002). Human neural systems for face recognition and social communication. *Biological Psychiatry, 51*(1), 59-67.

Haxby, J. V., Ungerleider, L. G., Clark, V. P., Schouten, J. L., Hoffman, E. A., & Martin, A. (1999). The effect of face inversion on activity in human neural systems for face and object perception. *Neuron, 22*(1), 189-199.

Institut für Parlamentarismus und Demokratiefragen (2009). *Frauen in der Politik - im Rahmen der EU.* [*Institute for Parliamentarism and Democracy Questions. Women in Politics - in the Framework of the European Union*]. Retrieved from http://www.parlamentarismus.at/fileadmin/Inhaltsdateien/IfPD/DAteien/Zusammenfassung-verteilt.pdf

Jenkins, R. (2011).[The Glasgow Face List].unpublished raw data.

Jenkins, R., & Burton, A. M. (2011). Stable face representations. *Philosophical Transactions of the Royal Society B-Biological Sciences, 366*(1571), 1671-1683.

Jenkins, R., Lavie, N., & Driver, J. (2003). Ignoring famous faces: Category-specific dilution of distractor interference. *Perception & Psychophysics, 65*(2), 298-309.

Johnson, M. H. (2005). Subcortical face processing. *Nature Reviews Neuroscience, 6*, 766-774.

Johnson, M. H. (2011). Face perception: A developmental perspective. In: A. Calder, G. Rhodes, M. Johnson, & J. Haxby (Eds.). *Oxford handbook of face perception* (pp. 3-14). Oxford:Oxford University Press.

Johnson, M. H., Dziurawiec, S., Ellis, H., & Morton, J. (1991). Newborns' preferential tracking of face-like stimuli and its subsequent decline. *Cognition 40*, 1–19.

Johnston, R. A., & Edmonds, A. J. (2009). Familiar and unfamiliar face recognition: A review. *Memory, 17*(5), 577-596.

Johnson, M. H., Grossman, T., & Farroni, T. (2008). The social cognitive neuroscience of infancy: Illuminating the early development of social brain functions*. Advances in Child Development and Behavior, 36,* 331-372.

Kanwisher, N., McDermott, J., & Chun, M. M. (1997). The fusiform face area: A module in human extrastriate cortex specialized for face perception. *Journal of Neuroscience, 17*(11), 4302-4311.

Kanwisher, N., & Yovel, G. (2006). The fusiform face area: a cortical region specialized for the perception of faces. *Philosophical Transactions of the Royal Society B-Biological Sciences, 361*(1476), 2109-2128.

Leder, H., & Bruce, V. (2000). When inverted faces are recognized: The role of configural information in face recognition. *Quarterly Journal of Experimental Psychology Section a-Human Experimental Psychology, 53*(2), 513-536.

Leder, H., Candrian, G., Huber, O., & Bruce, V. (2001). Configural features in the context of upright and inverted faces. *Perception, 30*(1), 73-83.

Leder, H., Schwarzer, G., & Langton, S. (2003). Development of face processing in early adolesence. In: Schwarzer, G &Leder, H. (Ed.). *Development of face processing.* Göttingen: Hogrefe.

Little, A. C., Jones, B. C., & DeBruine, L. M. (2011). The many faces of research on face perception Introduction. *Philosophical Transactions of the Royal Society B-Biological Sciences, 366*(1571), 1634-1637.

Maurer, D. & Barrera, M. (1981). Infants' perception of natural and distorted arrangements of a schematic face. *Child Development*, 52 (1), 1996-202.

Maurer, D., LeGrand, R., & Mondloch, C. J. (2002). The many faces of configural processing. *Trends in Cognitive Sciences, 6* (6), 255-260.

McCarthy, G., Puce, A., Gore, J. C., & Allison, T. (1997). Face-specific processing in the human fusiform gyrus. *Journal of Cognitive Neuroscience, 9*(5), 605-610.

McKone, E., Kanwisher, N., & Duchaine, B. C. (2007). Can generic expertise explain special processing for faces? *Trends in Cognitive Sciences, 11*(1), 8-15.

Minear, M., & Park, D. C. (2004). A lifespan database of adult facial stimuli. *Behavior Research Methods Instruments & Computers, 36*(4), 630-633.

Mondloch, C. J., Maurer, D., & Ahola, S. (2006). Becoming a face expert. *Psychological Science, 17*(11), 930-934.

Morton, J. & Johnson, M. H. (1991). CONSPEC and CONLEARN: A two-process theory of infant face recognition. *Psychological Review, 98* (2), 164-181.

Nelson, C. A. (2001). The development and neural bases of face recognition. *Infant and Child Development, 10*(1-2), 3-18.

O'Toole, A. J.(2011). Cognitive and computational approaches to face recognition. In: A. Calder, G. Rhodes, M. Johnson, & J. Haxby (Eds.). *Oxford handbook of face perception* (pp. 15-30). Oxford:Oxford University Press.

Palermo, R., & Rhodes, G. (2007). Are you always on my mind? A review of how face perception and attention interact. *Neuropsychologia, 45*(1), 75-92.

Richler, J. J., Cheung, O. S., & Gauthier, I. (2011). Holistic processing predicts face recognition. *Psychological Science, 22*(4), 464-471.

Schwaninger, A., Carbon, C.C., & Leder, H. (2003). Expert face processing: Specialization and constraints. In: Schwarzer, G & Leder, H. (Ed.). *Development of face processing.* Göttingen: Hogrefe.

Smeets, D., Claes, P., Vandermeulen, D., & Clement, J. G. (2010). Objective 3D face recognition: Evolution, approaches and challenges. *Forensic Science International, 201*(1-3), 125-132.

Smith-Spark, J. H., Moore, V., Valentine, T., & Sherman, S. M. (2006). Stimulus generation, ratings, phoneme counts, and group classifications for 696 famous people by British adults over 40 years of age. *Behavior Research Methods, 38*(4), 590-597.

Statistik Austria. *Population numbers in Austria*. Retrieved November 4, 2011 from: http://www.statistik.at/web_de/statistiken/bevoelkerung/index.html

Tanaka, J. W. & Farah, M. J. (1993). Parts and wholes in face recognition. *The Quarterly Journal of Experimental Psychology, 46A (2),* 225-245.

Wong, A. C. N., Palmeri, T. J., & Gauthier, I. (2009). Conditions for facelike expertise with objects: Becoming a ziggerin expert-but which type? *Psychological Science, 20*(9), 1108-1117.

Young, A. W. & Bruce, V. (2011). Understanding person perception. *British Journal of Psychology, 102*, 959-974.

Zebrowitz, L. A. (2011). Ecological and social approaches to face perception. In A. Calder, G. Rhodes, M. Johnson, & J. Haxby (Eds.). *Oxford handbook of face perception* (pp. 31-50). Oxford:Oxford University Press.

6 Appendix

6.1 Summary (English)

Face perception and recognition are essential aspects of human social interaction and communication that have both been intensively studied by researchers from various disciplines. Most of these attempts start with the implicit assumption that humans are able to memorize and identify a large number of individual faces. But up to know, the actual number of stored face representations has not been assessed. The aim of this present work was to provide a first quantitative approach to the implicit belief of an exceptional human capacity to memorize faces. For this purpose, participants were presented with the names of 1220 famous individuals from different categories (e.g. TV Stars, actors, painters) and asked to judge whether they knew the respective name (name agreement) and whether they could visualize the corresponding face (face agreement). Results indicate that on average, participants were able to visualize approximately 60 percent of the faces corresponding to the presented names. The missing 40 percent could be explained by the category a specific famous individual belonged to and by the lack of visual information associated with it. This indicates that individual abilities to memorize human faces are good. Results regarding face representations commonly shared by members of a homogenous social group (students in Vienna) are however different. Shared face agreement of 90% or higher was obtained for 89 celebrities, indicating that, though participants shared the same social background there were still differences in the type of famous faces they formed mental representations of. Additionally, by assessing name agreement and face agreement for famous individuals, familiarity norms for famous faces were collected constituting an important basis for future research.

6.2 Summary (German)

Die Erkennung und Verarbeitung von Gesichtern sind bedeutende Aspekte sozialer Interaktion und Kommunikation, die bis heute das Interesse von WissenschaftlerInnen unterschiedlicher Fachdisziplinen geweckt haben. Viele dieser wissenschaftlichen Untersuchungen gehen von der impliziten Annahme aus, dass Menschen grundsätzlich in der Lage sind eine große Zahl von Gesichtern im Gedächtnis zu speichern und zu identifizieren. Bis heute wurde allerdings die tatsächliche Zahl von Gesichtsrepräsentationen, die Menschen in der Lage sind im Gedächtnis zu speichern nicht explizit untersucht. Ziel der vorliegenden Studie war es daher, sich der Frage nach einem außergewöhnlichen Gedächtnis für menschliche Gesichter von einem quantitativen Standpunkt aus zu nähern.

