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Categorical priming of famous person recognition: A hitherto overlooked
methodological factor can resolve a long-standing debate.

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Abstract

The Burton, Bruce and Johnston (1990) model of person recognition proposes that representations of known persons are connected by shared semantic attributes. This predicts that priming should be observed between persons from the same category, e.g. famous persons with the same occupation. Empirical investigations to date have produced mixed results, and comparison of methods suggests that priming based on shared occupation may have been suppressed by the presence of prime-target pairs representing a stronger relationship of close association. In the present experiment, 72 participants performed a familiarity decision to famous names preceded by close associates or members of the same occupational category. As predicted, categorical priming was observed in the group of participants for whom the same-occupation prime-target pairs were presented before the close associate pairs, but not in the group for whom the two types of relationship were intermixed. Associate priming was significant in both groups. These results are attributed to differing levels of processing of the primes, invoked by participants' observation of the most salient prime-target relationship.

Introduction

Items can be related to each other either by being close associates (e.g. bread and butter, David and Victoria Beckham), or members of the same semantic category (e.g. bread and apple are both food, David Beckham and Michael Owen are both footballers). Categorical priming occurs when the response to a target item is speeded by the prior presentation of a different item belonging to the same semantic category, but not sharing a close association with the target. Categorical priming has been reported in tasks of word recognition (e.g. Becker, 1980; Fischler, 1977; Fischler & Goodman, 1978; Sperber, McCauley, Ragain & Weil, 1979; see Neely, 1991, for a review) and tasks of object recognition (Barry, Johnston & Scanlan, 1998; Humphreys, Riddoch & Quinlan, 1988; Huttenlocker & Kubicek, 1983; Lupker, 1988; Sperber et al, 1979). This paper investigates the categorical priming of famous person recognition.

The Burton, Bruce and Johnston (1990; see also Burton, Bruce & Hancock, 1999) model of person recognition proposes that when a known face or name is recognised, activation spreads from the face / name recognition unit (FRU / NRU) to the representation of the person in the Person Identity Node (PIN) and then to identity-specific semantic information stored in semantic information units (SIUs). Each SIU is connected to the PINs of other persons sharing the same semantics and, therefore, when the face or name of a known person is presented, activation should spread to the representations of other persons sharing the same semantics. Since categorical information (e.g. occupation) is assumed to be stored in SIUs, this clearly predicts categorical priming, and, as noted by Carson and Burton (2001), the failure to find categorical priming would be a problem for the Burton et al (1990) model.

To date, however, empirical evidence for categorical priming of person recognition has been inconclusive. Bruce (1983), Brennen and Bruce (1991), and Stone and Valentine (2007) all reported categorical priming, as did Carson and Burton (2001) from multiple primes though not from a single prime, while Barry, Johnston and Scanlan (1998) and Young, Flude, Hellowell and Ellis (1994) reported non-significant categorical priming. The latter two papers both noted that the absence of categorical priming, compared with larger and statistically significant associative priming, challenged the Burton et al (1990) model of organisation of person knowledge.

It is, therefore, relevant to consider whether methodological differences may have given rise to these inconsistent results. A factor that appears to have influenced the observation of significant categorical priming is the presence of a substantial proportion of close associate prime-target pairs.

Young et al (1994) presented each participant with a set of trials in which 25% of familiar targets were primed by close associates and 25% were primed by members of the same occupational category. They reported significant priming only from close associates, with non-significant categorical priming, in a face familiarity decision (Experiment 2 and 3) and a face naming response (Experiment 3). Barry et al (1998) used a similar design, and also reported significant associative priming and non-significant categorical priming, in a face familiarity decision (Experiment 1) and face naming response (Experiment 2).

In contrast, Bruce (1983) reported significant priming of a face familiarity decision from same-category primes as well as close-associate primes, but each participant responded to only 2 or 3 associate-primed targets and 2 or 3 category-primed targets embedded among 60 trials. Brennen and Bruce (1991) used only same-

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category pairs as their stimuli with no associated pairs (Experiment 1, 2 and 4), or varied type of relation as a between-participant factor (Experiment 5). Stone and Valentine (2007) used only same-category pairs. Carson and Burton (2001) used only same-category pairs, and observed significant categorical priming from 4 primes but not from a single prime.

