The Nominal Competitor Effect: When One Name Is Better Than Two.

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Abstract

Brédart, Valentine, Calder and Gassi (1995) described an interactive activation and competition (IAC) model in which the lexical representations of people's names have inhibitory connections between each other, but do not receive inhibition from the representation of biographical properties. The model predicts that people would be slower to name a celebrity for whom two names are equally available than they would be to name an equally familiar celebrity for whom only one name is available. However, naming should only be slowed by competition from a competing *name*; a highly available biographical property should not increase face naming latency. These predictions were confirmed in a simulation of the model. The effect is referred to as the *nominal competitor effect*. Experiment 1 showed that participants who had practiced naming actors using both the actor's name (e.g. John Cleese) and the character's name (e.g. Basil Fawlty) were slower to produce the actor's name at test than were participants who had practiced producing only the actor's name. However, practice in naming the relevant television series (e.g. Fawlty Towers) did not inhibit subsequent production of the actor's name. In contrast to the semantic competitor effect in picture naming, the effect reported here was found to be long-lasting (Experiment 2).

Introduction

A challenge addressed in the face processing literature has been to account for findings that the recall of identity-specific semantic information (biographic information; e.g. occupation) is far more robust than recall of a familiar person's name. In a diary study Young, Hay and Ellis (1985) found many errors when people could recall biographical details of somebody they encountered but were unable to recall the person's name. However, they found *no* occurrences of successful name retrieval when the diarist was unable to recall *any* identity-specific semantics. Furthermore, recall of biographical information is faster than recall of people's names (Young, Ellis and Flude, 1988). Any model of the normal process of face naming must be able to account for the contingency of name retrieval upon retrieval of biographical information and the longer latency of retrieval of name information than of identity-specific semantic information.

Burton and Bruce (1992) introduced an interactive activation and competition (IAC) model of face naming in which faces, names and biographical properties of familiar people were represented by localist representations. In the model biographical properties and names are represented within a single pool of units referred to as semantic information units (SIUs). It is assumed that when a familiar face is seen activation is passed via a face recognition unit (FRU) to a person identity node (PIN). The PIN is a localist representation of a specific familiar person activated by a stimulus from any domain (e.g. by seeing the face or name of that individual, or by hearing their name or their voice). A person is recognised when the activation of the relevant PIN passes a threshold. Familiarity decisions to a face or name are assumed to be based on the activation of PINs.

The structure of the Burton and Bruce (1992) model appears to allow for names to be retrieved as rapidly as other semantic information and for recall of a name not to be contingent on retrieval of other semantic properties. However, this is not the case because biographical properties are often shared between individuals but people's full names are usually unique to one person. All links between units in different pools are assumed to be excitatory and bi-directional. All units within a pool are connected by inhibitory links of equal connection strength to all other units within the pool. As the activation of a PIN rises it sends activation to the SIUs to which it is connected. For example, the PIN for Bill Clinton would activate units representing the fact that he is a politician, American, president, a Democrat etc. As between-pool links are bi-directional activation will be passed back to units in the PIN layer which are connected to any of these properties. All of the SIUs which have become activated will pass activation back to the Bill Clinton's PIN. This mutual support speeds up the rise in activation of the SIUs that represent properties which are shared by other familiar people. In contrast the unit representing Bill Clinton's name does not benefit from any such mutual support because his name is unique and therefore connected only to Bill Clinton's PIN. (i.e. It is assumed that most people know only one 'Bill Clinton'.)

Burton and Bruce showed that in their model 'unique' SIUs reach their threshold of activation more slowly than units representing shared properties. They propose that this effect is the basis of slower retrieval of names than of biographical information. Furthermore, attenuation of the links between PINs and SIUs will cause the activation of unique SIUs to fail to reach threshold before the SIUs representing shared biographical properties. If attenuation of

PIN - SIU links is assumed to model difficulties in accessing identity-specific semantic information (either in brain-injured patients or temporary failures in neurologically intact individuals), the 'uniqueness' of names explains why biographical information may be recalled when a person's name is inaccessible, but it is never the case that a person's name can be recalled in the absence of any biographical details.

