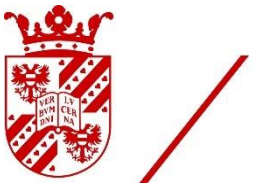

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Investigating the Impact of Face Memorability on Associative Recall of Person Information

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A thesis is an aptitude test for students. The approval of the thesis is proof that the student has sufficient research and reporting skills to graduate, but does not guarantee the quality of the research and the results of the research as such, and the thesis is therefore not necessarily suitable to be used as an academic source to refer to. If you would like to know more about the research discussed in this thesis and any publications based on it, to which you could refer, please contact the supervisor mentioned.

Throughout the writing process, ChatGPT is used to review and improve the grammar and academic writing style of this thesis.

Abstract

The task of associating names with faces is a complex cognitive challenge for individuals that holds significant social value. Previous research has examined how the memorability of faces influences the ability to recall associated names. However, questions remain regarding the effect of presentation modality on this phenomenon and whether memorable faces influence recall of associated information. The current study will investigate these questions using three studies with a within-subject design. Experiment 1 ($N = 60$) investigates how visual versus auditory presentation modalities of the names interact with face memorability in face-name recall. Experiment 2a ($N = 60$) examines whether memorable faces influence the recall of associated information, specifically name-profession associations, when the memorable face was task-irrelevant. Experiment 2b ($N = 60$) builds on these findings by testing whether actively incorporating memorable faces into the engram enhances recall of associated information, manipulating face memorability and recall cues. Results indicate that memorable faces consistently impact face-name memory regardless of presentation modality of the name. However, when memorable faces are not actively encoded in the engram, they do not significantly influence the recall of associated information, such as name-profession pairs. Moreover, results regarding the effect of actively encoding memorable faces in the engram are inconclusive, requiring additional research with greater statistical power. This study contributes to a deeper understanding of the complex dynamics involving face memorability, presentation modality, and the recall of associated information.

Keywords: memorability, face-name association, associative learning, recall-task, presentation modality.

Introduction

Do you know the feeling of having spoken to someone earlier and not remembering their name anymore? This is a common and often embarrassing experience. Recalling face-name associations is not only one of the most challenging associative memory tasks for humans, but it is also a task that is highly socially valued (Avery et al., 2016). This task highlights the complexities of associative memory for humans, requiring the connection of seemingly unrelated pieces of information (James, 2004). Additionally, it is one of the memory tasks where older adults experience the fastest decline (Sperling et al., 2001). Given the importance and difficulty of learning associations between unrelated pieces of information, exploring ways to enhance associative learning is valuable. In the current study, we explore whether the intrinsic memorability of one of the two pieces of information can strengthen the associative link. To do so, we made use of what seems to be the most challenging task of associative memory: learning the association between a face and a name.

Associative memory

Associative memory, at its core, involves linking unrelated items in the mind. This is a fundamental aspect of cognition and one of the most common forms of memory used in everyday situations (Suzuki, 2008). Beyond face-name recall, associative memory appears in various aspects of everyday life. For instance, in spatial navigation, research indicates that humans rely on spatial associative memory to form mental maps of their surroundings. This memory allows individuals to remember the locations of landmarks and pathways, facilitating efficient navigation through familiar environments. By forming associations between landmarks and their spatial relationships, people can navigate confidently and adapt their routes based on their memory of the environment (Ngo et al., 2016). Additionally, in learning a new language, individuals engage in a process where they must connect words with their

meanings and understand grammatical rules, which heavily relies on associative memory (Mårtensson & Lövdén, 2011). Connectionist models, which emphasize the strength of associations between nodes, offer valuable insights into how these associations are formed and utilized. For example, when learning Dutch, forming strong associations between "hond" (dog) and its meaning, or understanding how adjectives like "klein" (small) relate to nouns, illustrates the role of associative memory in language acquisition (Lachter & Bever, 1988).

In an associative memory task, participants learn a specific association between elements in the encoding phase. Within the brain there will be a network of neurons created about this association, this is called an engram (Josselyn & Tonegawa, 2020). In the test phase they are tasked with recalling the elements of the encoded association, the element that is given in the test phase is called a cue. For a face-name association, the face and the name of a person are the elements of the engram. In the test phase, the cue is either the face or the name from which the participant must recall the associated element (Alegret et al., 2020).

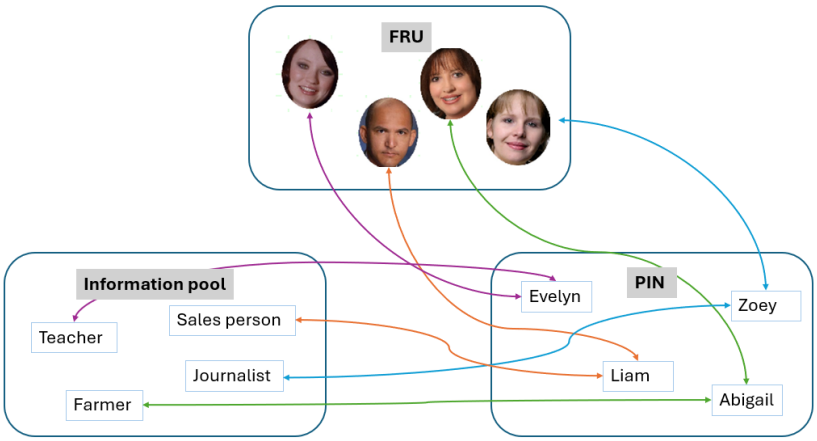
Face-name recall

Face-name association memory relies on specialized neural substrates, such as the fusiform gyrus, which plays a crucial role in the encoding, storing, and retrieving of facial information (Kanwisher et al., 1997). One important concept in this context is the 'face recognition unit' (FRU). The FRU stores the structural description of a face and is specific to each familiar face. When any view of a familiar face is seen, the corresponding FRU becomes active (Bruce & Young, 1986). After activation, an FRU can trigger the corresponding 'person identity node' (PIN). However, it is noteworthy that the PIN can not solely be activated by an FRU but also responds to for example voice recognition (Cohen & Burke, 1993). The PIN provides access to a pool with information units about that person, such as the profession they work in or other relevant details. This mechanism, illustrated in Figure 1, is central to

associative encoding and retrieval. When a PIN is activated by an FRU, it triggers the retrieval of any associated information by activating the corresponding units within the information pool. This process allows facial information and semantically related information to be stored and retrieved together, facilitating efficient recognition and recall of familiar faces and their associated details (Burton et al., 1990).

Figure 1.

Brain Network with FRU, PIN, and Information Pool



Improvement of associative memory with memorability

Given this mechanism of face-name association, a key research question arises: Does stronger activation of the FRU enhance recall of face-name associations? Evidence from models of spreading activation in memory networks suggests that increased activation of initial nodes, such as FRUs, indeed enhances the activation of associated nodes, such as PINs (Foster et al., 2016). Thus, when the FRU is more strongly activated, the association with the PIN and the broader information pool might also be activated more strongly.

Image memorability is one factor that may improve associative recall by increasing the activation of the units that form an engram. Bainbridge et al. (2017) found that memorability leads to great activation levels in the neural network. Research shows that for

example images vary in their memorability, such that different people consistently tend to remember and forget the same images as others (Bainbridge, 2019; Bainbridge et al., 2013). Hebart et al. (2019) analyzed a large dataset and discovered specific images that are memorable. Memorability is influenced by factors such as image composition, semantic content (Isola et al., 2014), and visual saliency (Bylinskii et al., 2015), although the exact mechanisms are still unknown. Interestingly, high memorability can be found in concepts other than images, such as words or sounds (Clark & Burchett, 1994; Ramsay et al., 2018). In the following discussion, we will review three studies that investigate the impact of memorability on associative recall performance.

Research on word association memory provides evidence that memorable items can enhance memory associations. Madan et al. (2010) studied associative memory with word pairs. In their study, they used high-frequency words, which are easier to recall, as well as high-imageable words, which are not only better remembered but also better recognized. Word pairs were created either pure (composed of two items of the same class, i.e., high–high or low–low), or mixed (composed of items differing in class, i.e., high–low or low–high). The study assessed the recall of associations between these word pairs in both forward and backward directions. The results showed that the imageability of a word influences both memory for items and memory for associations. Specifically, a high-imageability word enhances memory for the association, as demonstrated by the higher accuracy in the recall of these associations. These result supports the hypothesis that using highly memorable items in an associative task can improve the recall of the associated elements.

Van der Wal (2021) conducted research to test the hypothesis that memorable images of faces can improve face-name associations. Their research focused on the recall of names associated with memorable or non-memorable faces. Participants were exposed to both relatively memorable (referred to as memorable) and relatively non-memorable (referred to

as non-memorable) face images while simultaneously listening to audio containing the corresponding names. The findings revealed a significant positive effect of face memorability on face-name recall, such that participants were better in recalling the names associated with memorable faces compared to non-memorable faces.