This review suggests that categorical priming of person recognition is usually observed in the absence of a substantial proportion of prime-target pairs representing close associates. A potential explanation follows.

It seems plausible that closely-associated pairs would generally catch participants' attention due to their high familiarity as compound stimuli. To explain how such familiarity might be represented, consider that the close associates of a famous person are a type of semantic information and so would be represented in the Burton et al (1990) model within a type of SIU. This SIU would, logically, link to the PIN representing the close associate person. If two persons frequently co-occur then the links between their PINs and the corresponding close associate SIU would be strong. The precise nature of the close associate SIU remains to be established, but it seems probable that some conceptually similar structure must exist in order to represent close associations between known persons.

It has often been observed that the nature of the task performed on a prime stimulus affects the amount of priming of related targets (e.g. Friedrich, Henik & Tzelgov, 1991), an affect attributed to level of processing of the prime. It seems plausible that the presence of a substantial proportion of close-associate pairs within a series of trials would focus attention on the corresponding level of processing of each prime. Then activation would spread to the SIUs representing close associates, and on to the PINs of these persons, resulting in associate priming. A different level of

processing of the prime (e.g. category membership) would not be engaged, so activation would not spread to SIUs representing category. Thus, same-category targets would not be primed.

This analysis assumes that participants would generally be satisfied with the observation of a strong prime-target relationship and would not look for another, weaker relationship. This assumption is supported by Schweinberger, Pfütze and Sommer (1995), who found no effect of associative priming in a task with associated pairs and repeated pairs. The absence of associative priming, normally a reliable phenomenon, was attributed to the presence of the repeated pairs.

According to this analysis, significant categorical priming was observed by Bruce (1983) because the proportion of associated pairs (only 5%) was too low to focus the processing of the primes on close associates, so that activation was able to spread to same-category members. Carson and Burton (2001) observed significant categorical priming from 4 primes but not from a single prime; it seems plausible that 4 primes from the same occupation would have focused attention particularly strongly on this level of processing of the primes.

The present experiment investigated the hypothesis that categorical priming of person recognition would occur in the absence of a substantial proportion of prime-target pairs representing close associates. Names of famous people were presented in prime-target pairs representing two different relationships, close association and membership of the same occupational category. In the *mixed* condition, these were intermixed in the same block of trials: the prediction was for statistically significant associative priming and non-significant categorical priming. In the *category-first* condition, the same prime-target pairs were arranged so that all of the same-category pairs were presented before any of the close associate pairs: the prediction was for

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statistically significant categorical priming as well as associative priming. Condition (mixed vs. category-first) was varied between participants. Note that, because the presence of close associates was expected to result in processing of primes only at this level, a similar magnitude of associate priming was predicted in the mixed condition and the second block of the category-first condition. The task was a familiarity decision to the target name.

Method

Participants. The participants were 51 female and 21 male, aged between 18 and 63, mean age 32.1, s.d. 10.4 years. Other participants (n=12) with low accuracy in any condition, or unusually slow response times, were excluded from the analysis.

Stimuli. These consisted of 36 pairs of closely associated famous persons (see appendix) arranged into 3 sets of 12 pairs. Each participant saw the names in one set in their close associate pairs, the names in a second set rearranged to form pairs with the same occupational category but no close association, and in the remaining set rearranged to form unrelated pairs. The allocation of name set to type of relationship was counterbalanced across participants. In addition, 36 unfamiliar names (see appendix) were created to serve as targets, in order to generate the name familiarity decision. These were preceded by a new set of 36 famous names so that prime familiarity would have no predictive value for target familiarity.

Design. There was a between-participant factor of condition (mixed vs. category-first) and a within-participant factor of relationship (associated, same-category, unrelated, and unfamiliar). The unfamiliar targets were included only to generate a target name familiarity decision. Each participant responded to 72 targets: 36 unfamiliar targets; and 36 famous targets with 12 associate primes, 12 same-

category primes, and 12 unrelated primes. Each prime-target pair was presented twice for a total of 144 trials.