Versuchspersonen wurden daher 1220 Namen von berühmten Persönlichkeiten aus unterschiedlichen Kategorien (z.B. Fernseh-Stars, SchauspielerInnen, KünslterInnen etc.) präsentiert, mit der Bitte einerseits einzuschätzen inwieweit ihnen der Name der Person bekannt ist und inwieweit sie das entsprechende Gesicht vor ihrem inneren Auge visualisieren.

Die Ergebnisse zeigen, dass Versuchspersonen in der Lage waren durchschnittlich 60 Prozent der Gesichter zu den jeweilig dargebotenen Namen zu visualisieren. Die fehlenden 40 Prozent können eher auf die präsentierten Kategorien und das daraus resultierendes Fehlen visueller Information, als auf eine grundsätzliche Unfähigkeit stabile Gesichtsrepräsentationen zu bilden, zurückgeführt werden. Dies deuten darauf hin, dass die individuelle Fähigkeit Gesichter im Gehirn speichern zu können grundsätzlich sehr gut ist.

Hinsichtlich der Gesichtsrepräsentationen, die von Mitgliedern einer homogenen Gruppe geteilt werden (StudentInnen aus Wien) zeigen sich hingegen unterschiedliche Ergebnisse. Geischtserinnerungsübereinstimmungen von 90% oder höher wurden für 89 der dargebotenen berühmten Persönlichkeiten erzielt. Dies zeigt, dass sich Personen, trotz ähnlichem sozialen Hintergrund, dennoch in der Art von Gesichtern unterscheiden können, die sie bevorzugt im Gesicht speichern.

Die quantitative Untersuchung von Gesichtsrepresentationen ermöglichte es darüber hinaus Bekanntheitsnormen für berühmte Persönlichkeiten zu sammeln, die eine Grundlage für zukünftige Forschung bilden können.

6.3 Face and name agreement norms for celebrities sorted by category

6.3.1 Politicians

Degrees of Knowledge for Personal Names and Faces for the Category Politicians (1)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Adolf Hitler	male	100%	100%
Angela Merkel	female	100%	100%
Barack Obama	male	100%	100%
Bill Clinton	male	100%	98%
Prinzessin Diana	female	100%	98%
Prinz Wiliam	male	100%	95%
Prinz Harry	male	100%	93%
Silvio Berlusconi	male	100%	90%
George Bush Jr.	male	95%	88%
Michelle Obama	female	95%	88%
Nicolas Sarkozy	male	95%	88%
Wladimir Putin	male	98%	88%
Heinz Christian Strache	male	95%	86%
Hilary Clinton	female	98%	86%
Jörg Haider	male	100%	86%
Prinz Charles	male	98%	83%
Che Guevara	male	90%	81%
John F. Kennedy	male	100%	81%
Karl - Heinz Grasser	male	95%	79%
Michael Häupl	male	93%	79%
Saddam Hussein	male	100%	76%
Abraham Lincoln	male	100%	74%
Helmut Kohl	male	100%	74%
Mahatma Gandhi	male	98%	74%
Alfred Gusenbauer	male	86%	71%

Degrees of Knowledge for Personal Names and Faces for the Category Politicians (2)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Condoleezza Rice	female	90%	71%
Erwin Pröll	male	88%	71%
Fidel Castro	male	98%	71%
Gerhard Schröder	male	88%	71%
Nelson Mandela	male	95%	71%
Werner Fayman	male	88%	71%
Josef Pröll	male	88%	69%
Maria Vassilakou	female	71%	69%
Muamar Al-Gadaffi	male	95%	69%
Alexander Van der Bellen	male	76%	67%
Camilla Parker Bowles	female	74%	67%
Heinz Fischer	male	83%	67%
Prinzessin Victoria (Sweden)	female	90%	67%
Wolfgang Schüssel	male	86%	67%
Joschka Fischer	male	90%	67%
Benita Ferrero-Waldner	female	74%	62%
Maria Fekter	female	83%	60%
Edmund Stoiber	male	83%	60%
Eva Glawischnig	female	74%	57%
Guido Westerwelle	male	95%	57%
Helmut Zilk	male	60%	55%
Thomas Klestil	male	71%	55%
Martin Luther King	male	98%	55%
Karl Theodor zu Guttenberg	male	95%	52%
George Bush Sen.	male	95%	50%
Al Gore	male	83%	50%
Prinz Albert	male	93%	50%
Beatrix Karl	female	55%	48%
Boris Yeltsin	male	74%	48%
Franz Vranitzky	male	67%	45%

Degrees of Knowledge for Personal Names and Faces for the Category Politicians (3)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Jacques Chirac	male	95%	45%
Mikhail Gorbachov	male	86%	45%
Sarah Palin	female	57%	45%
Dominique Strauss-Kahn	male	69%	43%
Margaret Thatcher	female	88%	43%
Tony Blair	male	90%	43%
Viktor Klima	male	60%	43%
Helmut Schmidt	male	60%	43%
Ursula Stenzel	female	57%	40%
Bruno Kreisky	male	86%	38%
Kofi Anan	male	76%	33%
Lenin	male	93%	33%
Yasser Arafat	male	79%	33%
Josef Stalin	male	83%	33%
George Washington	male	95%	31%
Mahmoud Ahmadinejad	male	55%	31%
Peter Pilz	male	55%	31%
Ronald Reagan	male	90%	31%
Josef Stalin	male	83%	31%
Michael Spindelegger	male	69%	29%
Otto von Habsburg	male	86%	29%
Karl Marx	male	98%	29%
Horst Köhler	male	67%	26%
Benjamin Franklin	male	98%	24%
Christian Wulff	male	40%	24%
Claudia Schmied	female	29%	24%
Doris Bures	female	52%	24%
Madeleine Petrovic	female	40%	24%
Malcolm X	male	62%	24%
Benito Mussolini	male	88%	24%

Degrees of Knowledge for Personal Names and Faces for Category Politicians (4)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Konrad Adenauer	female	81%	24%
Ursala von der Leyen	female	45%	24%
Winston Churchill	male	98%	24%
Alois Mock	male	38%	21%
Claudia Roth	female	24%	21%
Ernst Strasser	male	67%	21%
Hugo Chavez	male	50%	21%
Jimmy Carter	male	86%	21%
Kurt Waldheim	male	48%	21%
José Manuel Barroso	male	60%	19%
Mao Zedong	male	55%	19%
Fred Sinowatz	male	45%	17%
Willi Brand	male	64%	17%
Colin Powell	male	40%	14%
Frank Walter Steinmeier	male	43%	14%
Johanna Dohnal	female	33%	14%
Josef Pühringer	male	43%	14%
Rudolf Kirchschläger	male	31%	14%
Franklin D Roosevelt	male	95%	12%
Gordon Brown	male	64%	12%
Madeleine Albright	female	50%	12%
Richard Nixon	male	83%	12%
Leopold Figl	male	50%	10%
Francois Mitterand	male	38%	7%
Otto von Bismarck	male	95%	7%
Viktor Orban	male	14%	7%
Karl Renner	male	69%	2%
Siegfried Nagl	male	7%	2%
Kurt Schuschnigg	male	29%	0%
Sandra Frauenberger	female	7%	0%

6.3.2 Novelists

Degrees of Knowledge for Personal Names and Faces for the Category Novelists (1)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Thomas Brezina	male	79%	74%
Elfriede Jelinek	female	90%	55%
Joanne K. Rowling	female	90%	55%
Marcel Reich-Ranicki	male	76%	50%
Alfred Hitchcock	male	90%	40%
Astrid Lindgren	female	98%	36%
William Shakespeare	male	100%	36%
Christine Nöstlinger	female	79%	29%
Friedrich Nietzsche	male	98%	26%
Paulo Coehlo	male	81%	26%
Agatha Christie	female	95%	24%
Hera Lind	female	60%	24%
Johann Wolfgang v. Goethe	male	100%	24%
Bertha von Suttner	female	55%	21%
Franz Kafka	male	98%	19%
Aristoteles	male	98%	17%
Oscar Wilde	male	98%	17%
Thomas Bernhard	male	71%	17%
Willem Dafoe	male	60%	17%
Arthur Schopenhauer	male	90%	14%
Günter Grass	male	50%	14%
Arthur Schnitzler	male	93%	12%
Bertolt Brecht	male	95%	12%
Ernest Hemingway	male	95%	12%
Ingeborg Bachmann	female	76%	12%
Stieg Larsson	male	50%	12%
Friedrich Schiller	male	95%	10%
Immanuel Kant	male	98%	10%
Jane Austen	female	76%	10%
John Grisham	male	90%	10%