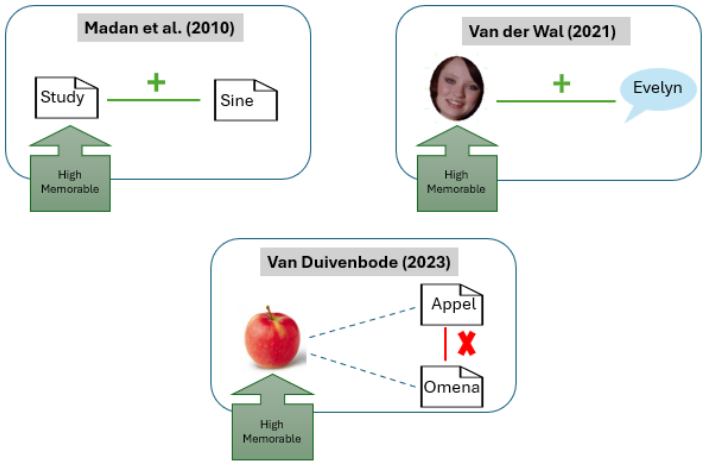
While these two studies support the effect of memorability on associative memory, Van Duivenboden (2023) conducted research on the memorization of translations of Finnish words and did not find a significant effect of memorability. The study involved participants viewing both memorable and non-memorable images of objects, while simultaneously being shown the Finnish and Dutch names for these objects on the screen. The task for participants was to recall the Dutch word when the Finnish word was given as cue. The investigation aimed to determine whether participants demonstrated better recall of word translations when an illustration of a memorable image was used compared to non-memorable images. The results showed that no significant effect was found of memorability on the recall of translation associations.

These studies (Madan et al., 2010; Van Der Wal, 2021; Van Duivenboden, 2023) showed mixed results, as illustrated in Figure 2. Madan et al. (2010) and Van der Wal (2021) both found a positive effect of memorability, despite using different presentation methods. Madan et al. (2010) presented the word pairs visually, a unimodal presentation modality, whereas Van Der Wal (2021) presented faces visually but names auditorily, a cross-modal presentation modality. This suggests that the modality of the element associated with the memorable or non-memorable element does not significantly impact the effect of memorability. However, it is important to note that neither study directly compared unimodal and cross-modal presentations, which limits the strength of this conclusion.

While the studies of Madan et al. (2010) and Van der Wal (2021) found a significant effect of memorability, Van Duivenboden's (2023) study indicated no significant influence of memorability. In their study, memorable and non-memorable images were not required for the to be encoded engram. Instead, these images served as illustrations for the studied word pairs. It remains unclear whether memorability can impact associative memory when the memorable stimulus is actively encoded as part of the engram.

Figure 2.

Study Results of Madan et al. (2010), Van der Wal (2021) and Van Duivenboden (2023)



Presentation modality and improved associative memory

Previous studies have found that memorable items improve associative memory both when the elements are presented unimodally or cross-modally, but no study has directly compared the effects of item memorability on remembering associated information presented in either the same or a different modality. So, it is unclear from these results whether presentation modality might modulate the effect of memorable items on associative memory. In the current study, we address this matter by the research question: What is the effect of presentation modalities of the face and name, cross modal vs. unimodal, on the effect of face memorability in the associative memory task face-name recognition?

Competing hypotheses can be formulated regarding the impact of presentation modality of a name on the effect of face memorability on face-name recall. According to Burton et al. (1990), information about a person, whether presented visually or auditorily, activates the same PIN. This PIN maintains an association with the FRU. Importantly, this theory posits that the strength of the association between the PIN and the FRU is not influenced by the modality in which the person's name is presented. The Mishkin's group supports this by stating that both visual and auditory presentations activate overlapping neural pathways (Macko & Mishkin, 1985; Poremba et al., 2003). Since the auditory and visual presentation will result in the same type of activation between the PIN and the FRU, the memorability will not have a different effect based on the presentation modality. Therefore, the impact of face memorability on recall should be the same for both visual and auditory presentations of the name.

Conversely, the attention selection theory offers a different perspective. According to this theory, in unimodal presentations where both the face and name are visually presented, there might arise a competition for attention between the two pieces of information. This competition may lead to selective information processing (Smith & Sewell, 2013), with a favoring bias towards faces over names (Bindemann et al., 2005). This bias could hinder the learning of face-name associations, resulting in no detectable effect of the memorable face in face-name recall. However, when elements such as a face and name are divided between visual and auditory aspects, as in cross modal presentations, there is no competition in selective visual attention. Consequently, the memorable image of the face can enhance the associative link with the name without being overshadowed by selective attentional competition. As a result, this theory suggests that memorability may have a stronger effect on face-name associations when the face and name are presented cross-modally instead of unimodally.

Transcendence effect of memorability in associative memory

As said above, an important aspect of the study by Van Duivenboden (2023) was that the memorable images were not part of the to-be-encoded word pairs, they merely served as an illustration. Since there was no significant effect found, it remains unclear whether the positive effect of a memorable item can transcend to the link between associated elements, if the memorable item is actively encoded in the engram. In the current study, we investigate whether using a memorable face in the engram enhances the association between other elements, such as names and professions. Therefore, the second question of this research is: What is the effect of face memorability on the association formed between additional elements of the engram, such as the person's name and profession, and does this depend on the task relevance of the face?

The hypothesis posits that face memorability should have a positive effect on the retrieval of the associated elements in the engram. According to the holistic view of memory encoding and retrieval, multi-element binding ensures that encoding one element is linked to encoding other elements from the same event (Horner & Burgess, 2013). This multi-element binding implies that as one element's association with another strengthens, so do the associations with other elements in the same engram. As a result, encoding and recalling an association within an engram is improved when there is a memorable element involved. On the other hand, Van Duivenboden's (2023) research demonstrated that a memorable item did not influence the recall of the associated translation. In this study, the memorable and non-memorable images were not part of the to-be recalled association, as the recall only focused on the translation association. Therefore, the hypothesis derived from the holistic view is that the recall of associated information will improve only if the memorable items are actively incorporated into the engram.

Present study

To investigate whether the effect of memorable faces on the face-name association depends on presentation modality, and whether the effect of memorable faces transcends towards associated information, three experiments were designed. The first experiment aimed to assess the impact of presentation modality. Participants were exposed to 40 face-name pairs, comprising 20 memorable and 20 non-memorable face images. Names were presented either auditorily through audio fragments or visually as written text on a display, with each presentation method used in half of the trials. Participants were tasked with recalling the name when the face image was the cue.

In Experiment 2a, Van Duivenboden's (2023) study was replicated to investigate the influence of memorability on face-name associations within a multi-element engram. This experiment aimed to determine whether the memorability of a face, used as a task-irrelevant element, affects the associations between names and professions. Participants were presented with a combination of a memorable or non-memorable face, a name, and a profession, all displayed visually on a computer monitor. Their task was to recall the associations between the names and professions.

Experiment 2b further investigated whether the memorability effect extends to associated information, but this time it was made sure that the memorable or non-memorable face was actively processed within the engram. Participants had to remember the connections between faces, names, and professions. They were asked to recall the name using either the face or the profession as cues, with the cue assigned randomly.

Experiment 1: Face-Name recall

This study aimed to investigate how presentation modality influences the effect of memorability on face-name retrieval. One possibility is that the strength of the association

between a face and its corresponding name is independent of whether the name and the associated PIN are activated visually or auditorily. In this case, the effect of memorability on recall should be identical for both visual and auditory presentations of the name. Alternatively, under an attentional selection framework, memorability may have a stronger influence on face-name associations when the face and name are presented cross-modally rather than unimodally.

Method

Participants

In the current study, first-year Psychology students from the University of Groningen participated. The participants volunteered to participate in return for partial fulfillment of a course assignment. According to Brysbaert (2019), a sample size of 60 participants is required to ascertain a null effect of a within-subject variable with two levels using a Bayesian repeated-measures ANOVA with $BF < .33$. In addition, this number of participants would be sufficient to obtain strong evidence ($BF > 10$) for the presence of an effect with an effect size of $d = .4$. We anticipated an effect for memorability, but for modality, it was uncertain whether there would be an effect or null effect. Therefore, a total of 60 participants participated, who were assigned to one of the four versions of the experiment. Notably, the participants' native languages were diverse and not uniformly English.

Materials and equipment

The experiment was designed using OpenSesame (v4.0.5; Mathôt et al., 2011) and hosted on a server using Just Another Tool for Online Studies (v3.3.1; JATOS, 2015). Participants could thus conveniently engage in the study from any computer with internet access and a functional audio system and keyboard to effectively engage with the experimental tasks. The resolution of the display was set to 1024 x 768 pixels. The

participants were instructed to put their web browser on full screen, and the volume of their audio to a pleasant hearing level.