The prime was presented for 250ms followed by the target after an inter-stimulus interval of 750ms, giving a stimulus onset asynchrony (SOA) of 1000ms. This compares with SOA of 1000ms in Carson and Burton (2001), 1100ms in Barry et al (1998), and 500ms in Young et al (1994). Note that Bruce and Valentine (1986) reported very little difference in associate priming between 250ms and 1000ms SOA.

Half the participants were allocated to the mixed condition, in which the sequence of trials was fully randomised by the computer for each participant. The remaining participants were allocated to the category-first condition, in which the first block contained same-category pairs and unrelated pairs, and the second block contained close-associate pairs and unrelated pairs; within this constraint, the sequence of trials was randomised for each participant.

Procedure. Participants performed the task individually. The task was a simple name familiarity decision (press Y if the name is famous and N if it is not) and the experimental trials were preceded by 8 practice trials (the practice was repeated if necessary to ensure the participant was fluent with the task). Each trial was initiated by the response on the previous trial after an inter-trial interval of 1 second. Participants were asked to read the prime but ignore it, then respond to the target “without thinking too long about it” and “not to worry about making a few mistakes”.

Results

Mean accuracy for two targets was low (Dec Donnelly 39%, Norman Pace 55%) and these were excluded from the analysis. In addition, it was observed post-experimentally that two of the same-category pairs included an element of repetition

priming (Prince Charles and Prince Albert; Prince Andrew and Prince Phillip) and these were also excluded from the analysis.

The mean response time was calculated for associated, same-category and unrelated targets. Incorrect responses (8.7%), responses faster than 200ms (none), and responses slower than 3 seconds or more than 2.5 standard deviations above the participant mean (3.5 %), were excluded. See Figure 1.

Analyses of variance were performed by participants (subscript 1) and by items (subscript 2) with factors of relationship (close associates, same category, unrelated; within-participant and within-item) and condition (mixed vs. category first; between-participant and within-item). The interaction was significant, $F_1(2,140) = 3.75, p < 0.05$ [$F_2(2,62) = 3.53, p < 0.05$]. Paired-samples t-tests examined associate priming and categorical priming in both conditions. In the category-first condition, associate priming of 67ms was significant, $t_1(34) = 3.89, p < 0.001$ [$t_2(31) = 4.36, p < 0.001$], as was categorical priming of 50ms, $t_1(34) = 4.68, p < 0.001$ [$t_2(31) = 4.82, p < 0.001$]. In the mixed condition, associate priming of 68ms was significant, $t_1(36) = 5.16, p < 0.001$ [$t_2(31) = 4.20, p < 0.001$], but categorical priming of 9ms was non-significant, $t_1 < 1$ [$t_2 < 1$].

Analyses of variance were performed with the same factors and accuracy as the dependent variable. No effects were significant, all $F < 1.3, p > 0.3$.

