EUROPEAN JOURNAL OF COGNITIVE PSYCHOLOGY
2006, 18 (5), 686–707

Psychology Press
Taylor & Francis Group

Competitor effects in naming objects and famous faces

Tim Valentine and Stephen Darling
Goldsmiths College, University of London, UK

The prior production of an alternative name increases the time taken to name a famous face. For example, naming a picture of the comedy actor "John Cleese" by the name of the character he played in the TV series *Fawlty Towers* (Basil Fawlty) increases the time required to subsequently produce the name "John Cleese". This effect has been termed the "nominal competitor effect". In contrast prior production of a property associated with a famous person has no effect on naming speed. For example, prior production of the name of the TV series *Fawlty Towers* does not slow subsequent production of "John Cleese". The experiments reported explored analogous effects in object naming. Experiment 1 examined the effects of prior production of an alternative name (e.g., from American English or British English) and a semantic associate on the time taken to name line drawings of objects. It was found that prior production of an alternative name slowed object naming, but prior production of the name of a semantic associate did not. Experiment 2 demonstrated that cueing a specific name (e.g., the British English name) was not a necessary condition for the nominal competitor effect on object naming. Experiment 3 demonstrated that the nominal competitor effect on naming famous faces was also observed under both cued and uncued naming instructions. The data from both object and face naming are interpreted within the terms of current models of speech production.

The ability to recall and produce a person's name is an important social skill that facilitates social interaction in daily life. Difficulties in the production of proper names, and people's names in particular, are commonly self-reported cognitive failures (Burke, MacKay, Worthley, & Wade, 1991), and are the most noticeable effect of cognitive ageing (Cohen & Faulkner, 1986; Maylor, 1995, 1997). In addition, production of proper names is particularly vulnerable to neurological impairment of word production (e.g., Brédart, Brennen, & Valentine, 1997; Kay, Hanley, & Miles, 2001). Therefore, proper name production is relevant to a range of theoretical and practical issues. Any comprehensive model of speech production needs to include production of proper names within its remit.

Correspondence should be addressed to Professor Tim Valentine, Department of Psychology, Goldsmiths College, New Cross, London SE14 6NW, UK. E-mail: t.valentine@gold.ac.uk

We thank Erin Ingvalson and Saada Mohamad for their assistance in running some of the experiments reported here.

http://www.psypress.com/ecp DOI: 10.1080/09541440500299131

Models of naming famous faces have developed from models of face processing (e.g., Bruce & Young, 1986; Burton & Bruce, 1992) rather than from models of speech production (e.g., Dell, 1986; Levelt, 1989; Levelt, Roelofs, & Meyer, 1999; Stemberger, 1985). As a result models of face naming and models of speech production differ on two important aspects. First, in all models of speech production the conceptual specification of an entity or idea to be verbalised is represented at a different level from lexical items. That is to say, semantic memory and lexical representations are separated (Figure 1a). In contrast, people's names and identity-specific semantic information are represented at the same level in the Burton and Bruce (1992) model of face naming (Figure 1b). Second, there is consensus in the speech production literature that lexicalisation involves two stages. For example, according to the models of Kempen and Huijbers (1983) and Levelt (1989) a semantically appropriate item, which is specified for its syntactic properties but not for its phonology, is selected during the initial stage of lexical access, termed "lemma" selection. Retrieval of the appropriate phonological word form (lexeme) forms the second step of lexicalisation. A two-stage lexicalisation process is shared by most models of speech production but has not gone unchallenged (e.g., Caramazza, 1997). There is less consensus on whether these representations form discrete stages (e.g., Levelt et al., 1999) or interact with each other (e.g., Dell, 1986; Dell & O'Seaghdha, 1991). In contrast, models of face naming specify only one, phonological level of representation of people's names (e.g., Bruce & Young, 1986; Burton & Bruce, 1992).

The differences between models of face naming and speech production raise the issue of whether models of speech production can account for the empirical data on face naming. Evidence from naming famous faces supports a two-stage process of lexicalisation for people's names (Brédart & Valentine, 1992). Cognitive processing of proper names is remarkably similar to processing of common names in a range of cognitive phenomena. For example, people's names show effects of associative priming, repetition priming, picture–name interference and release from proactive interference as found in object naming tasks (e.g., Bruce & Valentine, 1985, 1986; Darling & Valentine, 2005; Young, Ellis, Flude, McWeeney, & Hay, 1986).[1]

[1] One caveat needs to be added to the conclusion of the similarity of cognitive processes for production of common names and proper names. Production and recognition of people's names and some classes of proper names (landmark names) requires access to semantic memory to be made via a token marker (e.g., Burke et al., 1991; Hollis & Valentine, 2001; Valentine, Brennen, & Brédart, 1996). In many empirical phenomena this feature does not affect the comparison between object and face processing. However, the role of a token marker is critical in accounting for difference in the pattern repetition priming found for objects and faces between production and recognition of names, and between recognition within and across modalities (Hollis & Valentine, 2001; Valentine, Hollis, & Moore, 1998). For a detailed comparison of face naming and object naming, see Valentine et al. (1996).