The face images used in the experimental task were sourced from the 10k US Adult Faces Database created by Bainbridge and colleagues (2013) and they were identical to the images utilized in the study conducted by Van der Wal (2021). These faces were chosen based on specific criteria, including age (18-30 years), race (Caucasian), gender (equal representation of males and females), and only images showing faces photographed from the front with forward-facing eyes were included. Furthermore, they were selected based on their memorability score, such that one set of faces had relatively high memorability, while the other half had relatively low memorability. Table 1 shows the average memorability score for the images for in the memorable and the non-memorable conditions for both face genders. The images are included in Appendix A for reference.

Table 1.

Mean (M) Memorability Score and Standard Deviation (SD) for Male and Female Faces in the 'Memorable Faces' and 'Non-memorable Faces' Conditions

	M	SD
Memorable faces		
Male	.632	.083
Female	.626	.101
Non-memorable faces		
Male	.345	.065
Female	.314	.072

The images were paired with typical American names that were also identical to those used in the study of Van der Wal (2021; see Appendix B). The names were chosen based on their frequency of occurrence in America and they included the top 20 male and top 20 female names from the period of 2010-2020 (Social Security, 2021).

In half of the encoding trials, the names were presented visually as printed text under the image of the face in the format: “Hi, my name is…” followed by the name, as depicted in Figure 3a. In the other half of the encoding trials, the images of the faces were shown on the screen, but the names were presented auditorily using pre-recorded audio files identical to those used in the study by Van der Wal (2021). For the audio recordings, one female voice actor was used for the female faces, and one male voice actor was used for the male faces. Both actors were native speakers of American English. An illustration of this presentation format is provided in Figure 3b. The audio files consisted of the sentence: “Hi, my name is…”, followed by the name.

Figure 3a.

Screen When the Name is Presented Visual

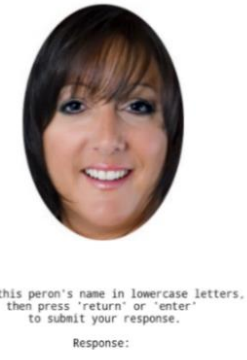
Figure 3b.

Screen When the Name is Presented Auditive

In the test phase, participants were presented with the images of faces on the screen, accompanied by a response line where they had to type in the name of that person, as depicted in Figure 4.

Figure 4.

Recall Screen When the Participant Needs to Fill in the Name



Design

The current study utilized a two-by-two design, with two independent variables. These independent variables were memorability of the faces (memorable vs. non-memorable, see Table 1) and the presentation modality of the associated names (auditory vs. visual). Both factors were manipulated as a within-subject variable, allowing for a comprehensive examination of their separate and combined effects on participants' responses.

Each presentation modality condition included 20 trials, in which 10 trials included a memorable face and 10 trials included a non-memorable face. Compared with Van der Wal's (2021) study, this means that there were half as many trials with visually presented names, as Van der Wal only used visually presented names. A power analysis using random subsets of data from Van der Wal's was performed, employing the methodology outlined by Brysbaert and Stevens (2018). This simulation involved generating 100 random samples, each consisting of 10 trials, to calculate the effect size one could expect for the effect of memorability with only 10 trials for each memorability condition. The analysis revealed a mean effect size $d_z = .42$ across these samples. With an effect size of .42 and a sample size of 60 participants, the power calculation indicated a statistical power of .94 for replicating the beneficial effect of face memorability on face-name recall with visually presented names.

To counterbalance the assignment of names across the faces used in the memorability and modality conditions, four versions of the experiment were created. This way, any potential differences in the memorability of the names themselves were controlled for. Furthermore, the presentation order of the face-name pairs was randomized to mitigate any potential order effects.

Procedure

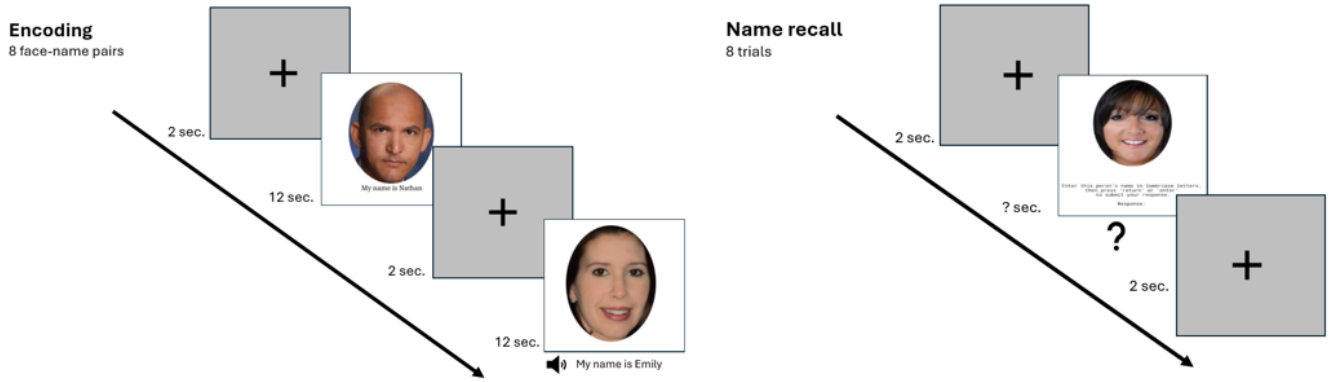
The experiment received approval from the Ethics Committee of the Faculty of Behavioral and Social Sciences of the University of Groningen. Participants voluntarily enrolled in the study. Upon clicking the provided link, the experiment started on their personal computers.

Participants were presented with a concise description of the study, outlined in Appendix C. By pressing the spacebar, they provided consent to participate. To familiarize the participants with the encoding task, they were then first presented an example of a face with a visual presentation of the name ensued by an example of a face with an auditory presentation of the name.

Following these examples, the first encoding block started. Each encoding block comprised eight face-name pairs, including four pairs with a memorable face and four pairs with a non-memorable face. Each face was displayed for 12 seconds. After 2 seconds either a visual presentation of the name was shown for 4 seconds, or the name was presented auditorily. After completing the encoding block, participants entered the test phase, wherein the eight images of faces were displayed again in random order. Participants were tasked with typing the corresponding names for each face (see Figure 4). This sequence of an encoding block and test phase was repeated five times until all 40 face-name pairs had been presented and tested. Figure 5 illustrates the task paradigm for each block.

Figure 5.

Example Encoding and Recall for a Block of the Face-Name Association Task



After completion of all encoding-test cycles, factors potentially influencing face memorability were examined. The participants were asked, “Does this person look like anyone you know personally?”. All faces were presented again, and the participants indicated their response by pressing the left arrow key for “No” or the right arrow key for “Yes”. Similarly, for the names, participants were asked, “Do you personally know someone who has this name?” and instructed to press the left arrow for "No" or the right arrow for "Yes". These data will not be included in our analyses.

Following this, a debriefing, detailing the study's objectives and intentions, was presented. This debriefing can be found in Appendix D. At the end, participants were redirected to the participant registration website where they automatically received credits for their participation.

Analysis

The dependent variable of interest was the average proportion of correct responses recorded during the test phases. Participants were tasked with accurately typing the names corresponding to the faces, accuracy of the answers was scored by the researcher. An answer

was considered correct if the typed name was homophonic to the correct name or if the name was nearly identical to the answer and contained no more than two typos. The number of correct answers served as the primary outcome measure.

Prior to conducting the repeated-measures analysis of variance (ANOVA), the assumption of normality was assessed. Normality was evaluated using the Shapiro-Wilk test, which indicated that the data did not meet the assumption of normality. However, it is worth noting that with a sample size exceeding 30 participants, violations of normality assumptions can be tolerated (Van Heijst, 2023).

Therefore, a repeated-measures ANOVA was performed. In this analysis, the proportion of correct answers served as the dependent variable, while the independent variables were the memorability of the image and the presentation modality of the name. This analysis allowed for the examination of how the memorability and presentation modality affected participants' ability to provide correct answers in the free recall.

Additionally, a Bayesian repeated-measures ANOVA in JASP was performed. Prior to analysis, the data was transformed into a wide dataset format. Then a Bayesian analysis was conducted, using the same dependent and independent variables as in the frequentist approach. This complementary analysis allowed to further explore the effects of memorability of the image and the presentation modality of the name.

Results

To test the main effects and interaction of face memorability and presentation modality of the names, we conducted a repeated-measures ANOVA on the proportion of correct responses using memorability and presentation modality as within subject factors, with a significance criterion of $p < .05$.

Table 2 displays the mean and standard deviation of the proportion of correct answers in each condition, Figure 6 shows a violin plot for each condition which shows the distribution of individual scores. Overall, there was a slightly higher score for the visual condition compared to the auditory condition, although it exhibited a larger spread in the results. In terms of memorability, the memorable condition exhibited higher scores compared to the non-memorable condition. Additionally, the spread was a bit smaller in the memorable condition compared to the non-memorable condition.