Some difficulties for the Burton and Bruce (1992) model have recently become apparent. The model predicts that knowing many biographical details about somebody should increase the time taken to name their face. SIUs that become activated as the PIN is activated will inhibit the activation of the SIU that represents the person's name. Therefore, the name will be recalled more quickly if few biographical details are known. Brédart *et al.* (1995) tested this prediction empirically. Participants named two groups of celebrities' faces. The groups were matched on rated familiarity but differed in the number of biographical facts about the celebrities that could be produced. Brédart *et al.* found that the faces of celebrities about whom many facts were known were named more quickly than were the celebrities about whom few facts were known.

Another prediction of the Burton and Bruce model is that patients who cannot name famous faces should be unable to retrieve other identity-specific semantic information that is unique to the individual. This prediction arises because the model makes no distinction at all between unique biographical information and a person's name. However, two patients have been reported who can retrieve unique information about celebrities they cannot name (Hanley, 1995; Harris and Kay, 1995). Patient BG reported by Harris and Kay (1995) was able to produce the catch-phrases of several celebrities she could not name

Brédart *et al.* (1995) noted that the Burton and Bruce (1992) model is incompatible with models of speech production because it does not draw a distinction between non-lexical conceptual representations and lexical representations. This distinction is found in most models of speech production (e.g. Butterworth, 1989; Dell, 1986; Garrett, 1980; Harley, 1993; Kempen & Huijbers, 1983; Levelt, 1989; Levelt, Roelofs & Meyer, in press; Roelofs, 1992). If SIUs are assumed to represent non-lexical conceptual knowledge, what is the conceptual knowledge of a person's name? Proper names are, by definition, lexical units. If this is the case either all SIUs are lexical units, which implies the representations in semantic memory are lexical, or a justification needs to be made for storing lexical and conceptual units in a common pool.

Brédart *et al.* (1995) showed that all of these issues can be addressed by slightly modifying the architecture of the interactive activation model. First, they argued that names must be represented in a pool of Lexical Output Units (LOUs) which are separate from the semantic information units that represent biographical information. These pools represent different types of information: LOUs are lexical units, SIUs represent non-lexical, conceptual knowledge. LOUs represent the first stage of lexical access (equivalent to the lexical representations termed *lemmas* by Levelt, 1989). Second, different types of biographical information are represented in separate pools of SIUs. Thus there might be a pool of SIUs representing different nationalities; another pool may represent political opinions and yet another may represent occupations. All other aspects of the architecture and the processing assumptions are the same as the Burton and Bruce (1992) IAC model. All units receive inhibitory connections of the same strength from all other units within the same pool. All connections between units in different pools are excitatory and bi-directional with a single uniform weight (except where stated in the simulation reported below).

Brédart *et al.* (1995) demonstrated that the revised architecture showed the same properties which Burton and Bruce (1992) had set out to explain: no naming without recall of some biographical details was possible and retrieval of names was slower than recall of biographical details. Although the structure of the model allows for the possibility that names might be recalled in the absence of recall of any biographical details, Brédart *et al.* showed that if PIN - SIU links were attenuated sufficiently to prevent any SIU reaching threshold, no lexical output unit could reach threshold. Although the PIN - LOU links were intact, attenuation of the PIN - SIU links depressed the activity in the network to the extent that LOUs could not exceed their threshold. The effect arises because the activity of PINs was receiving less support from feedback from SIUs. The revised model relied on the uniqueness of names (i.e. the one-to-one mapping between PINs and LOUs) to account for the slower retrieval of names than of semantic properties. Therefore, the account of this effect is identical to that proposed by Burton and Bruce (1992).

Furthermore, Brédart *et al.* (1995) showed that the revised model correctly simulated the finding that knowing many biographical details about a person reduces the time taken to recall their name: LOUs associated with PINs connected to many SIUs reached their threshold activation faster than LOUs associated with PINs connected to few SIUs. Another advantage of the revised architecture is that it allows for the possibility that patients with an anomia for people's names will be able to recall unique biographical information.

