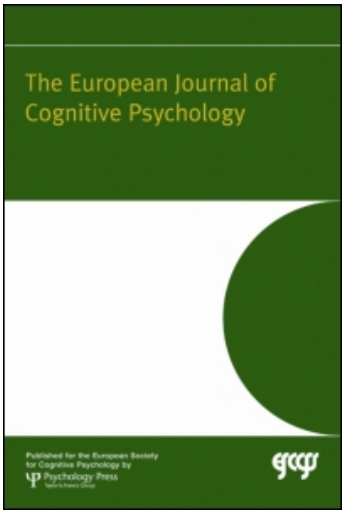

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Categorical proactive interference effects occur for faces

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Categorical proactive interference effects occur for faces

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Recent research has demonstrated that proactive interference (PI) between the names of familiar individuals in a memory task is category specific, and that subsequent release from proactive interference (RPI) is a useful tool for investigating the underlying categorisation of memory for people. These RPI effects are in line with the influential Interactive Activation and Competition (IAC) model of person recognition, which predicts the existence of such categorical effects. Here we report an experiment precisely replicating the categorical PI and RPI effects found previously for occupational categories, but using faces instead of names as stimuli. The results underscore the use of PI as a tool to investigate semantic categorisation, are compatible with models proposing a single point of access to semantic information about people and provide further evidence for the categorical organisation of person knowledge.

Keywords: Social cognition; Proactive interference; Face memory; Name memory; Interactive activation model.

Successful understanding of our social world is profoundly influenced by the ability to efficiently encode and retrieve semantic information about other people. Recent evidence suggests that, just as with other domains of semantic knowledge such as object naming (e.g., Huttenlocher & Kubicek, 1983), person-based semantic knowledge is organised categorically (Carson & Burton, 2001; Darling & Valentine, 2005). Such categorical organisation of person-based knowledge is predicted by the Interactive Activation and Competition (IAC) model of person recognition (Brédart, Valentine,

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Calder, & Gassi, 1995; Burton, Bruce, & Hancock, 1999; Burton, Bruce, & Johnston, 1990).

The IAC model (Figure 1) proposes that processes accessing stored knowledge about familiar individuals proceed via a single point of access, known as a person identification node (PIN). The PIN alone mediates access from person perception to related semantic knowledge. PINs should therefore be activated when familiar faces are recognised *or* when familiar names are read.

Under the IAC model, semantic information about people is thought to be represented by shared nodes known as semantic information units (SIUs). SIUs represent information like "actor", "husband", and "colleague".

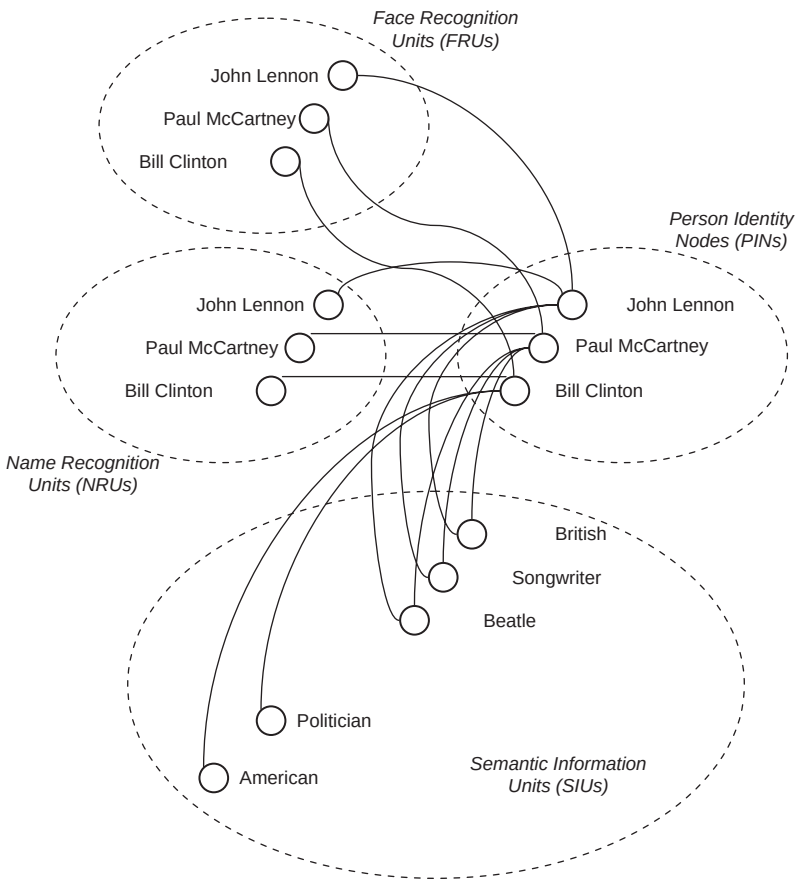

Figure 1. Central architecture of the IAC model of person recognition. Based on diagram in McNeill and Burton (2002).