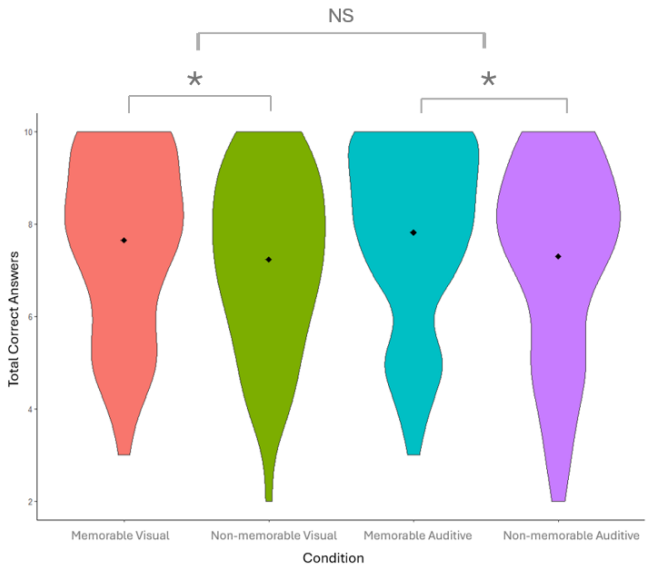
Table 2.

Mean (M) and Standard Deviation (SD) of Proportion of Correct Answers in each Condition

Condition	M	SD
Memorable visual	.782	.193
Non-memorable visual	.730	.212
Memorable auditive	.765	.191
Non-memorable auditive	.723	.192

Figure 6.

Participants Distribution in Total Number of Correct Answers in each Condition



Note. The dots in each violin depict the mean across participants. The asterisks indicate a significant difference ($p < .05$), while "NS" indicates no significant difference.

The assumption for the repeated-measures ANOVA was met (Normality*; n > 30*). The main effect of memorability was significant, whereas the main effect of modality was non-significant, and the interaction of memorability and modality was also non-significant (see Table 3). Specifically, the recall of face-name pairs was significantly better with memorable faces compared to non-memorable faces, and this effect did not depend on the presentation modality of the names.

Table 3.

Repeated-Measures ANOVA of the Effect of Memorable and Modality

Effect	DFn	DFd	SSn	SSd	F	p	p<.05	ges	eta_p2
Memorable	1	59	.131	.699	11.0	.002	*	.043	.157
Modality	1	59	.008	1.12	.430	.515		.003	.007
Memorable*Modality	1	59	.002	1.12	.079	.779		.001	.001

Using a Bayesian repeated-measures ANOVA, we assessed the extent to which the non-significant effects of modality and the modality*memorability interaction should be interpreted as evidence in favor of the null hypothesis. The analysis showed that there was moderate evidence for the null hypothesis in our tests of the main effect of modality and the interaction effect between memorability and modality. Furthermore, the results corroborated the frequentist analysis in showing that there was moderate evidence for the alternative hypothesis with the main effect of memorability (see Table 4). This confirms that face-name recall was better with a memorable face than with a non-memorable face and that the modality does not have a significant main effect, nor an interaction effect with memorability.

Table 4.

Bayesian Repeated-Measures ANOVA of the Effect of Memorable and Modality

Effects	P(incl)	P(excl)	P(incl||data)	P(excl||data)	BF_{incl}
Memorable	.400	.400	.790	.183	4.31
Modality	.400	.400	.176	.797	.221
Memorable*Modality	.200	.200	.027	.142	.191

Discussion

In this first experiment, our aim was to investigate whether the presentation modality of the names (visual vs. auditory) influences the beneficial effect of memorability on the associative learning of face-name pairs.

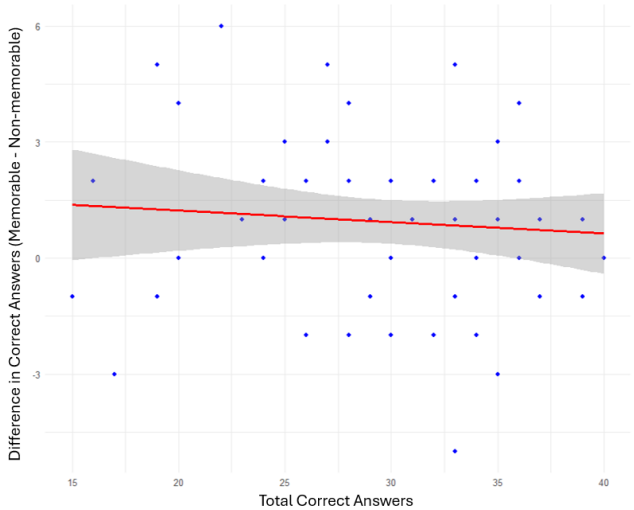
The findings revealed a significant main effect of memorability on face-name recall, indicating that participants exhibited significantly better recall of names associated with memorable faces compared to those associated with non-memorable faces. This result aligns with previous findings reported by Van der Wal (2021). In addition, the results provide evidence that the effect of memorability was consistent across both visual and auditory presentation modalities. This suggests that while the memorability of face images enhances the recall of associated names, the manner in which names are presented (visual or auditory) does not significantly alter this effect. This underscores the robustness of memorability as a factor influencing associative memory processes, independent of the modality used for presenting associated information.

A potential limitation of this experiment is that the names used were in English, which was not the native language of all participants. This could have resulted in the names being less familiar, particularly impacting the auditory condition. Participants might not have understood or processed the names well, making the task too difficult to detect a potential

effect of memorability. To investigate this possibility, an analysis was conducted that compared the memorability effect for participants who had a high number of correct answers to those who had a low number of correct answers. This analysis aimed to determine if the effect of memorability was stronger when the task was easier or more difficult. The data was analyzed by calculating the difference in correct answers between the memorable and non-memorable conditions for the total score of each participant. A scatter plot with a regression line (Figure 7) was used to visualize the relationship between total proportion of correct answers for each participant and the difference in performance between the memorable and non-memorable conditions. The scatter plot suggested that the positive effect of memorability was slightly higher for participants who had fewer correct answers overall, implying that the effect of memorability might be stronger when the task is more difficult. However, a linear regression analysis performed to statistically test this observation did not show a significant effect (p = .458), indicating that there was no significant relationship between the effect of memorability and the overall difficulty of the task. Therefore, it can be concluded that the effect of memorability does not significantly differ with the varying difficulty levels of the task, and the English names used in this experiment should not have limited the results.

Figure 7.

Effect of Memorability in Relation to Individual Participants' Total Scores



Experiment 2a: Name-Profession recall

This study aims to replicate Van Duivenboden's (2023) research within the context of a face-name association task. The goal is to determine if the beneficial effect of memorable faces on face-name recall, as demonstrated in Experiment 1, extends to improving associative memory for links between personal information, such as names and professions. The hypothesis posits that the recall of associated information will improve only if the memorable items are actively incorporated into the engram; otherwise, there will be no effect of memorability. Experiment 2a will assess the effect of face memorability when the face is not actively incorporated, whereas Experiment 2b will investigate if the effect of face memorability can transcend to linked information when the face is actively incorporated in the engram.

Method

Participants

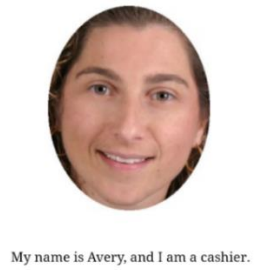
For this experiment, 60 participants were recruited again with the same requirements as in Experiment 1. Notably, the participants should not have participated in Experiment 1.

Materials and equipment

The materials and equipment were almost the same as in Experiment 1, with the addition of a set of professions. This set was generated using ChatGPT by asking “Can you create a list of 40 American professions with easy names?”, the list can be found in Appendix E. In the encoding phase the name and profession were presented visually as printed text under the image of the face in the format: “Hi, my name is … and my profession is ...” with the names and professions filled in, as depicted in Figure 8.

Figure 8.

Screen When the Name and Profession are Displayed



In the test phase, half of the participants were shown the names of individuals, accompanied by a response field where they were required to answer the corresponding professions, as illustrated in Figure 9a. Conversely, the other half of the participants were presented with the professions of individuals, along with a response field where they were required to answer the corresponding names, as illustrated in Figure 9b.

Figure 9a.

Recall Screen in Version 1 and 2

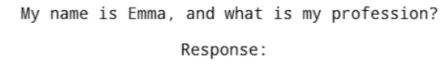
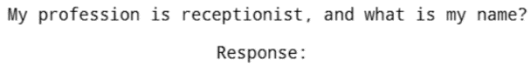


Figure 9b.