Degrees of Knowledge for Personal Names and Faces for the Category Novelists (2)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Karl May	male	88%	10%
Ludwig Wittgenstein	male	64%	10%
Max Frisch	male	81%	10%
Peter Handke	male	57%	10%
Simone de Beauvoir	female	64%	10%
Stephen King	male	100%	10%
Virginia Woolf	female	76%	10%
Albert Camus	male	50%	7%
Christoph Schlingensief	male	40%	7%
Edgar Allan Poe	male	95%	7%
Fjodor Michailowitsch Dostojewski	male	64%	7%
Franz Grillparzer	male	81%	7%
Franzobel	male	26%	7%
Friedrich Dürrenmatt	male	88%	7%
Isabell Alende	female	60%	7%
John Irving	male	81%	7%
Michael Köhlmeier	male	33%	7%
Platon	male	83%	7%
Umberto Ecco	male	79%	7%
Bernhard Schlink	male	26%	5%
Dan Brown	male	86%	5%
Daniel Kehlmann	male	24%	5%
Erich Kästner	male	100%	5%
Frank Schätzing	male	19%	5%
Heinrich Heine	male	83%	5%
Hermann Hesse	male	98%	5%
Irvin D. Yalom	male	21%	5%
Johannes Mario Simmel	male	21%	5%
Juli Zeh	female	12%	5%
Ken Follett	male	55%	5%

Degrees of Knowledge for Personal Names and Faces for the Category Novelists (3)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Marc Twain	male	93%	5%
Richard David Precht	male	19%	5%
Theodor Adorno	male	31%	5%
Thomas Glavinic	male	14%	5%
Thomas Mann	male	95%	5%
Wolf Haas	male	45%	5%
Adalbert Stifter	male	86%	2%
Christa Wolff	female	26%	2%
David Safier	male	12%	2%
Friedrich Thorberg	male	24%	2%
Gotthold Ephraim Lessing	male	88%	2%
Gustav Theodor Fechner	male	62%	2%
Haruki Murakami	male	40%	2%
Heinrich Mann	male	67%	2%
Henning Mankell	male	57%	2%
Hugo von Hoffmansthal	male	69%	2%
Kurt Tucholsky	male	43%	2%
Michael Ende	male	69%	2%
Michel Houellebecq	male	12%	2%
Patrick Süßkind	male	81%	2%
Rainer Maria Rilke	male	90%	2%
Robert Musil	male	45%	2%
Stephenie Meyer	female	24%	2%
Sven Regener	male	12%	2%
Terry Pratchett	male	38%	2%
Victor Hugo	male	50%	2%
Albrecht Haushofer	male	5%	0%
Barbara Frischmuth	female	12%	0%
Christoph Ransmayr	male	10%	0%
Cornelia Funke	female	31%	0%

Degrees of Knowledge for Personal Names and Faces for the Category Novelists (4)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Daniel Glattauer	male	24%	0%
Doris Lessing	female	12%	0%
E.T.A. Hoffmann	male	81%	0%
Ernst Jandl	male	26%	0%
Ferdinand von Saar	male	2%	0%
Florence Nightingale	male	38%	0%
George Orwell	male	76%	0%
Heinrich Böll	male	62%	0%
Heinrich von Kleist	male	60%	0%
Helmut Krausser	male	2%	0%
Honore de Balzac	male	33%	0%
Ingrid Noll	female	31%	0%
J. R. R. Tolkien	male	71%	0%
Johann Nestroy	male	86%	0%
Leo Tolstoi	male	81%	0%
Marie Luise Kaschnitz	female	2%	0%
Marie von Ebner-Eschenbach	female	55%	0%
Mario Vargas Llosa	male	0%	0%
Nick Hornby	male	45%	0%
Ödon von Horvath	male	67%	0%
Rosamunde Pilcher	male	98%	0%
Salman Rushdie	female	29%	0%
Stefan Zweig	male	57%	0%
Theodor Fontane	male	69%	0%
Wolfgang Hohlbein	male	33%	0%

6.3.3 Actors

Degrees of Knowledge for Personal Names and Faces for the Category Actors (1)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Arnold Schwarzenegger	male	100%	100%
Brad Pitt	male	100%	100%
Bruce Willis	male	100%	100%
George Clooney	male	100%	100%
Leonardo DiCaprio	male	100%	100%
Til Schweiger	male	100%	100%
Angelina Jolie	female	100%	98%
Ashton Kutcher	male	98%	98%
Cameron Diaz	female	98%	98%
Hugh Grant	male	100%	98%
Johnny Depp	male	100%	98%
Sandra Bullock	female	100%	98%
Tom Cruise	male	100%	98%
Tom Hanks	male	100%	98%
Adam Sandler	male	100%	95%
Ben Affleck	male	100%	95%
Elvis Presley	male	100%	95%
Gerard Depardieu	male	98%	95%
Julia Roberts	female	95%	95%
Marilyn Monroe	female	100%	95%
Whoopi Goldberg	female	98%	95%
Charlie Chaplin	male	100%	93%
Halle Barry	female	98%	93%
John Travolta	male	95%	93%
Nicole Kidman	female	100%	93%
Orlando Bloom	male	100%	93%
Pamela Anderson	female	100%	93%
Penelope Cruz	female	100%	93%
Richard Gere	male	98%	93%
Robin Williams	male	100%	93%

Degrees of Knowledge for Personal Names and Faces for the Category Actors (2)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Uschi Glas	female	98%	93%
Will Smith	male	98%	93%
Ben Stiller	male	100%	90%
Charlie Sheen	male	93%	90%
Jennifer Aniston	female	93%	90%
Kate Winslet	male	98%	90%
Eddie Murphy	male	100%	88%
Katie Holmes	female	95%	88%
Kevin Costner	male	100%	88%
Ottfried Fischer	male	95%	88%
Catherine Zeta Jones	female	98%	86%
Harrison Ford	male	95%	86%
Jim Carrey	male	93%	86%
Meg Ryan	female	98%	86%
Mel Gibson	male	98%	86%
Michael Douglas	male	100%	86%
Nicolas Cage	male	98%	86%
Patrick Swayze	male	95%	86%
Peter Falk (Columbo)	male	88%	86%
Romy Schneider	female	98%	86%
Sarah Jessica Parker	female	100%	86%
Alfons Haider	male	93%	83%
Bill Cosby	male	98%	83%
Clint Eastwood	male	100%	83%
Demi Moore	male	100%	83%
Enrique Iglesias	male	100%	83%
Eva Longoria	female	90%	83%
Goldie Hawn	female	90%	83%
Jack Nicholson	male	95%	83%
Keanu Reeves	male	95%	83%

Degrees of Knowledge for Personal Names and Faces for the Category Actors (3)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Matt Damon	male	95%	83%
Robert De Niro	male	100%	83%
Sean Connery	male	95%	83%
Uma Thurman	female	90%	83%
Vin Diesel	male	95%	83%
Anthony Hopkins	male	100%	81%
Antonio Banderas	male	100%	81%
Audrey Hepburn	female	98%	81%
Denzel Washington	male	98%	81%
Ed O'Neil (Al Bundy)	male	83%	81%
Fran Drescher (Fran Fine; Die Nanny)	female	76%	81%
Heath Ledger	male	98%	81%
Keira Knightley	female	100%	81%
Pierce Brosnan	male	93%	81%
Reese Witherspoon	female	93%	81%
Sylvester Stallone	male	100%	81%
Tim Allen (Tim Taylor; Hör mal wer da hämmert)	male	83%	81%
Veronika Ferres	female	100%	81%
Al Pacino	male	93%	79%
Ashley Olsen	female	86%	79%
Daniel Craig	male	95%	79%
Franka Potente	female	100%	79%
Jackie Chan	male	98%	79%
Renee Zellweger	female	93%	79%
Teri Hatcher (Susan; Desperate Housewives)	female	81%	79%
Jessica Alba	female	93%	76%
Jodie Foster	female	98%	76%
Kim Cattrall (Samantha; Sex and the City)	female	81%	76%