Individual PINs are connected to a broad range of SIUs. Because multiple SIUs are linked to multiple PINs, they are a route by which activation from one category member can spread to another. For example, activation should spread from Natalie Imbruglia to the SIU for "musician" to Pete Seeger, even though the two are unlikely to be frequently encountered together. Such categorical effects go beyond associational effects which occur because of the frequent cooccurrence of names in pairs such as John Lennon and Paul McCartney. Barry, Johnston, and Scanlan (1998) have argued against the IAC model on the basis of their failure to identify categorical nonassociational priming effects; however, Carson and Burton (2001) and Stone (2008) have since reported categorical priming effects in the absence of associative relationships. Wiese and Schweinberger (2008) observed both associative and categorical priming, but also reported that categorical and associative priming relationships exhibit different electrophysiological signatures.

Darling and Valentine (2005) showed that release from proactive interference (RPI; Wickens, 1970) was a useful marker of the categorical organisation of semantic memory for familiar names. In each of a sequence of memory trials, participants were asked to read and remember the names of four familiar celebrities over an interval of 10.5 s. Short-term memory (STM) rehearsal was prevented by counting backwards. When all of the names were from a single category (actors or musicians), performance declined over trials as proactive interference increased. On critical trials, however, a set of names was presented from the alternative category, and performance significantly improved. This was interpreted as being a consequence of a release from proactive interference when the category changed, thus demonstrating that proactive interference was a category-related phenomenon. Darling and Valentine also showed that similar patterns of categorical RPI effects on the basis of occupation emerged whether or not participants were explicitly cued as to the categorisation of the to-be-remembered stimuli, thus demonstrating the automatic accessibility of person-based semantic knowledge linked to familiar names.

The IAC model can explain both PI and RPI; as the exemplars from a single category are presented, the number of activated PINs attached to the categorical SIU increases, and the less effective that SIU becomes as a cue for recall. Once the category is shifted, however, the new categorical SIU is attached to far fewer active PINs, and serves as a more efficient memory cue. However, the IAC model clearly stipulates that there should be no difference in the pattern of RPI effects when the to-be-remembered items are presented as written names or as face images. Under the model, faces activate specific face recognition units (FRUs) which pass activation to the relevant PIN, whereas names activate name recognition units (NRUs) which also pass activation to the PIN. As the PIN is the sole point of access between

recognition systems and semantics, any pattern of effects related to semantic organisation should appear regardless of whether the input is via the NRU or the FRU, a prediction that has been corroborated in priming experiments (Carson & Burton, 2001; McNeill & Burton, 2002).

In the current investigation, we examined whether the categorical RPI effects reported by Darling and Valentine (2005) for occupational categories would be observed when the to-be-remembered material comprised faces rather than names. There were three specific motivations for this inquiry. First, finding RPI effects with faces would provide further evidence of categorical, nonassociational storage in semantic memory for people; second, it would strengthen the case for the RPI methodology as a useful tool for probing the structural organisation of person knowledge; and third, it would provide additional support for the IAC model, which predicts identical semantic memory effects for visual and verbal stimuli.

METHOD

Participants

Twenty-eight undergraduate students of the University of Aberdeen took part (14 males). Mean age was 19 years 1 month ($SD = 1$ year 6 months, range = 18–24). Participation was in return for course credit and the experiment was approved by the Psychology Ethics Committee at the University of Aberdeen.

Stimuli and apparatus

Stimuli comprised 40 greyscale images of the head and shoulders of familiar celebrities presented against varying backgrounds (20 actors and 20 musicians). These images were all scaled to be 250 pixels high (approx. 8° visual angle) and were presented centrally on a 17-inch CRT monitor using the E-Prime™ (Psychology Software Tools, Inc., PA) experiment generation package. The images were grouped into five sets of four images per condition. Twelve pilot participants had previously attempted to identify the images, and their performance was used in order to balance the difficulty of the image sets. The 20 most easily identified images of actors were included in the study alongside the 20 most easily identified images of musicians. None of the images were identified by fewer than half of the pilot participants and the mean number of pilot participants to correctly identify included items was 9.3 ($SD = 1.8$).