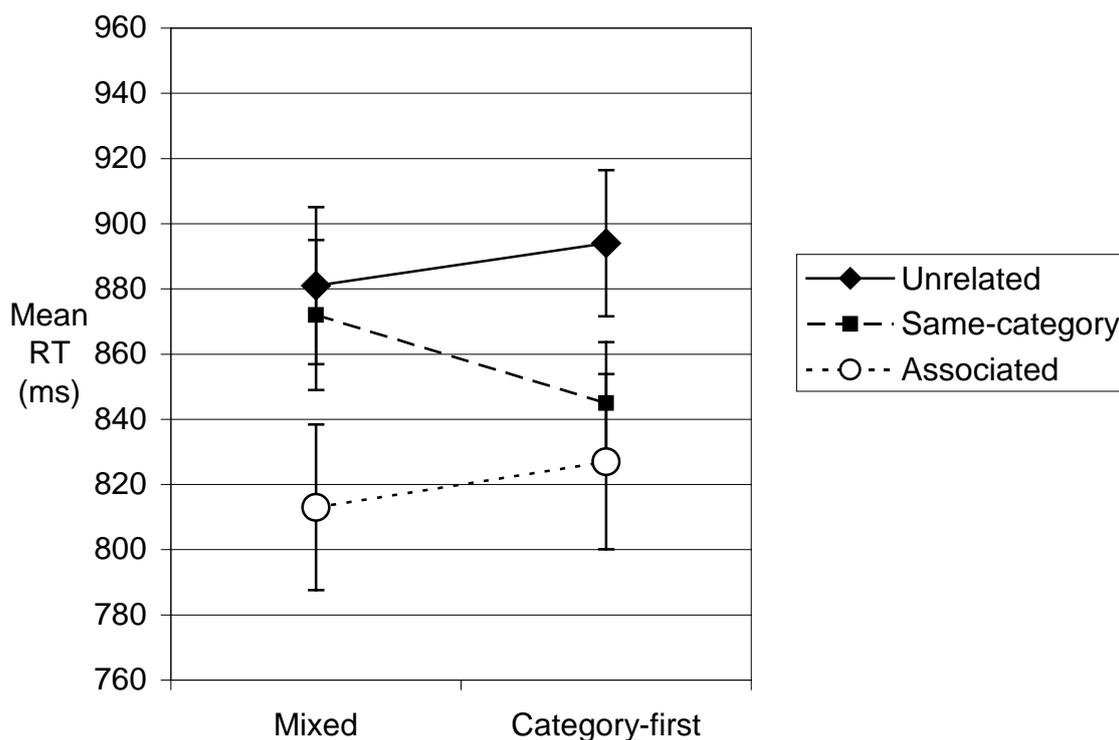


Figure 1: mean response time in the mixed and same-category conditions. Bars represent standard errors.

Discussion

The prediction for this experiment was confirmed: categorical priming was statistically significant when the targets primed by members of the same occupational category were presented before the targets primed by close associates, and was non-significant when the two types of relationship were intermixed. Associate priming was significant in both conditions. This supports the hypothesis that categorical priming of person recognition may be suppressed by the presence of prime-target pairs representing a stronger relationship of close association. It seems likely that levels of prime processing played a role in producing this observed pattern of results.

Participants in the mixed condition observed close associate prime-target pairs early in the sequence of trials. It seems plausible that their attention was captured by

the close associate pairs because of their familiarity as compound stimuli. As a consequence, when a prime was presented, processing was focused on its close associates, causing activation to spread to the representations of these persons and restricting the spread of activation to members of the same occupational category. In contrast, participants in the category-first condition observed only same-category related prime-target pairs during the first half of the experimental trials. It seems plausible that these participants would have processed the primes at the level of occupational category, causing activation to spread to same-category members. Thus, participants in the category-first condition showed categorical priming.

This experiment adds to recent evidence (e.g. Carson & Burton, 2001; Darling & Valentine, 2005; Stone & Valentine, 2007) that categorical priming of person recognition is a replicable phenomenon, and thus lends support to the Burton et al (1990) model of person recognition. The failure to consistently observe categorical priming of person recognition in previous published experiments had been a serious challenge to the model. By demonstrating that a simple methodological variable seems likely to have been responsible for inconsistencies in the previous literature, the present experiment may be able to resolve a long-standing debate.

Barry et al (1998) proposed that semantic representations of objects are structured such that superordinate categories serve to connect members of the same category. In contrast, they proposed that the structure of semantic knowledge for known persons has no such superordinate categories; rather, representations of known persons are connected to each other individually by links representing specific interpersonal relatedness. The results of the present experiment challenge this view. It seems likely that known persons are also linked via at least one superordinate category representing occupation.

The existence of a type of SIU representing close associates is supported by recent evidence from Vladeanu, Lewis and Ellis (2006). Participants learnt a set of new faces, in which some pairs of faces co-occurred several times, other pairs of faces had particular items of semantic information in common, and some pairs of faces enjoyed both forms of relatedness. The results showed that priming resulted both from shared semantics and from the likelihood of co-occurrence with the strongest priming observed when a pair of faces enjoyed both forms of relatedness. Thus, it appears that representations of known persons may be linked by SIUs representing close associates as well as SIUs representing other type of semantic information.