The aim of the present study is to provide a further empirical test of the Brédart *et al.* model. More specifically, we describe a direct test of the assertion that people's names are represented separately from other biographical details.

The first experiment reported makes use of actors who could be identified by either their own name or the name of a character with whom they have become closely associated. If both names are equally available (i.e. the links from the PIN have equal connection strengths), the Brédart *et al.* model predicts that participants should be slower to name the actor's face than they would be if only one name was available (*the nominal competitor effect*). If two LOUs receive activation from a PIN they will start to mutually inhibit one another within the LOU pool. This mutual inhibition would slow down retrieval of the name. If only one LOU received activation from a PIN, there would be no inhibition from other LOUs, so name retrieval would be relatively fast. It is important to note that the maximum effect of inhibition will be observed when the two competing names are equally available. If one LOU becomes more activated than the other it will send more inhibition to the competing LOU than it receives from its competitor. The effect of inhibition will be to increase the difference in activation between the two LOUs so that the winner will rapidly suppress the activation of the other. In order to make the two names equally available one group of participants were given extensive and equal practice producing both the actor's and the character's name to a small set of faces of famous actors. Another group of participants practiced producing only the actor's name to provide a baseline condition for when only one name is much more available than the other. The model also makes the clear prediction that practice accessing a biographical property cannot inhibit recall of a person's name. Biographical properties and people's names are stored in separate pools and therefore do not share any inhibitory connection.

Before reporting the experiment, we demonstrate the behaviour of the Brédart *et al.* model by simulation.

Simulation 1

The architecture of the network was the same as the 90-unit network described by Brédart *et al.* (1995) and was implemented using the McClelland and Rumelhart (1988) software package. There were 24 person identity nodes, 24 lexical output units and 42 semantic information units arranged in 4 separate pools. The pools might represent biographical properties such as occupation, nationality, political opinion etc. One pool of SIUs included 24 units, each was connected to a different PIN. There were 8 units in another SIU pool and 6 units in third, each unit was connected to between 1 and 4 PINs. Finally, there was a pool of 4 units each connected to between 2 and 6 PINs. The values of the model parameters are listed in the Appendix. In the Brédart *et al.* simulations each PIN had been connected to one LOU (or name). These connections were altered such that 8 PINs were connected to 2 LOUs, 8 PINs were to 1 LOU and 8 PINs were not connected to any LOUs. All links between units in different pools were set to 1.0 unless otherwise stated. The effect of practicing a name was simulated by increasing the weight of the PIN - LOU link from 1.0 to 3.0. Following the procedure adopted by Brédart *et al.* the threshold value of the LOUs was set at 80% of the mean of their maximum level of activation. The threshold in this simulation was 0.52. The simulation focused on the 8 PINs that were connected to two LOUs. All simulations were repeated for all of these 8 PINs, by setting the initial activation of each PIN to 1.0 in turn.

The mean rise in activation of LOUs was recorded as a function of the number of processing cycles under the following experimental conditions: 1) The activation of an LOU connected to a PIN by a link with connection strength 3.0. The PIN was connected to another LOU with connection strength 1.0. This simulated the condition in which participants practiced producing the actor's name only, so that the desired name was much more available than the competitor name: 2) This simulation was identical to (a) except that the connection strength to the 'competitor' LOU was increased to 3.0. This simulated practice in producing both the actor's and the character's name: 3) This simulation was identical to (a) except that the weight of a link from the relevant PIN to an SIU in a pool of non-unique biographical properties was increased from 1.0 to 3.0. The SIUs were connected to a mean of 2.7 PINS. This simulated practice in producing the actor's name and the name of the TV series or film.

It is assumed that naming latency is simulated in an IAC model by a monotonic function of the number of cycles taken for the relevant LOU to reach threshold. The rise in activation of the LOU was slower and the maximum level of activation (MLA) achieved in condition 2 (threshold reached after 17.0 cycles; MLA = 0.62) than in conditions 1 and 3 (threshold reached after 15.7 and 15.0 cycles respectively; MLA = 0.67 for both conditions). Note that there is no random factor in the interactive activation model. Thus, simulation 1 confirmed the prediction derived from the model. The aim of Experiment 1 was to provide an empirical test of the predictions.