Recall Screen in Version 3 and 4



Design

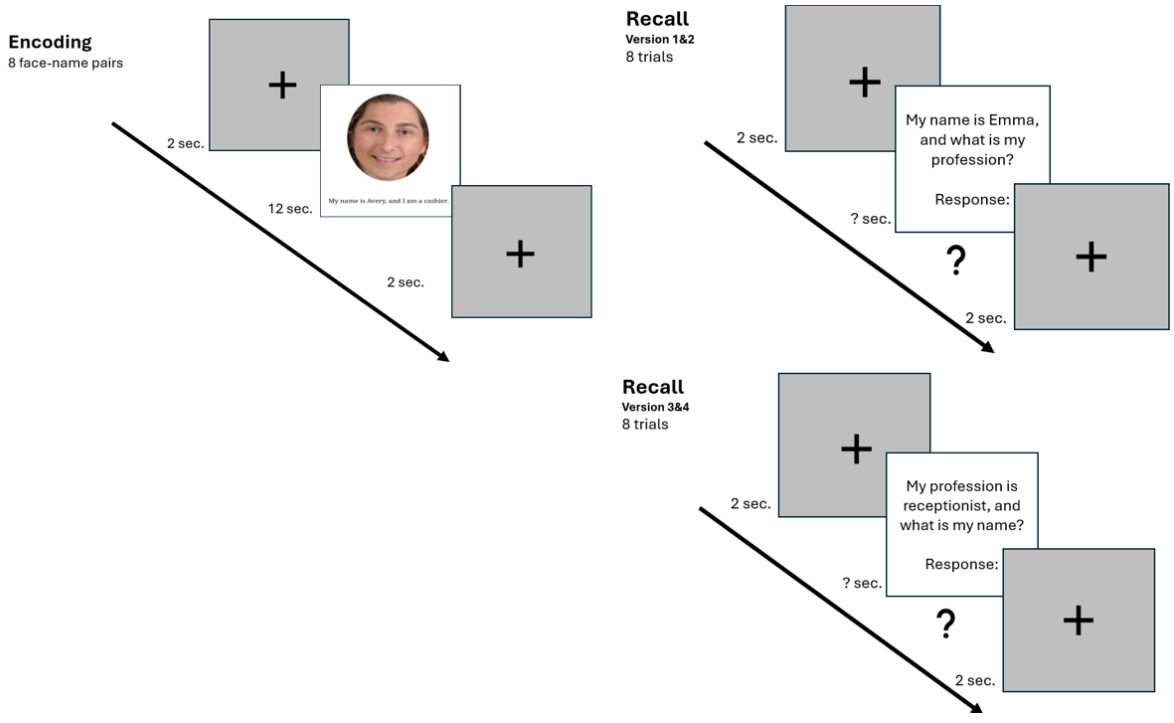
The experiment consisted of a within-subject design with one independent variable, namely memorability of the image. The dependent variable was again the proportion of the correct responses. Four versions of the experiment were created to counterbalance the assignment of names and professions across the memorable and non-memorable faces in the two recall versions of the task (i.e., recall the name based on the profession vs. recall the profession based on the name).

Procedure

The procedure of Experiment 2a was almost identical to that of Experiment 1. One difference pertained to the presentation procedure during the encoding phase. In Experiment 2a the face image was displayed for two seconds by itself, and then the person's name and profession were shown together with the face for another ten seconds. For half of the participants, the test phase consisted of recalling the profession of the person whose name was depicted on the screen, for the other half this consisted of recalling the name of the person whose profession was depicted on the screen (see Figure 9a and 9b). The task paradigm is depicted in Figure 10. Even though it was not explicitly stated that the face was task-irrelevant, participants could discern this because they were only instructed to remember the names and professions. Furthermore, this became evident during the test phases when the face itself was not presented, allowing participants to learn that the face was irrelevant to the task. The instructions for this study can be found in appendix F and the debriefing can be found in Appendix G.

Figure 10.

Example Encoding and Recall for a Block of the Name-Profession Association Taks



Analysis

The analysis of Experiment 2a employed the same methodology utilized in Experiment 1, with the independent variable only consisting of the memorability of the image.

Results

To test the main effects of face memorability on recall of name-profession pairs, we conducted a repeated-measures ANOVA on the proportion of correct responses using memorability as a within-subject factor.

The mean and standard deviation of the proportion of correct answers in each condition are displayed in Table 5, Figure 11 shows an overview of the distribution of total scores. Overall, the condition with memorable faces resulted in a slightly higher number of correct answers and demonstrated a lower spread compared to the condition with non-memorable faces.

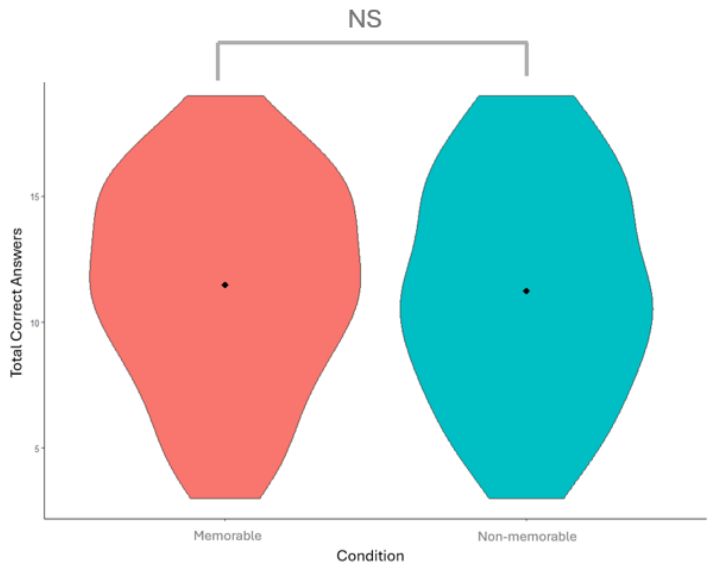
Table 5.

Mean (M) and Standard Deviation (SD) of Proportion of Correct Answers in both Conditions

Memorable	M	SD
Memorable	.574	.203
Non-memorable	.562	.216

Figure 11.

Participants Distribution in Total Number of Correct Answers in both Conditions



Note. The dots in each violin depict the mean across participants. The asterisks indicate a significant difference ($p < .05$), while "NS" indicates no significant difference.

The assumption for the repeated measure ANOVA was satisfied (Normality*; $n > 30$*). The main effect of memorability was found to be non-significant (see Table 6). Specifically, there was no significant difference in name-profession recall between memorable faces and non-memorable faces used during the encoding phase. Within the Bayesian repeated-measures ANOVA, we assessed the extent to which the non-significant effects of memorability should be interpreted as evidence in favor of the null hypothesis. The analysis showed that there was moderate evidence for the null hypothesis in our tests of the main effect of memorability (see Table 7). This confirms that face memorability does not have a significant effect on name-profession recall.

Table 6.

Repeated-Measures ANOVA of the Effect of Memorable Faces

Effect	DFn	DFd	SSn	SSd	F	p	p<.05	ges	eta_p2
Memorable	1	59	.005	.544	.508	.479		.009	.009

Table 7.

Bayesian Repeated-Measures ANOVA of the Effect of Memorable Faces

Effects	P(incl)	P(excl)	P(incl|data)	P(excl|data)	BF_{incl}
Memorable	.500	.500	.196	.804	0.244

Discussion

This experiment examined whether the effect of a memorable face extends to the association between two elements presented together with the face, specifically the person's name and profession. Similar to Van Duivenboden's study, participants in Experiment 2a were not required to memorize the memorable or non-memorable face images, which were therefore task-irrelevant.

The results showed no significant main effect of memorability on participants' ability to recall the association between profession and name. This finding is consistent with the research of Van Duivenboden (2023). It supports our hypothesis that memorable images will not influence the strength of association between two elements shown together with the image, when the image itself does not need to be remembered as part of the engram. The focus of participants may have been primarily on memorizing the name-profession associations, which were the elements being tested during recall. Consequently, the

memorable of non-memorable faces may not have been effectively incorporated into the engram, preventing them from influencing the associative link.

To investigate whether the memorability effect does extend to other personal information when the memorable face needs to be remembered as part of the engram, Experiment 2b was conducted. In this follow-up experiment, measures were implemented to encourage greater participant engagement with face images during the encoding phase.

Experiment 2b: Face-Name-Profession recall

The aim of this study was to investigate the impact of face memorability on the retention of associated information when participants have to encode the memorable or non-memorable face in the engram. During the recall task, participants were asked to recall the name based on either the face image itself or the associated profession. From a holistic view perspective, recall of associated information will improve with memorable faces when the face is actively incorporated into the engram.

Method

Participants

For this experiment, 60 participants were recruited again with the same requirements. Notably, the participants should not have participated in Experiment 1 or 2a.

Materials and equipment

The materials and equipment were almost the same as in Experiment 2a. In the encoding phase, the name and profession were again shown visually underneath the image on the screen in the format: “Hi, my name is … and my profession is ...” with the names and professions filled in, as depicted in Figure 8.