Design and procedure

The design and procedure was modelled closely on Darling and Valentine (2005, Exp. 1), but with one important modification: The to-be-remembered items comprised faces rather than names (see Appendix). The experiment consisted of 10 trials. Each trial comprised the appearance of a fixation cross, which remained on screen for 1000 ms. This was then replaced by the sequential presentation of four faces, individually, for 1500 ms each. Following the presentation of the faces, participants counted backwards in threes, aloud, from a designated three-digit number. Backward counting was included to prevent participants rehearsing the stimuli in working memory. After 10.5 s of counting, the message "RECALL" was presented on the screen, and participants attempted to name the four celebrities aloud: Order of recall was not important. Fifteen seconds were allowed for recall before the next trial was automatically initiated.

Face sets used in the first five trials in the experiment were all from one of two occupational categories, either all four faces were of musicians or of actors (category was counterbalanced fully across participants). The selection of the specific set used for each trial was randomised across the sample. Crucially, on the sixth trial, the category changed, either from musicians to actors or vice versa, enabling the presence of RPI to be observed by comparing performance on Trials 5 and 6. Remaining trials all used items from the second occupational category. Build-up of PI could therefore be assessed over Trials 1–5 and 6–10.

As in Darling and Valentine's (2005) study, cueing was manipulated as a between-participants variable: Participants in the cued condition were shown the text "Actors" or "Musicians" at both fixation and test, depending on the nature of the to-be-remembered items on that trial. Participants in the uncued condition were not shown a cue. Prior to the study, participants in the cued condition were told that the cue would provide information about the items in the trial. Formal instructions, backward-counting practice, and practice trials were all administered prior to participants undertaking the experimental trials.

RESULTS

Memory performance in cued and uncued conditions is shown in Figure 2. RPI was assessed by a 2×10 mixed design ANOVA. If RPI was present, it would be demonstrated by an increase in performance from Trial 5 to Trial 6. Hence, trial was included in the analysis as a within-subjects factor, and cue condition (cued or uncued) as a between-subjects factor. The main effect of trial was significant, $F(9,\ 234) = 3.82,\ MSE = 0.78,\ p < .001,\ \eta^2 = .12$.

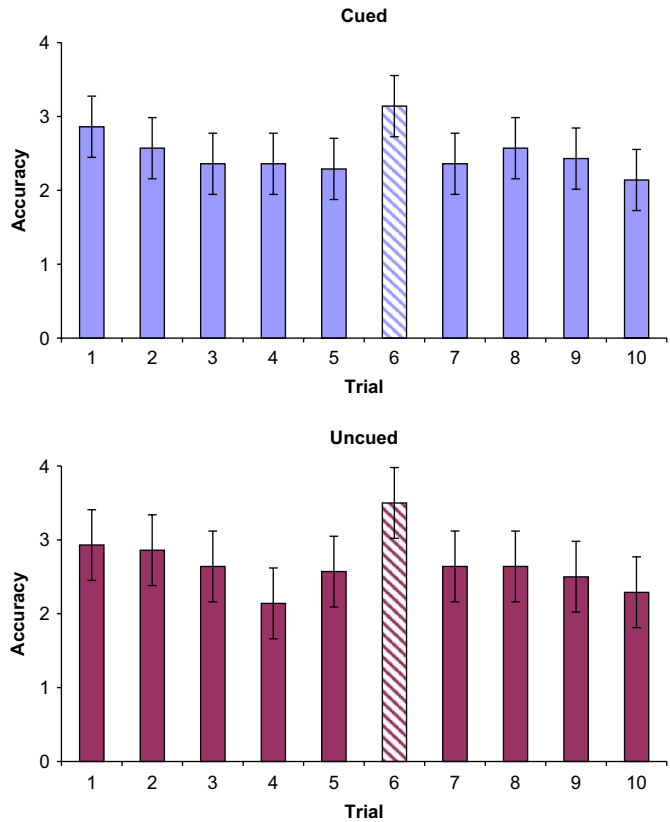

Figure 2. Graphs showing the mean number of correctly remembered items on different trials for cued and uncued groups. Error bars represent within-subjects confidence intervals. Trial 6, critical for assessing the presence of RPI, is highlighted. To view this figure in colour, please see the online issue of the Journal.

Predicted comparisons analysis demonstrated significantly higher mean accuracy on Trial 6, immediately after the category shift ($M = 3.32$, $SD = 0.72$) than on Trial 5, immediately before the shift ($M = 2.43$, $SD = 1.00$), $p < .005$. Neither the main effect of cueing or the interaction between cueing and trial was significant (both Fs < 1). Figure 2 suggests that there was a difference between performance on Trial 1 and Trial 6. This had not been explicitly predicted, and did not emerge as a significant difference when investigated by a post hoc comparison corrected for multiple comparisons.