Degrees of Knowledge for Personal Names and Faces for the Category Actors (4)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Lindsay Lohan	female	95%	76%
Tobias Moretti	female	86%	76%
Danny DeVito	male	93%	74%
Meryl Streep	female	90%	74%
Michelle Pfeiffer	male	93%	74%
Moritz Bleibtreu	male	90%	74%
Woody Allen	male	100%	74%
Christina Applegate	female	90%	71%
Gwyneth Paltrow	female	95%	71%
Hugh Laurie (Gregory House; Dr. House)	male	69%	71%
Jude Law	male	95%	71%
Kevin James (Dough Heffermann; King of Queens)	male	71%	71%
Lauren Graham (Loreley Gilmore; Gilmore Girls)	female	79%	71%
Michael J. Fox	male	88%	71%
Patrick Dempsey (Dr. Shepherd; Grey's Anatomy)	male	71%	71%
Russell Crowe	male	98%	71%
Sarah Michelle Gellar (Buffy)	female	88%	71%
Scarlett Johanson	female	86%	71%
Uwe Ochsenknecht	male	90%	71%
Christoph Waltz	male	90%	69%
Elizabeth Taylor	female	90%	69%
Emma Watson	female	93%	69%
Jessica Biel	female	86%	69%
Karl Markovics (Stockinger; Kommissar Rex)	male	71%	69%
Marcia Cross (Bree; Desperate Housewives)	female	71%	69%

Degrees of Knowledge for Personal Names and Faces for the Category Actors (5)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Mary Kate Olsen	female	86%	69%
Roseanne Barr (Roseanne)	male	71%	69%
Ruth Drexel (Resi Berghammer; Bulle v. Tölz)	female	69%	69%
Sky Du Mont	male	81%	69%
Ellen Pompeo (Meredith Grey; Grey's Anatomy)	female	67%	67%
Eva Mendes	female	83%	67%
Gedeon Burkhard	male	71%	67%
Grace Kelly	female	100%	67%
Karl Merkatz (Mundl)	male	76%	67%
Kirsten Dunst	female	90%	67%
Lucy Liu	female	86%	67%
Mischa Barton (Marissa Cooper; O.C. California)	female	81%	67%
Peter Alexander	male	90%	67%
Robert Pattinson	male	71%	67%
Robert Redford	male	95%	67%
Adam Brody (Seth Cohen; O.C. California)	male	76%	64%
Colin Farrell	male	95%	64%
David Duchovny	male	64%	64%
Kim Basinger	female	90%	64%
Lionel Richie	female	98%	64%
Natalie Portman	female	93%	64%
Owen Wilson	male	86%	64%
Quentin Tarantino	male	98%	64%
Salma Hayek	male	93%	64%
Zach Braff (Scrubs)	male	69%	64%

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Audrey Tatou	female	64%	62%
Bette Midler	female	71%	62%
Carmen Electra	female	100%	62%
Christiane Hörbiger	female	74%	62%
Elijah Wood	male	83%	62%
Kate Hudson	female	98%	62%
Katherine Heigl	female	74%	62%
Kiefer Sutherland	male	83%	62%
Megan Fox	female	90%	62%
Senta Berger	female	83%	62%
Sharon Stone	female	95%	62%
Anne Hethaway	female	83%	60%
Bruce Lee	male	95%	60%
Cate Blanchett	female	90%	60%
Charlize Theron	female	86%	60%
Dustin Hoffmann	male	98%	60%
Freddie Prinze Junior	male	76%	60%
Jean-Claude VanDamme	male	90%	60%
Leslie Nielsen	male	81%	60%
Macaulay Culkin	male	64%	60%
Marlene Dietrich	female	95%	60%
Matt LeBlanc (Joey; Friends)	male	60%	60%
Matthew McConaughey	male	86%	60%
Morgan Freeman	male	95%	60%
Brooke Shields	female	83%	57%
Heike Makatsch	female	81%	57%
Iris Berben	female	86%	57%
Jack Black	male	69%	57%
James Dean	male	98%	57%
Jamie Lee Curtis	female	88%	57%

Degrees of Knowledge for Personal Names and Faces for the Category Actors (7)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Roger Moore	male	86%	57%
Daniel Radcliffe	male	86%	55%
David Schwimmer (Ross, Friends)	male	60%	55%
Diane Kruger	female	74%	55%
Hannelore Elsner	female	88%	55%
Hilary Swank	female	86%	55%
Jennifer Garner	female	76%	55%
Liv Tyler	female	88%	55%
Shannen Doherty (Brenda Walsh; Beverly Hills 90210)	female	69%	55%
Alyssa Milano	female	64%	52%
Brigitte Bardot	female	86%	52%
Hugh Jackman	male	88%	52%
Jennifer Love Hewitt	female	81%	52%
Klaus Jürgen Wussow	male	79%	52%
Marlon Brando	male	90%	52%
Ryan Phillippe	male	57%	52%
Steve Martin	male	81%	52%
Toby McGuire	male	79%	52%
Tori Spelling	female	71%	52%
Wesley Snipes	male	86%	52%
Alec Baldwin	male	83%	50%
Ben Becker	male	67%	50%
Calista Flockhart	female	64%	50%
Christina Ricci	female	69%	50%
David Caruso (Horatio Cane; CSI Miami)	male	60%	50%
Edward Norton	male	71%	50%
John Malkovich	male	86%	50%
Samuel L. Jackson	male	90%	50%
Brittany Murphy	female	69%	48%

Degrees of Knowledge for Personal Names and Faces for the Category Actors (8)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Diane Keaton	female	76%	48%
Elfriede Ott	female	86%	48%
Elizabeth Hurley	female	81%	48%
Kevin Spacey	male	86%	48%
Monika Weinzettl	female	52%	48%
Nina Proll	female	60%	48%
Sean Penn	male	88%	48%
Susan Sarandon	female	76%	48%
Winona Ryder	female	86%	48%
Chris Lohner	female	50%	45%
Christian Bale	male	62%	45%
Courtney Cox	female	79%	45%
Daniel Brühl	male	67%	45%
Harald Krassnitzer	male	81%	45%
Heinz Rühmann	male	64%	45%
Jürgen Vogel	male	64%	45%
Klaus Maria Brandauer	male	71%	45%
Mike Myers	male	76%	45%
Tyra Banks	female	76%	45%
Vince Vaughn	male	64%	45%
Wolfgang Böck (Inspektor Trautmann)	male	45%	45%
Andie MacDowell	female	69%	43%
Christine Neubauer	female	60%	43%
Ewan McGregor	male	74%	43%
Fritz Muliar (Max Koch; Kommissar Rex)	male	55%	43%
James (Jim) Belushi	male	69%	43%
Julia Stiles	female	57%	43%
Kurt Russell	male	81%	43%
Mickey Rourke	male	60%	43%
Sigourney Weaver	female	60%	43%

Degrees of Knowledge for Personal Names and Faces for the Category Actors (8)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Bill Murray	male	76%	40%
Billy Bob Thornton	male	57%	40%
Elke Winkens	female	57%	40%
Florian David Fitz (Marc Meier; Doctor's Diary)	male	38%	40%
Humphrey Bogart	male	71%	40%
Jake Gyllenhaal	male	60%	40%
Jane Fonda	female	86%	40%
Nora Tschirner	female	57%	40%
Tommy Lee Jones	male	88%	40%
Gene Hackman	male	76%	38%
Helen Hunt	female	74%	38%
Helmut Qualtinger	male	60%	38%
Jared Leto	male	55%	38%
Kirstie Alley	female	67%	38%
Monica Bellucci	female	86%	38%
Olivia Wilde (Dr. Hadey „Dreizehn"; Dr. House)	female	38%	38%
Sienna Miller	female	79%	38%
Zac Efron	male	57%	38%
Zsa-Zsa Gabor	female	71%	38%
David Letterman	male	67%	36%
Julianne Moore	female	55%	36%
Katja Riemann	female	71%	36%
Matthias Schwaighöfer	male	64%	36%
Priscilla Presley	female	88%	36%
Steven Seagal	male	64%	36%
Tilda Swinton	female	48%	36%
Wolke Hegenbarth	female	45%	36%
Adam Rodriguez (Eric Delko; CSI Miami)	male	40%	33%