In the test phase, in half of the trials, the participants were shown the professions of individuals, along with a response field where they were required to input the corresponding names, as illustrated in Figure 9b. In the other half of the trials, participants were presented with the images of faces on the screen, accompanied by a response line where they had to type in the name of that person, as depicted in Figure 4.

Design

This experiment involved manipulating the memorability of images as an independent variable within a within-subject design. Additionally, the type of test served as another independent variable, with cues being either the profession or the face image. The dependent variable was the proportion of correct responses for recalling the name associated with either the face or the profession cue.

Again, four versions were used to counterbalance the combinations of faces, names, and professions, with the sequence altered to minimize any order effects. Participants were required to recall names when the cue was either the face or the profession. By asking for names in both cue conditions, the recall requirements were kept equivalent, ensuring that the results were not influenced by the type of information that needed to be recalled.

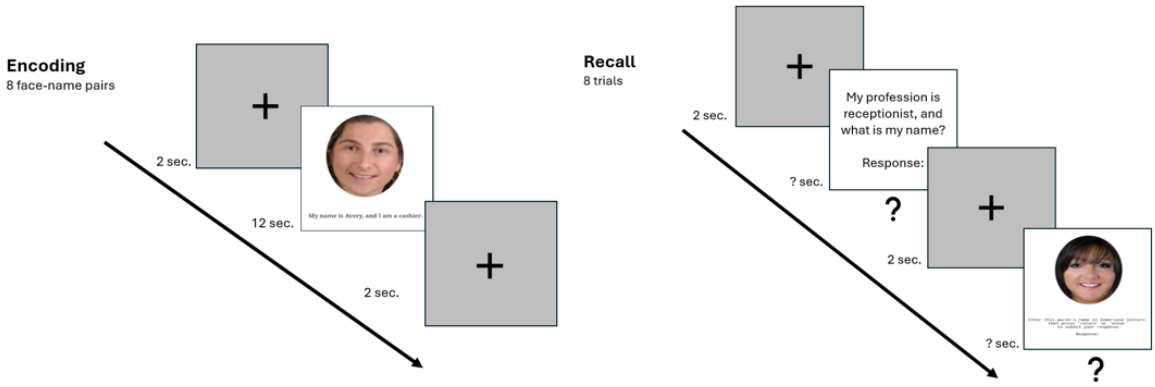
Procedure

The procedure of Experiment 2b was almost identical to that of experiment 2a. However, in the test phase the cue consisted of either the profession or the image of the face and the recall element was the name of that person (see Figure 9b and 4). This method was intended to ensure that the participants would pay attention to the memorable and non-memorable faces and try to memorize the associations between each pair of elements, instead of focusing solely on the name-profession association. The task paradigm is depicted in

figure 12. The introduction of this study can be found in appendix H and the debriefing can be found in Appendix I.

Figure 12.

Example Encoding and Recall for a Block of the Face-Name-Profession Association Task



Analysis

For the analysis of this experiment, the same method was used as in experiment 2a. However, the independent variables were the memorability of the image and the type of cue used during recall.

Results

To test the main effects and interaction of face memorability and cue-type on the recall of associated information, we conducted a repeated-measures ANOVA on the correct responses using memorability and cue-type as within-subject factors.

The mean and standard deviation of the proportion of correct answers in each condition are shown in Table 8, Figure 13 shows an overview of the total score of the individuals in each condition. Overall, there were slightly more correct answers in the condition with the memorable images compared to the condition of the non-memorable images. Furthermore, for the condition in which the image of the face was used as cue, the

scores appeared to be higher than in the condition with the profession used as cue, but the face-as-cue condition has a larger spread.

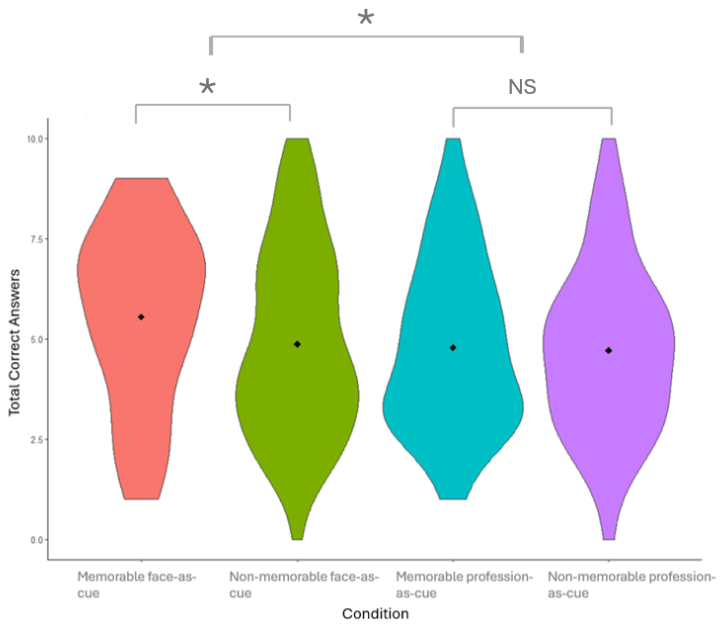
Table 8.

Mean (M) and Standard Deviation (SD) of Proportion of Correct Answers in both Conditions

Memorable	M	SD
Memorable face: face-as-cue	.555	.224
Non-memorable face: face-as-cue	.487	.232
Memorable face: profession-as-cue	.479	.211
Non-memorable face: profession-as-cue	.472	.209

Figure 13.

Participants Distribution in Total Number of Correct Answers in each Condition



Note. The dots in each violin depict the mean across participants. The asterisks indicate a significant difference ($p < .05$), while "NS" indicates no significant difference.

The assumption for the repeated-measures ANOVA was met (Normality; $n > 30$). The main effect of memorability was significant, the main effect of cue-type was also significant, but the interaction of memorability and cue-type was non-significant (see Table 9).

Specifically, name recall was significantly better with memorable faces in the engram than with non-memorable faces. Furthermore, name recall was significantly better with the face image as cue than with the profession as cue. In interpreting the lack of an interaction effect of memorability and cue-type it is important to note that the effect of memorability was relatively large when the face was used as cue and numerically almost absent when the profession was used as cue, thus suggesting that the lack of an interaction could be due to a lack of statistical power to establish this interaction reliably, an issue returned to below after we present the results of the Bayesian analyses.

Table 9.

Repeated-Measures ANOVA for the Effect of Memorable and Cue-Type

Effect	DFn	DFd	SSn	SSd	F	p	p<.05	ges	eta_p2
Memorable	1	59	.086	1.007	5.019	.023	*	.022	.078
Cue-Type	1	59	.124	1.462	5.024	.023	*	.032	.078
Memorable*Cue-Type	1	59	.055	1.301	2.479	.121		.014	.040

The Bayesian repeated-measures ANOVA conducted in this study did not provide sufficient evidence to support either the null hypothesis or the alternative hypothesis for the main effects of memorability, cue type, or their interaction on face-name-profession recall (see Table 10). These results indicated that there was uncertainty regarding whether associative recall is influenced by the memorability of faces, the type of cue used during recall, or the interaction between these factors.

Table 10.

Bayesian Repeated-Measures ANOVA for the Effect of Memorable and Cue-Type

Effects	P(incl)	P(excl)	P(incl||data)	P(excl||data)	BF_{incl}
Memorable	.400	.400	.367	.422	.870
Cue-Type	.400	.400	.454	.335	1.36
Memorable*Cue-Type	.200	.200	.211	.213	.990

Even though the interaction was not significant, an additional explorative analysis is performed by splitting the dataset into two halves. One subset consists of trials in which the cue was the image of the face, and the other subset includes trials where the cue was the profession.

The assumptions for the repeated-measures ANOVA were met for both datasets: when the face was the cue (Normality*: n > 30*), and when the profession was the cue (Normality*: n > 30*). The main effect of memorability was significant when the face image was given as cue, the main effect of memorability was non-significant when the profession was given as cue (see Table 11). Specifically, name recall was significantly better with memorable faces than with non-memorable faces when the face images were used as cue. Name recall was not significantly different between memorable faces and non-memorable faces when the professions were used as cue.

Table 11.

Repeated-Measures ANOVA for the Effect of Memorability for both Cue Types

Effect	DFn	DFd	SSn	SSd	F	p	p<.05	ges	eta_p2
Memorable: face-as-cue	1	59	.155	1.640	5.484	.023	*	.086	.086
Memorable: profession-as-cue	1	59	.004	.609	.347	.558		.006	.006

According to the Bayesian repeated-measures ANOVA results, there was slight evidence supporting the alternative hypothesis when the cue-type was the face. In contrast, there was moderate evidence favoring the null hypothesis when the cue-type is the profession (see Table 12). This indicates that when a face was given as a cue, the names corresponding to memorable faces were recalled slightly better than the names corresponding to non-memorable faces. However, when the profession was given as cue, there was no effect for the memorability of the face.

Table 12.