Experiment 1

Method

Participants: Fifty-four students took part (34 male and 20 female).

Stimuli: The stimuli consisted of a set of twelve pictures of famous actors playing characters with which they have become strongly associated Therefore the pictures could be named with either the actor's name (e.g. John Cleese) or with the character's name (e.g. Basil Faulty).

The pictures were digitized as 16 grey level monochrome images 256 x 256 pixels. They showed head and shoulders views of the actor in approximately a full-face view.

Apparatus: Images were displayed in the centre of a PC screen using the MEL software package at a screen resolution of 640 x 480 pixels on a 14" screen. This software controlled the display of stimuli and logged vocal naming latency (with millisecond accuracy) from a voice key. A throat microphone was used to detect the participants' vocal responses. The experimenter coded each response recorded as acceptable or unacceptable. This enabled data from trials on which there was an accidental triggering of the voice key, a failure to trigger the voice key or an incorrect naming response to be excluded from the analysis.

Design: The experiment consisted of a between-participants design incorporating two phases; a practice phase and a test phase. There was one independent variable; the nature of the naming tasks in which the participant was practiced prior to the test phase. There were three levels of this variable. Either participants only practiced naming the pictures with the actor's name (condition 1); or they practiced naming the picture with both the actor's and the character's name (condition 2); or they practiced producing the actor's name and naming the TV series or film in which the character appeared (condition 3). In the test phase all participants were required to produce the actor's name only. The dependent variable was the mean naming latency of correct responses in the test phase.

Procedure: PRACTICE PHASE. The procedure for the practice phase of the experimental condition in which participants practised producing the actor's name only was as follows. Instructions were presented on the computer screen. Participants were informed that the face of a famous actor would appear in the centre of the PC screen after a brief warning tone. Their task was to say aloud the name of the actor as quickly as possible. Participants were instructed to give the full name of the actor. The image disappeared when the voice key was triggered by the participant's response. If the participant did not know the name or gave an incorrect response, the experimenter said the correct name and the participant was required to repeat it. The experimenter entered a response using the keyboard to code each response as correct or incorrect. Entering this response triggered the next trial. The warning tone at the start of each trial lasted for 250ms. There was a 500ms interval between the end of the tone and the display of the stimulus face. All 12 stimuli were presented once in a random order before any stimulus was repeated. The stimulus set was presented 4 times in a different random order each time. Although the presentation was organised into four 'blocks', the stimuli were presented as one list of 48 trials in which each stimulus appeared four times.

In the two other experimental conditions the procedure differed in only two respects. The group of participants who practiced producing both the actor's name and the character's name received 48 trials practice in producing the actor's name as described above. These trials were mixed in a pseudo-random order with 48 trials practice in producing the character's name, making a total of 96 trials. Each stimulus was presented once for each naming response before any of the stimuli were repeated. Immediately after the warning tone, the instruction 'ACTOR'S NAME' or 'CHARACTER'S NAME' was presented in the centre of the screen for a 2 second interval. The stimulus face then replaced the instruction.

The procedure for the participants who practiced production of the actor's name and the name of the TV series or film was the same as described above for the 'actor's name and character's name' condition, except that the instructions were modified appropriately. 'TV SERIES OR FILM' was presented in the centre of the screen in the place of 'CHARACTER'S NAME'.

TEST PHASE: The procedure for the test phase was identical for all participants. Instructions were presented on the computer screen. Each of the twelve stimulus faces was presented once in a random order. Participants were required to give the actor's name only as quickly as possible. In the test phase the latency of the vocal response (the time between the presentation of the stimulus and the triggering of the voice key) were logged by the computer. The logging of the accuracy of the response by the experimenter and the triggering of the presentation of the next image was as described for the practice phase.