It follows that associate priming of person recognition would typically benefit from co-occurrence and other shared semantics, while categorical priming would benefit only from other shared semantics. This would explain why associate priming is consistently observed to be greater than categorical priming where both are statistically significant (99ms vs. 37ms in Brennen & Bruce, 1991; 135ms vs. 118ms in Bruce, 1983; 67ms vs. 50ms in the present experiment).

A question still remains, however: it appears that categorical priming of person recognition can be suppressed by the presence of a stronger relationship intermixed in the same block of trials, yet this does not appear to be the case for object recognition. It might be tempting to conclude that categorical priming of person recognition is an especially fragile phenomenon. Leaving aside that it would be invalid to make this assumption on the basis of investigation of a single categorical relationship, another, more intriguing possibility arises. It may be the case that associate priming of person recognition is a particularly strong phenomenon. Why should this be the case? A speculative answer can be offered, as follows.

The strength of associate priming seems likely to depend on (among many factors) the frequency of co-occurrence. Specifically, the magnitude of priming would depend on the predictive value of the prime for the target; if the prime almost always co-occurs with the target then the predictive value is high. The mean predictive value of the prime for the target in the present experiment was over 60%. This may reflect that some pairs of closely associated famous persons are (virtually) never encountered singly, but only as the duo (e.g. Morecambe and Wise). This is less likely to be the case for objects that are encountered in everyday life. This seems worthy of further exploration.

In conclusion, the experiment presented here resolves an inconsistency in the extant literature on categorical priming of person recognition, and demonstrates that a methodological variable was likely to have been responsible for different patterns of results. The demonstration of significant categorical priming of person recognition supports the Burton et al (1990) model of person recognition. Further investigation of the contribution of co-occurrence to associate priming would be an interesting line for future investigation.

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Appendix A – Stimuli

Associated Pairs

Numbers show the degree of association, measured as the proportion of participants (n = 17, 5 male) who gave the second name as the “first name that springs to mind” when presented with the first name. Mean degree of association = 0.61, s.d. = 0.23

Set A

0.53	John Lennon	Paul McCartney	0.71	Keith Richards	Mick Jagger
0.41	The Queen	Prince Philip	0.65	Prince Andrew	Sarah Ferguson
0.94	Stanley Laurel	Oliver Hardy	0.88	Eric Morecambe	Ernie Wise
0.71	Ronnie Corbett	Ronnie Barker		Ant McPartlin	Dec Donnelly
1.00	Ginger Rogers	Fred Astaire	0.18	Tom Cruise	Katie Holmes
0.29	Phillip Schofield	Fern Britten	0.59	Robin Hood	Maid Marion

Set B

0.59	Madonna	Guy Ritchie	0.47	Zoe Ball	Fatboy Slim
0.53	Prince Charles	Camilla Parker-Bowles	0.76	Queen Victoria	Prince Albert
0.53	Mel Smith	Griff Rhys-Jones	0.71	Ian Hislop	Paul Merton
0.88	Dawn French	Jennifer Saunders	0.29	Martin Clunes	Neil Morrissey
0.71	Angelina Jolie	Brad Pitt	0.53	Hugh Grant	Liz Hurley
0.71	Richard Madeley	Judy Finnegan	0.94	Romeo	Juliet

Set C

0.94	Chris Evans	Billie Piper	0.53	Justin Timberlake	Britney Spears
0.41	Prince Edward	Sophie Rhys-Jones	0.59	Henry the Eighth	Anne Bolyen
0.76	Vic Reeves	Bob Mortimer	0.47	Paul Whitehouse	Harry Enfield
	Gareth Hale	Norman Pace	0.35	John Cleese	Michael Palin
0.82	Michael Douglas	Catherine Zeta-Jones	0.12	Gwynneth Paltrow	Ben Affleck
0.24	Tess Daley	Vernon Kaye	0.53	Anthony	Cleopatra

Same-category Pairs

None of these pairs had any measured degree of association, in so far as none of the 17 participants offered the second name as “the first name that springs to mind” when presented with the first name.