Degrees of Knowledge for Personal Names and Faces for the Category Actors (9)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Benno Führmann	male	50%	33%
Jessica Schwarz	female	52%	33%
Kevin Bacon	male	67%	33%
Liza Minnelli	female	74%	33%
Otto Schenk	male	62%	33%
Robert Downey Jr.	male	71%	33%
Tom Selleck	male	55%	33%
Birgit Minichmayr	female	38%	31%
Blake Lively (Serena van der Woodsen; Gossip Girl)	female	38%	31%
Burt Reynolds	male	60%	31%
Christopher Reeve	male	52%	31%
Hans Moser	male	55%	31%
Klaus Kinski	male	64%	31%
Matthew Broderick	male	69%	31%
Susan Sideropolous	female	38%	31%
Tara Reid	female	64%	31%
Adrien Brody	male	50%	29%
Dolores Schmiedinger	female	43%	29%
Ethan Hawke	male	69%	29%
John Cusack	male	60%	29%
Martin Lawrence	male	48%	29%
Maximilian Schell	male	55%	29%
Michael Bublé	male	62%	29%
Ruppert Grint	male	33%	29%
Twiggy	female	36%	29%
Alexandra Maria Lara	female	31%	26%
Christian Slater	male	52%	26%
Colin Firth	male	52%	26%
Kate Beckinsale	female	60%	26%

Degrees of Knowledge for Personal Names and Faces for the Category Actors (10)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Maria Furtwängler	female	45%	26%
Nick Nolte	male	69%	26%
Ralph Fiennes	male	38%	26%
Robert Stadlober	male	40%	26%
Tony Curtis	male	74%	26%
Viggo Mortensen	male	45%	26%
Benicio Del Toro	male	36%	24%
Donald Sutherland	male	64%	24%
Jeff Goldblum	male	38%	24%
John Wayne	male	76%	24%
Leighton Meester (Blair Waldorf; Gossip Girl)	female	17%	24%
Mel Brooks	male	71%	24%
Naomi Watts	female	76%	24%
The Rock	male	43%	24%
Val Kilmer	male	48%	24%
Ben Kingsley	male	43%	21%
Cary Grant	male	55%	21%
Chevy Chase	male	36%	21%
Dan Ackroyd	male	33%	21%
Helena Bonham Carter	female	36%	21%
Javier Bardem	male	33%	21%
Laurence Fishburne	male	33%	21%
Paul Newman	male	71%	21%
William Shatner	male	43%	21%
Billy Crystal	male	57%	19%
Forest Whitaker	male	43%	19%
Judi Dench	female	24%	19%
Liam Neeson	male	48%	19%
Omar Sherif	male	71%	19%
Waltraud Haas	female	33%	19%

Degrees of Knowledge for Personal Names and Faces for the Category Actors (11)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Alfred Böhm	male	29%	17%
Erich Altenkopf (Dr. Niederbühl; Sturm der Liebe)	male	14%	17%
Erika Pluhar	female	31%	17%
Jason Biggs	male	36%	17%
Juliet Binoche	female	40%	17%
Michael Keaton	male	69%	17%
Christopher Walken	male	29%	14%
Conny Froboess	female	17%	14%
Greta Garbo	female	60%	14%
Haley Joel Osment	male	14%	14%
Jeremy Irons	male	31%	14%
Roberto Benigni	male	40%	14%
Christiane Paul	female	17%	12%
Dennis Hopper	male	64%	12%
Heinz Conrads	male	31%	12%
Mia Farrow	female	33%	12%
Fritz Karl	male	10%	10%
Luke Wilson	male	14%	10%
Oskar Werner	male	24%	10%
Felix Mitterer	male	38%	7%
Lilian Klebow	female	12%	7%
Ursula Strauss	female	17%	7%
Peter Blaikner	male	0%	0%
Tobias Ofenbauer	male	0%	0%

6.3.4 Singers

Degrees of Knowledge for Personal Names and Faces for the Category Singers (1)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Michael Jackson	male	100%	100%
Britney Spears	female	100%	98%
DJ Ötzi (Gerry Friedle)	male	100%	98%
Robbie Williams	male	100%	98%
Victoria Beckham	female	100%	98%
Amy Whinehouse	female	100%	95%
Christina Stürmer	female	98%	95%
Elton John	male	100%	95%
Janet Jackson	female	100%	95%
Jennifer Lopez	female	98%	95%
Bob Marley	male	100%	93%
Celine Dion	female	100%	93%
David Hasselhoff	male	100%	93%
Eminem	male	100%	93%
Herbert Grönemayer	male	100%	93%
Justin Timberlake	male	100%	93%
Madonna	female	98%	93%
Nena	female	100%	93%
Cher	female	98%	90%
Christina Aguilera	female	95%	90%
Janette Biedermann	female	98%	90%
Kylie Minogue	female	98%	90%
Pink	female	100%	90%
John Bon Jovi	male	100%	88%
Lady Gaga	female	100%	88%
Mariah Carey	female	100%	88%
Tina Turner	female	95%	88%
Beyoncé Knowles	female	93%	86%
Falco (Hans Hölzl)	male	100%	86%
Marilyn Manson	male	98%	86%

Degrees of Knowledge for Personal Names and Faces for the Category Singers (2)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Ozzy Osbourne	male	98%	86%
Rihanna	female	98%	86%
Sarah Connor	female	98%	86%
Shakira	female	93%	86%
Udo Jürgens	male	100%	86%
Whitney Houston	male	100%	86%
Avril Lavigne	female	93%	83%
Eros Ramazzotti	male	100%	83%
Hansi Hinterseer	male	100%	83%
John Lennon	male	95%	83%
Nina Hagen	male	98%	83%
Xavier Naidoo	male	95%	83%
Yvonne Catterfeld	female	98%	83%
Anastacia	female	98%	81%
Carla Bruni-Sarkozy	female	95%	81%
Geri Halliwell	female	90%	81%
Lenny Kravitz	male	95%	81%
Ricky Martin	male	100%	81%
Anna Netrebko	female	95%	79%
Barbara Streisand	female	90%	79%
Bill Kaulitz (Tokio Hotel)	male	88%	79%
Gwen Stefani	female	100%	79%
Katy Perry	female	100%	79%
Justin Biber	male	88%	76%
Tom Jones	male	95%	76%
Wolfgang Ambros	male	95%	76%
Alanis Morissette	female	95%	74%
Alicia Keys	female	95%	74%
Luciano Pavarotti	male	88%	74%
Nelly Furtado	female	93%	74%

Degrees of Knowledge for Personal Names and Faces for the Category Singers (3)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Paul Mc Cartney	male	100%	74%
Rainhard Fendrich	male	88%	74%
Sido	male	100%	74%
Kurt Cobain	male	93%	71%
Mick Jagger	male	98%	71%
Puff Daddy/P.Diddy	male	98%	71%
50 Cent	male	95%	69%
Lena Mayer-Landruth	female	86%	69%
Snoop Dogg	male	90%	69%
Bryan Adams	male	100%	67%
George Michael	male	88%	67%
Kid Rock	male	90%	67%
Melanie Chisholm (Mel C)	female	86%	67%
Ashlee Simpson	female	79%	64%
Bushido	male	98%	64%
Jazz Gitti	female	71%	64%
Pete Doherty	male	79%	64%
Phil Collins	male	93%	64%
Wolfgang Amadeus Mozart	male	100%	64%
Courtney Love	female	95%	62%
Dido	female	93%	62%
Freddie Mercury	male	95%	62%
Heino	male	88%	62%
James Blunt	male	95%	62%
Joe Cocker	male	95%	62%
Melanie Brown (Mel B)	female	88%	62%
Norah Jones	female	88%	62%
Peter Maffay	male	90%	62%
Udo Lindenberg	male	93%	62%
Bono	male	88%	60%

Degrees of Knowledge for Personal Names and Faces for the Category Singers (4)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Carlos Santana	male	93%	60%
Farin Urlaub	male	76%	60%
Jessica Simpson	female	93%	60%
Stevie Wonder	male	98%	60%
David Bowie	male	93%	57%
Frank Sinatra	male	98%	57%
Rod Stewart	male	95%	57%
Ronan Keating	male	95%	57%
Roy Black	female	90%	57%
Andrea Bocelli	male	76%	55%
Bob Dylan	male	98%	55%
Jimmy Hendrix	male	100%	55%
Judith Holofernes (Wir sind Helden)	female	60%	55%
Miley Cyrus	female	76%	55%
Nadine Beiler	female	67%	55%
Sting	male	93%	55%
Hubert von Goisern	male	71%	52%
Jan Delay	male	86%	52%
Nicole Scherzinger	female	88%	52%
Fred Durst (Limb Bizkit)	male	69%	50%
Georg Danzer	male	83%	50%
Kelly Clarkson	female	79%	50%
Leona Lewis	female	76%	50%
Prince	male	90%	50%
Thomas D	male	76%	50%
Bruno Mars	male	67%	48%
Johnny Cash	male	95%	48%
Missy Elliot	female	83%	48%
Steven Tyler (Aerosmith)	male	67%	48%
Tupac (2pac) Shakur	male	69%	48%