Bayesian Repeated-Measures ANOVA for the Effect of Memorability for both Cue Types

Effects	P(incl)	P(excl)	P(incl|data)	P(excl|data)	BF_{incl}
Memorable: face-as-cue	.500	.500	.618	.382	1.62
Memorable: profession-as-cue	.500	.500	.177	.823	.216

Discussion

This study investigated whether the positive effect of memorability in face-name recall could extend to the association between associated information in the engram, namely the association between the name and profession of the person. In contrast to Experiment 2a, participants were forced to actively process the memorable or non-memorable face within the engram. The hypothesis was that when a memorable or non-memorable item is actively incorporated into an engram, recall of associated information improves.

The frequentist repeated-measures ANOVA revealed significant main effects for both memorability and cue type, but no significant interaction between the two. These findings indicate that participants had better name recall when the face in the engram was more memorable, which aligns with our hypothesis. Furthermore, participants were better at name recall when the face was given as cue compared to when the profession was given as cue.

In contrast, Bayesian analysis provided a more nuanced perspective. Given that all Bayes Factor (BF) values were close to 1, the data did not favor either the null hypothesis or the alternative hypothesis. This suggests that the evidence was inconclusive regarding the effects observed in the frequentist analysis. The Bayesian approach underscores the importance of cautious interpretation and suggests that additional data is necessary to obtain clearer findings.

Further analysis revealed that a significant main effect of memorability was observed when the face was the cue, but no such effect was observed when the profession was the cue. The former finding aligns with Van der Wal (2021), who reported a similar main effect for memorability with face cues. The latter finding suggests that the effect of memorability did not transcend to the association between the name and profession, which is in contrast with our hypothesis.

General discussion

This study aimed to investigate whether the effect of memorable faces on the face-name association depends on presentation modality, and whether the effect of memorable faces transcends towards associated information.

The first experiment investigated the interaction between memorability and presentation modality using a two-by-two within-subject design. The results indicate that presentation modality did not significantly influence the effect of memorability on face-name associations. This finding supports the hypothesis that both visual and auditory stimuli activate the same Person Identity Node (PIN) and result in similar associations with the Face Recognition Unit (FRU) (Burton et al.,1990). This theory is further supported by research from Mishkin's group, which suggests overlapping activation pathways between auditory and visual brain areas (Macko & Mishkin, 1985; Poremba et al., 2003). This overlap suggests a

shared activation pathway that could facilitate processing of face-name information irrespective of whether the name is received visually or auditorily.

Furthermore, Johannsen and Röder (2014) have suggested that multisensory development runs parallel to unimodal development, indicating that individuals are equally adept at cross-modal learning as they are at unimodal learning. Therefore, when connecting faces with names, whether the name is presented visually or auditorily, they are involved in the same neural development. This suggests the notion that the effect of face memorability operates independently of presentation modality.

Additionally, cognitive processes associated with face-name associations might rely more heavily on the visual characteristics of the face than on the presentation modality of the name. Bindemann et al. (2005) suggested a small attentional bias towards faces, wherein individuals tend to allocate more cognitive resources to processing facial information compared to other information. This bias could potentially explain the observed positive effect of memorable faces and the absence of an interaction effect with the presentation modality of names.

The second experiment investigated whether the effect of memorability could transcendence to associated information. A within-subject design was used in which the memorability of the face was the independent variable and the participants had to recall the name-profession association. The results indicate that there was no significant effect of memorability on the recall of name-profession associations. Given that in this experiment memorable and non-memorable faces were treated as task-irrelevant during encoding, the results support the hypothesis. Since the faces were task-irrelevant, it is possible that these images were processed without receiving adequate attention, resulting in insufficient processing within the engram. This lack of engagement and processing can be explained by

Craik and Lockhart's (1972) Levels of Processing framework. According to this framework, information that is not adequately attended to remains in the "short-term store", where it is likely to be forgotten within 30 seconds and does not undergo further processing. In contrast, information that receives sufficient attention is transferred to "long-term memory", where it undergoes deeper processing and is more likely to be retained. Therefore, if participants did not deeply process the face images during encoding, these images would not be effectively integrated into the engram, thereby reducing their impact on associative learning.

To further investigate these findings, Experiment 2b examined whether the absence of a significant effect challenges the holistic view of memory integration or merely reflects insufficient processing of the memorable or non-memorable element. A within subject two-by-two design was performed in which the memorability of the face and the type of cue used where the independent variables. The participants were tasked with recalling the name when either the face or the profession was given as cue. The frequentist approach results indicate no significant interaction between memorability and cue type, suggesting that face memorability influences name recall independently of the cue used. This pattern of results aligns with previous literature indicating that elements within the engram operate holistically, where successful encoding and retrieval of elements are interconnected, regardless of the type of cue used (Horner & Burgess, 2013).

However, the absence of a significant main effect for memorability when the profession was the cue challenges the holistic view hypothesis by Horner & Burgess (2013). Caplan et al. (2014) similarly observed varying strength in associations within the engram, suggesting that not all associations are uniformly strong. This complexity indicates that while memorable images may enhance face-name associations, the extension of memorability effects to other associated information, such as professions, remains inconclusive.

Moreover, the discrepancy between the frequentist and Bayesian approaches highlights the need for careful interpretations. This discrepancy may be attributed to the study's statistical power. With 60 participants each completing 20 trials per cue type, from which 10 were memorable and 10 were non-memorable, the study achieved a high power of 0.94, calculated following Brysbaert (2019). However, this power calculation pertains to the main effect. The interaction effect, which is more complex, inherently has lower statistical power (Brysbaert, 2019). Consequently, it is plausible that the number of trials or participants was insufficient to consistently detect an interaction effect. Future studies should consider increasing statistical power through larger sample sizes or adding additional trials.

A limitation of this study is its practical application. While an effect of memorability was found in the face-name association, it is not directly usable. As noted by Bainbridge (2017), it is unclear which specific features make a face more memorable and it is therefore difficult to adjust facial features to make a face more memorable. So, this effect is only beneficial if you have a face that is naturally more memorable than others, which may help people remember your name better.

Furthermore, it remains unclear whether the effect of face memorability can extend to information beyond the face-name pair. A possible explanation could be related to the test design: associated semantic information might be better retrieved only when the memorable face is used as a cue. This aspect was not examined in the current study. Future research should explore this by partially replicating the study, but this time using the image of the face as a cue and the profession as the recall element. This could determine whether the effect of a memorable face can be transcended to a personal characteristic from the semantic information pool. If this effect is found, it would be interesting to investigate whether the connection between the face and associated information extends beyond a single word to encompass a sentence or even a statement. Such findings could have practical applications in

areas like politics, where a highly memorable face of a politician could be paired with statements to make them easier to recall.

Overall, this study contributes valuable insights into the mechanisms underlying face-name associations and the role of memorability in associative learning. To advance this field and enhance its practical relevance, future research should be performed.

Conclusion

This study aimed to deepen our understanding of how memorable faces influence the recall of face-name pairs and other associated elements through three experiments. Initially, a significant effect of face memorability on name recall was found, consistent with previous research. Additionally, it was demonstrated that the presentation modality of the name did not impact this effect, indicating that memorability is equally influential whether the name is presented visually or auditorily.

However, the effect of memorability does not extend to other associated information when the memorable or non-memorable element is not actively part of the engram. Whether this effect transcends to other information when the memorable or non-memorable element is actively part of the engram remains unclear. Further research with greater statistical power is needed to draw definitive conclusions, which will enhance the generalizability of the results to real-world situations. Such insights can be helpful for real-world applications, such as politics, where information is often associated with faces.

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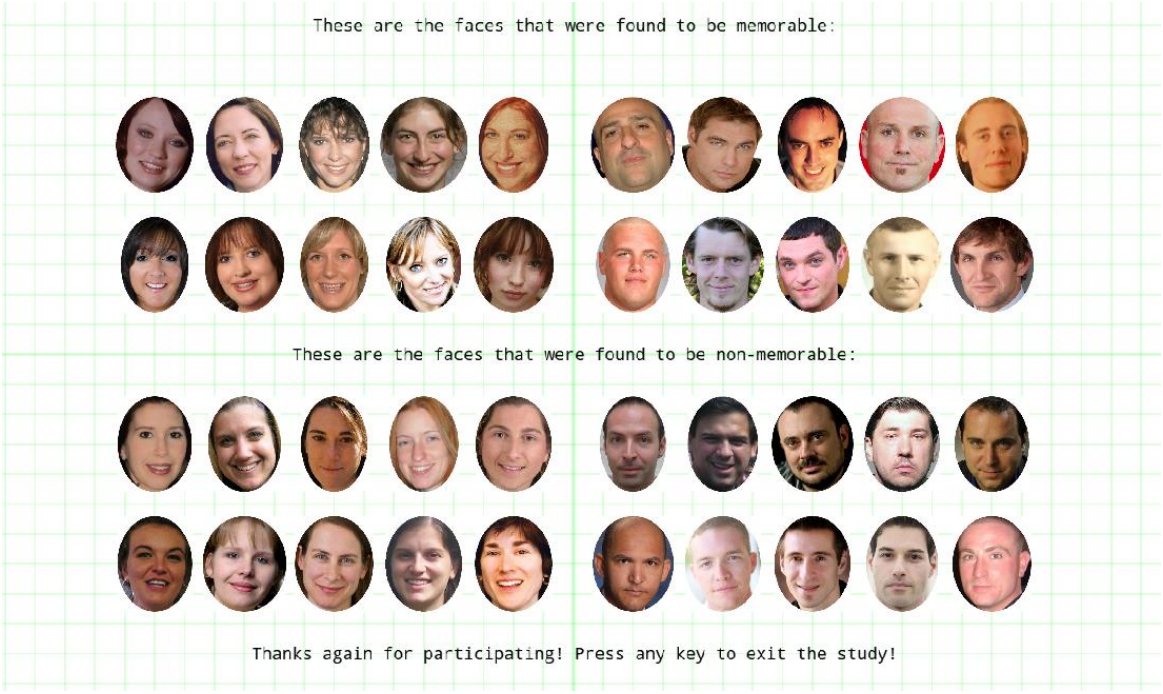
Appendix A: Faces