Set A

Keith Richards	Paul McCartney	John Lennon	Mick Jagger
Prince Andrew	Prince Philip	The Queen	Sarah Ferguson
Eric Morecambe	Oliver Hardy	Stanley Laurel	Ernie Wise
Ant McPartlin	Ronnie Barker	Ronnie Corbett	Dec Donnelly
Tom Cruise	Fred Astaire	Ginger Rogers	Katie Holmes
Richard Madeley	Fern Britten	Romeo	Maid Marion

Set B

Zoe Ball	Guy Ritchie	Madonna	Fatboy Slim
Queen Victoria	Camilla Parker-Bowles	Prince Charles	Prince Albert
Ian Hislop	Griff Rhys-Jones	Mel Smith	Paul Merton
Martin Clunes	Jennifer Saunders	Dawn French	Neil Morrissey
Hugh Grant	Brad Pitt	Angelina Jolie	Liz Hurley
Tess Daley	Judy Finnegan	Anthony	Juliet

Set C

Justin Timberlake	Billie Piper	Chris Evans	Britney Spears
Henry the Eighth	Sophie Rhys-Jones	Prince Edward	Anne Bolyen
Paul Whitehouse	Bob Mortimer	Vic Reeves	Harry Enfield
John Cleese	Norman Pace	Gareth Hale	Michael Palin
Gwynneth Paltrow	Catherine Zeta-Jones	Michael Douglas	Ben Affleck
Phillip Schofield	Vernon Kaye	Robin Hood	Cleopatra

Unrelated Pairs

Set A

Ronnie Corbett	Paul McCartney	Ant McPartlin	Mick Jagger
Tess Daley	Prince Philip	Ginger Rogers	Sarah Ferguson
Tom Cruise	Oliver Hardy	Anthony	Ernie Wise
John Lennon	Ronnie Barker	Keith Richards	Dec Donnelly
Prince Andrew	Fred Astaire	Stan Laurel	Katie Holmes
The Queen	Fern Britten	Eric Morecambe	Maid Marion

Set B

Dawn French	Guy Ritchie	Martin Clunes	Fatboy Slim
Phillip Schofield	Camilla Parker-Bowles	Angelina Jolie	Prince Albert
Hugh Grant	Griff Rhys-Jones	Robin Hood	Paul Merton
Madonna	Jennifer Saunders	Zoe Ball	Neil Morrissey
Queen Victoria	Brad Pitt	Mel Smith	Liz Hurley
Prince Charles	Judy Finnegan	Ian Hislop	Juliet

Set C

Richard Madeley	Billie Piper	Michael Douglas	Britney Spears
Gwynneth Paltrow	Sophie Rhys-Jones	Romeo	Anne Bolyen
Chris Evans	Bob Mortimer	Justin Timberlake	Harry Enfield
Prince Edward	Norman Pace	Henry the Eighth	Michael Palin
Paul Whitehouse	Catherine Zeta-Jones	Gareth Hale	Ben Affleck
Vic Reeves	Vernon Kaye	John Cleese	Cleopatra

Unfamiliar target names

Alan Overton	Bill Royston	Billy Boone	Bob Smith
Carl Boone	Dean Chambers	Dick Selly	Donald Lester
Eric Bellow	Glad Coombe	Greg Tooting	Harry Boulder
James Morton	Kevin Donnelly	Laura Belling	Lindy Burge
Lucy Bamber	Malcolm Dollard	Mark Selby	Martin Deal
Maynard Hull	Nina Dillon	Norbert Fellows	Paul Carroll
Rick Oswald	Roger Tintern	Ross Poole	Sarah Barnet
Serge Cottell	Stuart Millet	Susan Wieland	Terry Black
Trevor Brown	Vernon Miller	Walter Dougal	William Hodge