Degrees of Knowledge for Personal Names and Faces for the Category Singers (5)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Janis Joplin	female	93%	45%
Joss Stone	female	62%	45%
Shania Twain	female	88%	45%
Alice Cooper	male	81%	43%
Axel Rose	male	57%	43%
Beth Ditto (Gossip)	female	52%	43%
Louis Armstrong	male	98%	43%
Ringo Starr	male	90%	43%
Aimee Ann Duffy (Duffy)	female	57%	40%
Bjork	female	69%	40%
Karel Gott	male	81%	40%
Ludwig van Beethoven	male	98%	40%
Marius Müller Westernhagen	male	79%	40%
Max Raabe	male	71%	40%
Natalie Imbruglia	female	71%	40%
Ray Charles	male	86%	40%
Usher	male	88%	40%
Ville Valo	male	48%	40%
Bob Geldof	male	71%	38%
Dannii Minogue	female	62%	38%
Jack Johnson	male	81%	38%
Mary J. Blidge	female	64%	38%
Mietze (MIA)	female	50%	38%
Sinead O' Conner	female	64%	38%
Uwe Kröger	male	69%	38%
Bruce Springsteen	male	95%	36%
Jay Kay (Jamiroquai)	male	48%	36%
Jay-Z	male	71%	36%
Keith Richards	male	90%	36%
Sheryl Crow	female	88%	36%

Degrees of Knowledge for Personal Names and Faces for the Category Singers (6)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Diana Ross	female	79%	33%
Edith Piaf	female	79%	33%
Eric Clapton	male	98%	33%
Jim Morrison	male	86%	33%
Kim Wilde	female	69%	33%
Lilly Allen	female	76%	33%
Lisa Kudrow	female	43%	33%
Marianne Mendt	female	38%	33%
Meatloaf	male	76%	33%
Peter Fox	male	76%	33%
Placido Domingo	male	76%	33%
Barry White	male	83%	31%
Boy George	male	60%	31%
Kanye West	male	71%	31%
Ke$ha	female	55%	31%
Lukas Plöchl	male	50%	31%
Michelle Luttenberger (Luttenberger*Klug)	female	55%	31%
Reinhard Mey	female	83%	31%
Sean Paul	male	83%	31%
Aretha Franklin	female	57%	29%
Chris Rock	male	50%	29%
Flavor Flav (Public Enemy)	male	33%	29%
James Brown	male	79%	29%
Joy Denalane	female	38%	29%
Macy Gray	female	67%	29%
Peter André	male	40%	29%
Queen Latifah	female	62%	29%
Akon	male	64%	26%
Chris Martin	male	64%	26%
Franz Schubert	male	88%	26%

Degrees of Knowledge for Personal Names and Faces for the Category Singers (7)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Jamie Foxx	male	67%	26%
Lionel Messi	male	62%	26%
Nicole	female	45%	26%
Stefanie Werger	female	45%	26%
Adel Tawel (Ich und Ich)	male	29%	24%
Adele (Laurie Blue Adkins)	female	38%	24%
Billy Idol	male	88%	24%
Johann Strauss	male	98%	24%
Max Herre	male	33%	24%
Simone	female	48%	24%
Susan Boyle	female	43%	24%
Ludwig Hirsch	male	36%	21%
Michael Caine	male	52%	21%
Peter Brugger (Sportfreunde Stiller)	male	24%	21%
Pharrell Williams	male	38%	21%
Tommy Lee	male	60%	21%
Vanessa Mae (violin)	female	52%	21%
Sammy Davis Jr.	male	57%	19%
Tracy Chapman	female	76%	19%
Art Garfunkel	male	74%	17%
Brian Molko (Placebo)	male	26%	17%
Christina Klug (Luttenberg*Klug)	female	62%	17%
Inga Humpe (2raumwohnung)	female	33%	17%
LL Cool J (Rapper)	male	55%	17%
Slash	male	33%	17%
Austrofred	male	24%	14%
Lars Ulrich	male	50%	14%
Neil Young	male	81%	14%
Paolo Nutini	male	38%	14%
Peter Cornelius	male	50%	14%

Degrees of Knowledge for Personal Names and Faces for the Category Singers (8)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Kate Nash	female	45%	12%
Pit Bull	male	55%	12%
Sade	female	31%	12%
Andrew Lloyd Webber	male	93%	10%
Angus Young (AC/DC)	male	31%	10%
Gregor Mendel	male	83%	10%
Ice T	male	52%	10%
Kate Bush	female	48%	10%
Leslie Feist (Feist)	female	19%	10%
Maria Callas	female	55%	10%
Marla Glen	female	12%	10%
Steven Patrick Morrissey	male	14%	10%
Barry Manilow	male	64%	7%
Ice Cube	male	52%	7%
Johann Sebastian Bach	male	98%	7%
PJ Harvey	female	14%	7%
Nina Simone	female	19%	5%
Clara Luzia	female	12%	2%
Dirk von Lowtzow (Tocotronic)	male	12%	2%
Elvis Costello	male	36%	2%
Josef Haydn	male	88%	2%
Anja Plaschg (Soap and Skin)	female	2%	0%
Gustav Mahler	male	83%	0%
Hans-Peter Falkner (Attwenger)	male	17%	0%

6.3.5 Scientists

Degrees of Knowledge for Personal Names and Faces for the Category Scientists (1)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Albert Einstein	male	100%	100%
Siegmund Freud	male	100%	83%
Bill Gates	male	100%	81%
Steve Jobs	male	67%	55%
Danielle Spera	female	55%	50%
Stephen Hawking	male	86%	38%
Konrad Lorenz	male	88%	33%
Charles Darwin	male	98%	31%
Marie Curie	female	88%	21%
Anna Freud	female	86%	19%
Neil Armstrong	male	95%	17%
Philip Zimbardo	male	69%	17%
Viktor Frankl	male	62%	17%
Karl Popper	male	83%	14%
Paul Watzlawick	male	62%	14%
Alfred Adler	male	64%	10%
Anton Zeilinger	male	31%	10%
Carl Gustav Jung	male	83%	10%
Charlotte Bühler	female	81%	7%
Eric Kandel	male	7%	7%
Erwin Schrödinger	male	31%	7%
Iwan Petrowitsch Pawlow	male	71%	7%
Jean Piaget	male	81%	7%
Alexander von Humboldt	male	60%	5%
Erik Erikson	male	64%	5%
Johannes Keppler	male	79%	5%
Karl Bühler	male	74%	5%
Nikola Tesla	male	29%	5%
Robert Koch	male	50%	5%
Wilhelm Wundt	male	71%	5%

Degrees of Knowledge for Personal Names and Faces for the Category Scientists (2)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Alexander Flemming	male	52%	2%
Carl Djerassi	male	5%	2%
Ignaz Semmelweis	male	69%	2%
Isaac Newton	male	98%	2%
Karl Landsteiner	male	21%	2%
Lise Meitner	female	7%	2%
Mary Ainsworth	female	31%	2%
Niels Bohr	male	40%	2%
Nikolaus Kopernikus	male	83%	2%
Pierre Curie	male	64%	2%
Simon Binet	male	62%	2%
Werner Heisenberg	male	21%	2%
Alfred Nobel	male	71%	0%
Carl Friedrich Gauß	male	43%	0%
Conrad Röntgen	male	76%	0%
Ferdinand de Saussure	male	7%	0%
Francis Crick	male	10%	0%
James Watson	male	40%	0%
James Watt	male	36%	0%
Josef Ressel	male	17%	0%
Karl Jaspers	male	69%	0%
Konrad Zuse	male	2%	0%
Max Planck	male	90%	0%
Noam Chomsky	male	19%	0%

6.3.6 Painters

Degrees of Knowledge for Personal Names and Faces for the Category Painters (1)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Frida Kahlo	female	76%	60%
Yoko Ono	female	83%	48%
Pablo Picasso	male	100%	43%
Dean Martin	male	76%	38%
Salvador Dali	male	83%	36%
Vincent van Gogh	male	98%	33%
Andy Warhol	male	93%	31%
Leonardo Da Vinci	male	100%	29%
Manfred Deix	male	64%	29%
Hermann Nitsch	male	55%	24%
Bob Ross	male	36%	21%
Friedensreich Hundertwasser	male	98%	21%
Arik Brauer	male	26%	19%
Ernst Fuchs	male	50%	19%
Albrecht Dürer	male	93%	17%
Alfons Mucha	male	45%	14%
Claude Monet	male	93%	14%
Egon Schiele	male	93%	14%
Engelbert Dollfuß	male	60%	12%
Christian Ludwig Attersee	male	24%	7%
Gustav Klimt	male	100%	7%
Edvard Munch	male	74%	5%
Maria Lassnig	female	19%	5%
Auguste Rodin	male	31%	2%
Casper David Friedrich	male	24%	2%
Gottfried Helnwein	male	14%	2%
Joseph Beuys	male	7%	2%
Michelangelo (Buonarrotti)	male	83%	2%
Paul Cezanne	male	60%	2%