Results

The accuracy of participants in producing the correct actor's name in the test phase was close to ceiling. The number of correct responses was as follows (maximum = 12): 11.67 (Actor's name only); 10.94 (Actor's and character's name) and 11.17 (actor's name and TV series or film). In view of the restricted variability in the data no further analysis was carried out.

The mean naming latency of correct responses in each experimental condition were as follows (standard errors are given in parentheses): actor's name only = 969ms (41ms); actor's and character's name = 1312ms (51ms) and actor's name and TV series or film = 939ms (35ms). These data were subjected to two separate one-way analyses of variance taking participants (F_1) or items (F_2) as the random factor, with repeated measures in the items analysis. The main effect of condition was significant $F_1(2,51)=9.66$, $p<.001$; $F_2(2,22)=32.03$, $p<.001$ Planned comparisons showed that naming latencies in the test phase following practice with the actor's name and the character's name were significantly slower than latencies following either practice with the actor's name alone $t_1(51)=3.64$, $p<.002$; $t_2(11)=5.15$, $p<.001$ or with the actor's name and the TV series or film $t_1(51)=3.95$, $p<.001$; $t_2(11)=7.14$, $p<.001$. Naming latencies in the test phase following practice with actors name and the TV series or film did not differ from naming latencies following practice with the actors name alone $t_1(51)=0.30$; $t_2(11)=1.01$.

Discussion

Practice naming the face of an actor using both the actor's name and the name of the character who (s)he portrays increased the time taken to subsequently name the face using the actor's name compared to the naming latency following practice in producing the actor's name only. Practice in producing the name of the TV series did not slow the speed of face naming. The predictions derived from the Brédart *et al.* (1995) model, were clearly supported by the data.

A comparison between priming a competitor name in picture naming and face naming.

Wheeldon and Monsell (1994) found that priming a semantic competitor increased the time taken to name a picture. For example, having recently produced the word 'shark' in response to a definition increased the naming latency of a picture of a whale. The effect was found to be short lived: it was reliable after an interval of approximately 12 seconds during which two trials had intervened but no effect was found after 4 - 8 minutes during which 38 - 100 names were produced. This is much shorter-lived than the facilitation that results from repetition priming. They suggest that the difference in time scale can be explained by attributing repetition priming to an increase in connection strength between the lemma and phonology but the semantic competitor effect to greater availability of the lemma of a semantic competitor following recent activation.

The results reported above raise the following question: Is the inhibition from having practiced an alternative name of a celebrity analogous to the semantic competitor effect in speech production? The present procedure is somewhat different to that used by Wheeldon and Monsell (1994). First, in Experiment 1 the participants were highly practiced in naming a small set of items. This was not the case in Wheeldon and Momsell's experiments. Second, the semantic competitor effect arises from previously naming a closely related but *different* concept (e.g. whale vs. shark), but the nominal competitor effect arises from having named the *same* person with a different name. Naming a whale as a shark is an error, but naming John Cleese as Basil Fawlty is not incorrect.

If the mechanism for the nominal competitor effect is the same as that which produces the semantic competitor effect both phenomena should be short-lived. In contrast, the Brédart *et al.* model uses the same mechanism to explain the nominal competitor effect and repetition priming. Therefore, this model predicts that the nominal competitor effect will be long-lived.

Experiment 2

In Experiment 1 the test phase followed the practice phase immediately. The number of intervening items between the last practice trial and the test trial of an item was between 0 and 12. The delay was between approximately 30 seconds and 2 minutes. These parameters include the number of intervening items and the delay after which the semantic competitor effect has been observed. Experiment 2 replicated conditions 1 and 2 of Experiment 1 but the test phase following after a minimum delay of 5 minutes and 46 intervening face naming trials.

Method

Participants: Twenty-four students (23 female and 1 male) took part for a course credit.

Stimuli and Apparatus: The stimuli and apparatus were the same as described above for Experiment 1.

Design: The design was the same as Experiment 1 except that there were only two experimental conditions: Either participants only practiced naming the pictures with the actor's name (condition 1) or they practiced naming the picture with both the actor's and the character's name (condition 2).