Appendix B: Names

Carter	Julian	Abigil	Evelyn
Cristian	Levi	Addison	Hannah
Daniel	Liam	Aubrey	Harper
David	Logan	Ava	Lillian
Dylan	Mattew	Avery	Maddison
Elijah	Nathan	Charlotte	Mia
Ethan	Owen	Cloe	Natalie
Gabriel	Samuel	Ella	Olivia
Isaac	Sebastian	Emily	Sophia
Joseph	William	Emma	Zoe

Appendix C: Introduction Experiment 1

"In this experiment, you will see pictures of the faces of different people. The names of these persons will be presented auditive or visual. To ensure that the visual displays and audios are clearly perceived, please set your browser to full screen, and please set the volume of your computer to a pleasant level. By pressing the spacebar, you will give CONSENT that we may use your data."

"The experiment consists of 5 blocks. In each block you will be shown eight photographs of faces. During the presentation of each photograph, you will HEAR OR SEE the first name of that person. The face remains in view for 12 seconds. During this time, you should try to memorize the name of this person. Afterwards, we will test your memory for the names connected to the faces. During the memory test, the faces appear in a random order. Note: You should NOT write down the names or make any notes. We are interested in how well you can remember the names, without relying on external aids. PRESS 'B' TO BEGIN, GOOD LUCK!"

Appendix D: Debriefing Experiment 1

“This is the end of the experiment, thanks for participating! The aim of this experiment is to investigate how the memorability of a face influences whether people can remember someone's name and whether there is a difference in presenting the names visual or auditive. The faces we used have been used in previous memory studies, where it was found that some faces are consistently remembered very well, whereas others are easily forgotten. In the next slide, we will show you which faces were in the high memorable and low memorable categories. Press any key to see the high memorable and low memorable faces we used!"

Appendix E: Professions

Pharmacist	Financial advisor	Receptionist	Plumber
Dentist	Police officer	Project manager	Musician
Artist	Painter	Nurse	Construction worker
Engineer	Truck driver	Accountant	Event planner
Cashier	Chef	Software developer	Photographer
Soldier	Bartender	Electrician	Social worker
Salesperson	Lawyer	Caregiver	Writer
Teacher	Mechanic	Pilot	Psychologist
Hairdresser	Researcher	Farmer	
Firefighter	Gardener	Architect	
Security guard	Journalist		

Appendix F: Introduction Experiment 2a

"In this experiment, you will see pictures of the faces of different people. The names and professions of these persons will be presented after 2 seconds. To ensure that the visual displays are clearly perceived, please set your browser to full screen. By pressing the spacebar, you will give CONSENT that we may use your data."

“The experiment consists of 5 blocks. In each block you will be shown eight photographs of faces. During the presentation of each photograph, you will see the first name of that person and the profession they work in. The face remains in view for 12 seconds. During this time, you should try to memorize the name and profession of this person. Afterwards, we will test your memory for the names/profession of the persons. During the memory test, the names/professions appear in a random order. Note: You should NOT write

down names or profession. We are interested in how well you can remember it, without relying on external aids. PRESS 'B' TO BEGIN, GOOD LUCK!"

Appendix G: Debriefing Experiment 2a

"This is the end of the experiment, thanks for participating! The aim of this experiment is to investigate how the memorability of a face influences whether people can remember information about this person. The faces we used have been used in previous memory studies, where it was found that some faces are consistently remembered very well, whereas others are easily forgotten. In the next slide, we will show you which faces were in the high memorable and low memorable categories. Press any key to see the high memorable and low memorable faces we used!"

Appendix H: Introduction Experiment 2b

"In this experiment, you will see pictures of the faces of different people. The names and professions of these persons will be presented after 2 seconds. To ensure that the visual displays are clearly perceived, please set your browser to full screen. By pressing the spacebar, you will give CONSENT that we may use your data."

“The experiment consists of 5 blocks. In each block you will be shown eight photographs of faces. During the presentation of each photograph, you will see the first name of that person and the profession they work in. The face remains in view for 12 seconds. During this time, you should try to memorize the name and profession of this person. Afterwards, we will test your memory for the names of the persons. During the memory test, the face or professions appear in a random order. Note: You should NOT write down names or profession. We are interested in how well you can remember it, without relying on external aids. PRESS 'B' TO BEGIN, GOOD LUCK!"

Appendix I: Debriefing Experiment 2b

"This is the end of the experiment, thanks for participating! The aim of this experiment is to investigate how the memorability of a face influences whether people can remember someone's name and whether there is a difference in presenting the image or profession in the test phase. The faces we used have been used in previous memory studies, where it was found that some faces are consistently remembered very well, whereas others are easily forgotten. In the next slide, we will show you which faces were in the high memorable and low memorable categories. Press any key to see the high memorable and low memorable faces we used!"

Appendix J: RESI Checklist

General questions

- Do any of the authors have competing interests?
    - The authors have no competing interests.
- Did you obtain ethics approval to conduct this study?
    - Yes. [PSY-2324-S-0293], [PSY-2324-S-0355] & [PSY-2324-S-0386]
- Was the study preregistered prior to data collection?
    - No, the study is not preregistered because of time constrains. The experiment had to start as soon as possible to make good use of the data pool.

Archiving and accessibility

- Did you archive the data according to the Heymans Data Storage Protocol?
    - Yes.
- Did you make the raw (unprocessed) data publicly available?
    - No, because of time constraints.

- Did you make the experimental and analysis scripts publicly available?
    - No, because of time constraints.

Interacting with participants

- Was participant data made anonymous such that it cannot be traced back to individual participants?
    - Yes, only JATOS IDs are in the data set.
- Were participants informed about the goal of the study (debriefed) after participating?
    - Yes, participants received an online debriefing page at the end. They received the explanation and goals of the experiment. Furthermore, they were also shown which conditions were manipulated.

Sample size and statistical power

- Was the number of participants determined in advance?
    - Yes.
- How was the number of participants determined?
    - According to the study of Brysbaert (2019), when you are not sure if you would find either an effect or null effect and you want to achieve d=.4, 60 participants are needed.
- If applicable, was the number of observations per participant determined in advance?
    - Yes
- If applicable, how was the number of observations per participant determined?
    - A power analysis using random subsets of data from Van der Wal's was performed, employing the methodology outlined by Brysbaert and Stevens (2018). This simulation involved generating 100 random samples, each consisting of 10 trials, to calculate the effect size. The analysis revealed a

mean effect size dz =.42 across these samples. With an effect size of .42 and a sample size of 60 participants, the power calculation indicated a statistical power of .94 for replicating the beneficial effect.

- Did you conduct a power analysis beforehand?
    - Yes .94 see above

Exclusion of participants and observations

- Were any participants excluded from the analysis?
    - We conducted 3 experiments, participants that already participated in one of them was excluded from the others since they already know the concept.
- If applicable, were any observations (per participant) excluded from the analysis.
    - Yes, there was one participant excluded from the analysis since the answers were clearly not filled in seriously (the participant had to fill out names and only answered with random letters like “asjhf”). This exclusion criteria was not determined beforehand, because we did not think of these types of responses.

Reporting

- Were the outcome variables determined in advance?
    - Yes
- Did you report all outcome variables?
    - No not all outcome variables were reported. We asked the participants to indicate familiar faces and names since this was also done in the study of Van der Wal (2021), but we did not use this data. We did not use this because Van der Wal (2021) did not find a significant difference by using these strict data exclusion rules.

- Did you clearly identify exploratory analysis in the text? (An analysis is exploratory when the analysis procedure was not determined in advance.)
    - Yes, the exploratory analysis is clearly stated.