Degrees of Knowledge for Personal Names and Faces for the Category Painters (1)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Rembrandt	male	93%	2%
Roy Lichtenstein	male	48%	2%
Valie Export	female	17%	2%
Arnulf Rainer	male	19%	0%
Daniel Richter	male	12%	0%
Edouard Manet	male	43%	0%
Franz Marc	male	14%	0%
Franz West	male	0%	0%
Gerhard Richter	male	7%	0%
Günter Brus	male	2%	0%
Hans Makart	male	24%	0%
Jackson Pollock	male	26%	0%
Jan Vermeer	male	26%	0%
Lucas Cranach	male	5%	0%
Marc Chagall	male	50%	0%
Max Weiler	male	12%	0%
Oskar Kokoschka	male	57%	0%
Otto Dix	male	12%	0%
Paul Gauguin	male	60%	0%
Paul Klee	male	48%	0%
Peter Paul Rubens	male	64%	0%
Pierre-Auguste Renoir	male	67%	0%
Raffaelo Santi (Raffael)	male	21%	0%
Rudolf von Alt	male	5%	0%
Sandro Boticelli	male	64%	0%
Wassily Kandinsky	male	48%	0%
Rembrandt	male	93%	2%

6.3.7 Comedians

Degrees of Knowledge for Personal Names and Faces for the Category Comedians (1)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Anke Engelke	female	100%	93%
Michael "Bully" Herbig	male	98%	93%
Oliver Pocher	male	98%	93%
Otto Waalkes	male	93%	88%
Harald Schmidt	male	98%	86%
Robert Palfrader (Wir sind Kaiser)	male	81%	79%
Hella von Sinnen	female	86%	76%
Alfred Dorfer	male	83%	69%
Atze Schröder	male	86%	69%
Hape Kerkeling	male	81%	69%
Helge Schneider	male	95%	69%
Mario Barth	male	88%	69%
Michael Mittermaier	male	95%	69%
Michael Niavarani	male	76%	69%
Roland Düringer	male	81%	69%
Sacha Baron Cohen (Ali G, Borat)	male	74%	69%
Alf Poier	male	76%	67%
Bastian Pastewka	male	76%	67%
Rowan Atkinson	male	86%	67%
Cindy aus Mahrzahn	female	67%	62%
Josef Hader	male	81%	60%
Viktor Gernot	male	60%	55%
Christian Tramitz	male	67%	52%
Andreas Vitasek	male	74%	50%
Ingo Appelt	male	62%	50%
Ingolf Lück	male	62%	48%
Markus Maria Profitlich	male	48%	45%
Loriot	male	64%	43%

Degrees of Knowledge for Personal Names and Faces for the Category Comedians (2)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Andrea Händler	female	43%	38%
Dieter Nuhr	male	48%	38%
Gernot Kulis	male	57%	36%
Kaya Yanar	male	38%	36%
Rick Kavanian	male	43%	36%
Willi Resetarits	male	67%	33%
Lukas Resetarits	male	67%	31%
Christoph Maria Herbst	male	45%	29%
Gerold Rudle	male	33%	29%
Günther Paal (Gunkl)	male	36%	29%
Thomas Hermanns	male	33%	29%
Alexander Göbel	male	52%	26%
Christoph Fälbl	male	36%	26%
Joesi Prokopetz	male	50%	26%
Stan Laurel	male	45%	26%
Paul Panzer	male	55%	24%
Bülent Ceylan	male	26%	21%
Dr. Eckart von Hirschhausen	male	33%	21%
Piet Klocke	male	24%	19%
Thomas Maurer	male	31%	19%
Jerry Seinfeld	male	40%	17%
Bernhard Ludwig	male	19%	12%
Gerhard Polt	male	26%	12%
Karl Valentin	male	21%	10%
Sissi Perlinger	female	21%	10%

Degrees of Knowledge for Personal Names and Faces for the Category Comedians (3)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Carolin Kebekus	female	12%	7%
Volker Pispers	male	17%	7%
Hagen Rether	male	5%	5%
Jeff Dunham	male	14%	5%
Kurt Krömer	male	10%	5%
Thomas Stipsits	male	14%	2%
John Stewart	male	24%	0%
Serdar Somuncu	male	7%	0%

6.3.8 Historical Figures

Degrees of Knowledge for Personal Names and Faces for the Category Historical Figures (1)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Buddha	male	100%	79%
Jesus Christus	male	95%	74%
Julius Caesar	male	93%	69%
Cleopatra	female	98%	67%
Franz Josef (Kaiser)	male	98%	67%
Anne Frank	female	100%	62%
Napoleon Bonaparte	male	98%	62%
Elisabeth Amalie Eugenie, Kaiserin ("Sissi")	female	74%	52%
Kaiserin Maria Theresia	female	98%	45%
Alexander der Große	male	98%	19%
Königin Viktoria	female	69%	19%
Ludwig XIV	male	76%	19%
Jeanne d'Arc (Johanna von Orleans)	female	93%	17%
Marie Antoinette	female	98%	17%
Christoph Kolumbus	male	100%	14%
Martin Luther	male	83%	14%
Sophie Scholl	female	74%	14%
Casanova	male	95%	12%
Johannes Gutenberg	male	86%	12%
Cicero	male	90%	10%
Galileo Galilei	male	98%	10%
Kronprinz Rudolf (Österreich-Ungarn)	male	64%	10%
Rosa Luxemburg	female	52%	10%
Andreas Hofer	male	62%	7%
Dschingis Khan	male	88%	7%
Hannibal	male	98%	5%
Nero	male	69%	5%

Degrees of Knowledge for Personal Names and Faces for the Category Historical Figures (2)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Friedrich Barbarossa	male	69%	2%
Friedrich II von Preußen	male	45%	2%
Maria Stuart	female	69%	2%
Maria Vetsera	female	19%	2%
Ferdinand Magellan	male	52%	0%
Fürst von Metternich	male	86%	0%
Heinrich V	male	45%	0%
Heinrich VIII	male	48%	0%
Kaiser Karl der Große	male	90%	0%
Katharina die Große	female	79%	0%
König Artus	male	81%	0%
Oskar Schindler	male	57%	0%

6.3.9 Athletes

Degrees of Knowledge for Personal Names and Faces for the Category Athletes (1)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Michael Schuhmacher	male	100%	100%
Boris Becker	male	100%	98%
David Backham	male	100%	98%
Niki Lauda	male	100%	98%
Steffi Graf	female	100%	95%
Vladimir Klitschko	male	98%	88%
Armin Assinger	male	86%	86%
Anton (Toni) Polster	male	88%	83%
Lothar Matthäus	male	95%	83%
Oliver Kahn	male	100%	83%
Vitali Klitschko	male	93%	83%
Andre Agassi	male	93%	79%
Franz Beckenbauer	male	95%	76%
Tiger Woods	male	100%	76%
Christiano Ronaldo	male	90%	74%
Hermann Maier	male	86%	74%
Joachim Löw	male	86%	71%
Mike Thyson	male	93%	71%
Andreas Goldberger	male	79%	69%
Markus Rogan	male	83%	69%
Michael Ballack	male	93%	69%
Sebastian Vettel	male	88%	69%
Zinedine Zidane	male	95%	67%
Anna Kournikova	female	93%	64%
Diego Maradonna	male	86%	62%
Herbert Prohaska	male	79%	62%
Mirna Jukic	female	74%	62%
Ronaldinho	male	90%	62%

Degrees of Knowledge for Personal Names and Faces for the Category Athletes (2)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Stefan Effenberg	male	88%	62%
Bastian Schweinsteiger	male	79%	60%
Franziska van Almsick	female	81%	60%
Hulk Hogan	male	74%	60%
Mika Hakkinen	male	83%	60%
Thomas Muster	male	64%	60%
Hans Krankl	male	76%	57%
Michael Jordan	male	88%	57%
Benjamin Raich	male	76%	55%
Alexandra Meissnitzer	female	74%	52%
Katharina Witt	female	74%	52%
Muhammad Ali	male	90%	52%
Jan Ulrich	male	79%	50%
Lukas Podolski	male	74%	50%
Michaela Dorfmeister	female	74%	50%
Serena Williams	female	76%	50%
Andreas Herzog	male	74%	48%
Gerhard Berger	male	60%	48%
Mesut Özil	male	64%	48%
Dirk Nowitzki	male	62%	45%
Miroslav Klose	male	76%	45%
Stefan Eberharter	male	71%	45%
David Coulthard	male	76%	43%
Ivo Vastic	male	74%	43%
Jürgen Kliensmann	male	71%	43%
Lisa Marie Presley	male	83%	43%
Renate Götschl	female	71%	43%
Roger Federer	male	83%	43%
Sven Hannawald	male	67%	43%
Thomas Morgenstern	male	83%	43%