Procedure: The procedure was identical to that for conditions 1 and 2 of experiment 1, except for the intervening period between the practice phase and the test phase. After completing the practice phase, participants carried out a face naming task in which 46 famous faces were presented on the same PC screen for the participant to name as quickly as possible This task took approximately five minutes. The interval between the final practice trial and the first trial of the test phase was a minimum of 5 minutes and a maximum of 10 minutes.

Results

The number of correct responses in the test phase was as follows (maximum = 12): 10.17 (Actor's name only); 9.58 (Actor's and character's name). An independent t-test taking participants as the random factor and a related t-test taking items as the random factor confirmed that there was no reliable difference in the accuracy of face naming between the two experimental conditions (both t's < 1).

The mean naming latency of correct responses in each condition were as follows (standard errors are given in parentheses): actor's name only = 1178ms (64ms); actor's and character's name = 1920ms (268ms). An independent t-test (not assuming equal variances) was used to analyse the data by participant and a related t-tests were used for the by-items analysis. Naming latencies in the test phase following practice with the actor's name and the character's name were significantly slower than latencies following practice with the actor's name alone $t_1(12)=2.70$, $p<.02$; $t_2(11)=4.02$, $p<.01$.

Discussion

The results of Experiment 2 show that the nominal competitor effect survives over 46 intervening trials and a period of approximately 5 minutes. Therefore the effect is longer lasting than the semantic competitor effect. These data suggest different mechanisms underlie the two effects. The long-lasting nature of the nominal competitor effect suggests that it could arise from the same mechanism as that which gives rise to repetition priming. Therefore, the data are consistent with the interpretation in terms of an increase in the weight of the PIN – lexical unit link postulated by the Brédart *et al.* (1995) model.

Processing assumptions required to model inhibition of naming by priming a competitor name.

The architecture of the Brédart *et al.* model is broadly compatible with current models of speech production, in particular it has similarities with spreading activation models such as Dell (1986), Harley (1993), Roloefs (1992) and Levelt, Roloefs & Meyer (in press). However, only the Harley (1993) model and the Brédart *et al.* model include inhibitory connections in the lemma or morphological layer. The simulation reported above demonstrated that the Brédart *et al.* model can simulate the experimental result successfully. The question, therefore, arises of whether the models that do not postulate inhibitory links between lemmas can simulate the slowing of face naming by increased availability of a competitor. Wheeldon and Monsell (1994) point out that such slowing can be produced only in models which have either inhibitory links between lemmas or which have a differential activity criterion for lemma selection. Roloefs (1992) and Levelt *et al.* (in press) use a ratio rule which takes the activity of other lemmas into account. As practicing the character's name will result in the lemma (or LOU) for a competing name becoming more activated than otherwise would be the case, these models can simulate the experimental effect. However, Dell's (1986) model neither has inhibitory connections between lemmas nor uses a differential criterion in lemma selection. In Dell's model the most activated lemma is selected after a period determined by the rate of speech. In conclusion, Dell's model does not have a mechanism that could account for the nominal competitor effect.

How do speech production models account for the lack of inhibition following naming of a TV series? The Brédart *et al.* model does not include lemmas for biographical properties. However, a simulation of an extended network, in which lemmas for biographical properties were included in a separate pool produced that same result as Simulation 1 above. In order to account for the data, the selection rule in the speech production models must be restricted to the relative activation of people's names. Names of TV series or films must not enter the selection process either because they are not in the response set used (Levelt *et al.*, in press) or because the selection can be limited to only lemmas marked as representing only the class of people's names.

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Appendix

Parameters used in the interactive activation and competition network.

The simulation reported here was run using McClelland and Rumelhart iac program (McClelland & Rumelhart, 1988). The global parameters were set as follows:

Maximum activation	1.0
Minimum activation	-0.2
Resting activation	-0.1
Decay rate	0.1
Alpha (strength of excitatory input)	0.1
Gamma (strength of inhibitory input)	0.1
Estr (strength of external input)	0.1

All excitatory connections have a weight of 1.0 except for 'practiced' connections which had a weight of 3.0 (see text). All inhibitory connections have a weight of -0.5.

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