Build up of PI was assessed by two separate mixed design ANOVAs to probe for linear trends. One analysis compared Trials 1–5, the other compared Trials 6–10. Trial and cue condition were factors. For Trials 1–5, the main effect of trial was significant, $F(4, 104) = 2.63$, $MSE = 0.67$, $p < .05$,

$\eta^2 = .09$, but not the main effect of cueing or the two-way interaction ($F < 1$ in both cases). Within-subjects contrast analysis showed that the linear trend across Trials 1–5 was significant, $F(1, 26) = 6.52$, $p < .05$, $MSE = 0.83$, $\eta^2 = .20$, with performance declining across Trials 1–5. For Trials 6–10, the main effect of trial was significant, $F(4, 104) = 5.72$, $MSE = 0.85$, $p < .001$, $\eta^2 = .18$, but not the main effect of cueing or the interaction between trial and cueing ($F < 1$ in both cases). The linear trend of performance declining from Trial 6 to Trial 10 was significant, $F(1, 26) = 41.71$, $p < .001$, $MSE = 0.34$, $\eta^2 = .61$.

To ensure that RPI was not related to variations in counting performance, counting performance was analysed with a 2×10 mixed design ANOVA. There was no evidence of main effects or interactions (all Fs < 1), and therefore it cannot be the case that the PI and RPI effects observed in this study were the result of tradeoffs between counting task and memory task performance.

DISCUSSION

The results showed a category-shift related RPI effect on Trial 6 compared to Trial 5 across both the cued and uncued conditions. There was also evidence of the build-up of PI over Trials 1–5, and Trials 6–10. There were no interactions with cueing. This pattern is consistent with the idea that category-specific proactive interference increased when items were drawn from a single occupational category, but was released when the category shifted, and that cueing did not modify this pattern.

The current experiment using faces as stimuli replicated Darling and Valentine's (2005) results almost exactly: Comparing the two studies shows that there were no substantive differences in the patterns of RPI obtained when either faces or names were used. The observation of RPI in the uncued condition demonstrated that categorical effects for faces were automatically accessible as they had been to names in the previous study. This pattern is consistent with the IAC model, which asserts that there should be no differences in processing in semantic memory as a consequence of input modality. This observation converges with evidence of cross-modality priming in semantic memory for people (Carson & Burton, 2001; McNeill & Burton, 2002). Valentine, Hollis, and Moore (1998) argued that cross-modal priming effects were different between object and person domains, and that cross-modal priming was only present for people as opposed to objects because of the reliance on the single PIN in person, but not object-based semantic memory. Therefore, although RPI in person stimuli should be identical irrespective of modality of presentation, this is not necessarily the case for object stimuli.

Alternative explanations of the interaction between face and name recognition and semantic memory have been proposed. Recently, Damjanovic and Hanley (2007) reported that access to semantic and episodic information about familiar celebrities in a remember/know experiment differed when the stimuli were presented as voices as opposed to faces. They argued that this might pose a problem for the single-point-of-access aspect of the IAC model. Had patterns of RPI in the current study been different to those observed by Darling and Valentine (2005), this would have presented great difficulty for the IAC model as it would have represented a situation in which semantic effects were different when person information was accessed via names or faces. In this study, we observed almost identical RPI effects in face recognition as in name recognition, so the data are compatible with the single-point-of-access PIN. However, other explanations involving multiple routes of access to semantic memory are also compatible with the data observed.

The novel finding that categorical RPI effects can be found in a memory task using face images as the to-be-remembered stimuli adds support to Darling and Valentine's (2005) claim that RPI is a valid indicator of the categorical structure of semantic memory. Thus, the current study can be added to previous work arguing for categorical organisation in semantic memory (e.g., Carson & Burton, 2001; Darling & Valentine, 2005). This suggests that the RPI technique may be useful in probing categories of direct importance to social cognition. The method used in the current study has the power to identify the categorical structure of semantic knowledge about people. Such categories are not limited to the occupational categories used in the current study: Therefore, in the future this methodology has the potential to be used to investigate knowledge related to potent social categories, such as race, age, or sex.

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APPENDIX

Names of celebrities whose images were used as to-be-remembered items

Mel Gibson	Jenifer Aniston	Tom Hanks	Ewan Mcgregor
Leonardo Di Caprio	Jack Nicholson	Drew Barrymore	Julia Roberts
Rene Zellweger	Tom Cruise	Sarah Jessica Parker	Marilyn Monroe
Halle Berry	Hugh Grant	Catherine Zeta Jones	Kate Winslet
Samuel L. Jackson	Sean Connery	Nicole Kidman	Jackie Chan
Eminem	Kylie Minogue	Elton John	Sting
Ozzy Osbourne	Mariah Carey	Madonna	Bob Geldof
Natalie Imbruglia	Marilyn Manson	George Michael	Elvis Presley
Paul Mccartney	Britney Spears	Robbie Williams	Gwen Stefani
Cliff Richard	Geri Halliwell	Will Young	Bono