Degrees of Knowledge for Personal Names and Faces for the Category Athletes (3)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Venus Williams	female	71%	43%
Franz Klammer	male	67%	40%
Jürgen Melzer	male	76%	40%
Kevin Federline	male	71%	40%
Marlies Schild	male	71%	40%
Philip Lahm	male	62%	40%
Wayne Rooney	male	60%	40%
Fernando Alonso	male	88%	38%
Lewis Hamilton	male	88%	38%
Michael Konsel	male	60%	38%
Pele	male	69%	38%
Rafael Nadal	male	76%	38%
Lance Amstrong	male	93%	36%
Lindsey Vonn	female	67%	36%
Toni Sailer	male	60%	33%
Gregor Schlierenzauer	male	76%	31%
Maria Riesch	female	50%	31%
Regina Halmich	female	45%	31%
Mario Matt	male	57%	29%
Nicole Hosp	female	50%	29%
Usain Bolt	male	40%	29%
Michael Phelps	male	55%	26%
Michael Walchhofer	male	57%	26%
Patrick Ortlieb	male	57%	26%
Pete Sampras	male	55%	26%
Annemarie Moser-Pröll	female	43%	24%
Felix Gottwald	male	64%	24%
Fritz Strobl	male	52%	24%
Marko Arnautovic	male	48%	24%
Georg Hackl	male	43%	19%

Degrees of Knowledge for Personal Names and Faces for the Category Athletes (4)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Karl Schranz	male	48%	19%
Fabian Hambüchen	male	29%	17%
Kaka	male	52%	17%
Manuel Neuer	male	31%	17%
Ernst Happel	male	90%	14%
Stefan Meierhofer	male	43%	14%
Horst Skoff	male	26%	12%
Tamira Paszek	female	31%	12%
Hans Grugger	male	29%	10%
Steffen Hoffmann	male	33%	10%
Birgit Prinz	female	19%	7%
Magdalena Neuner	female	17%	7%
Toni Kross	male	19%	7%
Werner Schlager	male	26%	7%
Clemens Doppler	male	33%	5%
Thomas Vanek	male	26%	5%
Ludger Beerbaum	male	7%	2%
Max Schmeling	male	29%	2%
Roman Hagara	male	26%	2%

6.3.10 TV stars

Degrees of Knowledge for Personal Names and Faces for the Category TV stars (1)

Personal Name	Gender	Degree of Knowledge	
		Name	Face
Claudia Schiffer	female	100%	100%
Dieter Bohlen	male	100%	100%
Günther Jauch	male	100%	100%
Heidi Klum	female	98%	98%
Paris Hilton	female	100%	98%
Stefan Raab	male	100%	98%
Thomas Gottschalk	male	100%	98%
Verona Feldbusch	female	100%	95%
Arabella Kiesbauer	female	95%	90%
Richard Lugner	male	98%	90%
Elton	male	88%	88%
Michelle Hunziger	female	98%	88%
Dita von Teese	female	98%	83%
Jamie Oliver	male	93%	81%
Kelly Osbourne	female	100%	79%
Kai Pflaume	male	93%	76%
Sonja Kraus	female	98%	76%
Christoph Grissemann	male	88%	74%
Dirk Stermann	male	86%	74%
Anastasia Sokol ("Katzi")	female	83%	71%
Barbara Karlich	female	88%	71%
Jürgen von der Lippe	male	90%	71%
Miriam Wechselbraun	female	81%	71%
Dominik Heinzl	male	79%	69%
Jörg Pilawa	male	81%	69%
Oprah Winfrey	female	93%	67%
Rudi Carrell	male	90%	67%
Barbara Schöneberger	female	76%	62%
Daniela Katzenberger	female	88%	62%

Degrees of Knowledge for Personal Names and Faces for the Category TV stars (2)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Dirk Bach	male	83%	60%
Ingrid Thurnher	female	67%	60%
Johannes B. Kerner	male	79%	60%
Nicole Richie	female	86%	60%
Oliver Geissen	male	88%	60%
Sharon Osbourne	female	86%	60%
Vera Russwurm	female	67%	60%
Uri Geller	male	95%	57%
Britt Hagedorn (Britt)	female	57%	55%
Karl Moik	male	76%	55%
Peter Rapp	male	62%	55%
Klaus Eberhartinger	male	71%	50%
Katie Price (Jordan)	female	79%	48%
Armin Wolf	male	55%	45%
Desirée Nick	female	60%	45%
Elisabeth Engstler	female	60%	43%
Jack Osbourne	male	67%	43%
Sarah Kuttner	female	69%	43%
Sonja Zietlow	female	64%	43%
Christian Ulmen	male	55%	40%
Doris Golpashin	female	60%	40%
Markus Lanz	male	57%	38%
Christoph Feuerstein	male	40%	36%

Degrees of Knowledge for Personal Names and Faces for the Category TV stars (3)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Klaas Heufer-Umlauf (Joko und Klaas)	male	36%	31%
Mirja Boes	female	33%	31%
Dave Chappelle	male	36%	26%
Jerry Springer	male	52%	26%
Anne Will	female	40%	21%
Joachim Winterscheid (Joko und Klaas)	male	26%	21%
Marie-Claire Zimmermann	female	52%	21%
Jay Leno	male	48%	19%
Martin Rütter	male	19%	19%
Reinhold Beckmann	male	52%	17%

6.3.11 Others

Degrees of Knowledge for Personal Names and Faces for the Category TV stars (1)

		Degree of Knowledge	
Personal Name	Gender	Name	Face
Osama Bin Laden	male	100%	93%
Naomi Campbell	female	98%	90%
Papst Johannes Paul II.	male	98%	90%
Hugh Hefner	male	98%	83%
Karl Lagerfeld	male	100%	83%
Dalai Lama	male	95%	81%
Gisele Bundchen	female	93%	79%
Kate Moss	female	98%	79%
Papst Benedict XVI	male	93%	74%
Josef Fritzl	male	90%	71%
Mutter Theresa	female	95%	71%
Donatella Versace	female	90%	62%
Monica Lewinsky	female	90%	60%
Michael Moore	male	90%	55%
Donald Trump	male	88%	48%
Steven Spielberg	male	100%	48%
Vivienne Westwood	female	81%	48%
Guy Ritchie	male	95%	40%
Linda Evangelista	female	71%	36%
Coco Chanel	female	98%	33%
Roman Polanski	male	81%	31%
Jackie Onassis	female	62%	24%
George Lucas	male	57%	21%
Stella McCartney	female	76%	19%
James Cameron	male	74%	17%
Jean-Paul Gaultier	male	95%	12%
Tim Burton	male	81%	12%
Warren Beatty	male	38%	10%
Martin Scorsese	male	48%	7%

6.4 List of figures and tables

7 Academic Curriculum

Personal Information

Date of birth: 01/21/1985 in Bucharest/Romania
Citizenship: German
Email: johanna.palcu@gmail.com

Education and Academic Qualifications

10/2006 – 01/2012	Study of Psychology at University of Vienna (Austria) Areas of Interest: • Social Psychology with Focus on Consumer and Advertising Psychology • Psychological Basic Research
03/2011 – 01/2012	Study Assistant at the Department of Economic Psychology Educational Psychology and Evaluation (University of Vienna, Austria)
10/2004-07/2006	Study of Drama, Psychology and Philosophy at Ludwig-Maximilians University Munich (Germany)
11/1995- 06/2004	Rudolf–Diesel Secondary School in Augsburg (Germany) with General Qualification for University Entrance

Research Skills

- Extensive knowledge of SPSS
- Programming ability in experimental research software (Eprime, Inquisit and GlobalPark)
- Familiar with HTML
- Excellent knowledge in the use of Microsoft Office, Adobe Photoshop, EndNote and Internet Research
- Extensive knowledge of the APA publication guidelines

Language Skills

- German: mother tongue
- English: fluent, nearly mother-tongue fluency
- Romanian: fluent, nearly mother-tongue fluency
- French: basic communication

Johanna Palcu Vienna, November 30th, 2011