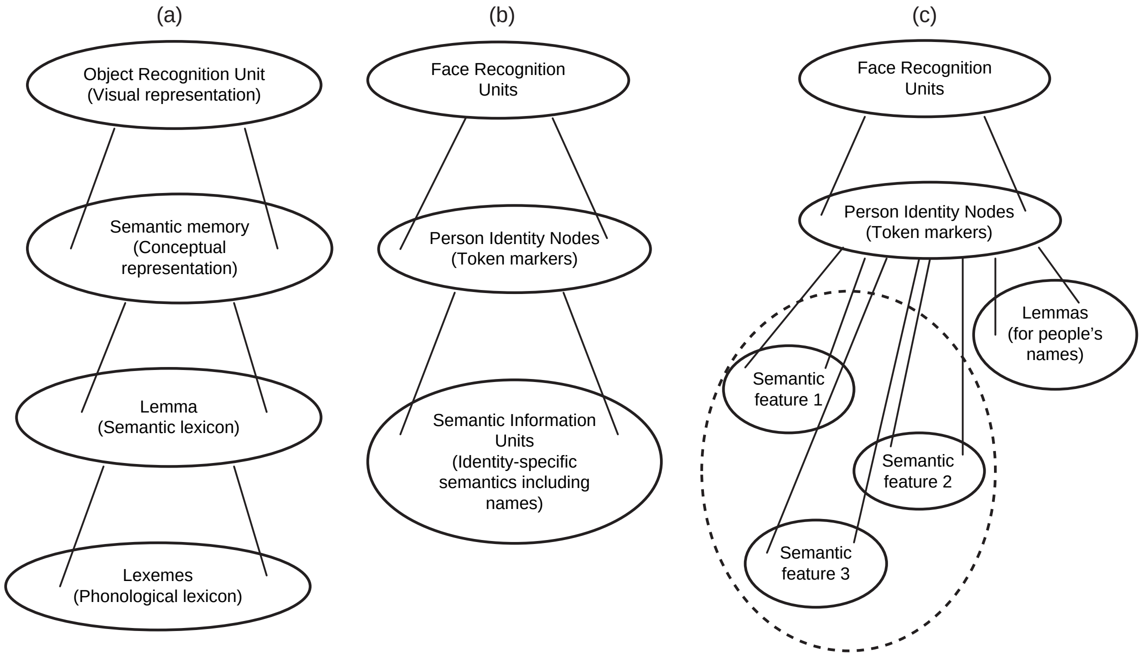

Figure 1. (a) A generic model of speech production. Ellipses represent different levels of representation for known items. Connections between levels are excitatory. In some models they are bidirectional, in others the levels are connected in a feedforward hierarchy. Some models have inhibitory links between units within a level of representation. See text for details. (b) The Burton and Bruce (1992) model of face naming. Connections between levels are excitatory and bidirectional. All units within a level have fully connected inhibitory links. Recognition of a face is based on activity at the Person Identity Node layer. (c) The Brédart et al. (1995) model. The processing assumptions are as stated for model (b).

Models of speech production are generally appropriate to account for the empirical phenomena observed in face naming and proper name processing. On the grounds of parsimony a model of speech production that can account for face naming data should be preferred to a model developed specifically to address face naming alone. In this paper we investigate the nominal competitor effect, which has been demonstrated in the context of naming famous faces. If models of speech production are to provide a complete account of face naming, they need to be able to account for this effect. Therefore, we address the issue of whether the nominal competitor effect can be generalised to an object naming task, and whether models of speech production could account for such an effect.

The nominal competitor effect was observed in a study of naming faces of actors who were strongly associated with a prominent character (Valentine, Hollis, & Moore, 1999). Participants took part in one of three training conditions. One group practised producing the actor's name only; a second group practised producing the actor's and the character's name; a third group practised producing the actor's name and the name of the TV series or film in which the actor had appeared in the role. During the test phase of the experiment all participants produced the actor's name under time pressure. Participants who practised the two alternative names were slower than participants who had practised producing the actor's name only. Thus production of the character's name interfered with subsequent production of the actor's name. This result cannot be attributed to response competition because participants who produced the name of the TV series were no slower to name the actor than were participants who had only practised the actor's name. Two names interfered with each other but a TV series name and a person's name did not, hence the term "nominal competitor".

The purpose of the Valentine et al. (1999) study was to provide an empirical test of differential predictions derived from the Burton and Bruce (1992) model of face naming and one that is more compatible with models of speech production (Brédart, Valentine, Calder, & Gassi, 1995; see Figure 1c). Detailed discussion of the results, which supported the predictions derived from the latter model, will not be repeated here. For the present discussion it is sufficient to note that both models account for the interference between two names by strengthening of links between representations that denote personal identity (person identity nodes or token markers) and nodes representing the corresponding personal name. The strengthening results from recent retrieval of the name, and provides the mechanism for repetition priming in the models. Strengthening of the connection to the competitor name means that the competitor is more highly activated and therefore sends more inhibition (via within-layer inhibitory connections) to the target name than is the case when the competitor name has not been practised. The inhibition from the competitor name increased the time taken for the "target" name to reach a simple threshold. The lack of interference as a consequence of practise naming the TV series occurs in the Brédart et al. model because names are represented within a different level of representations from semantic properties, and there are no inhibitory connections between representations at different levels in the model. Therefore recent activation of the association with a TV series could not inhibit subsequent face naming as there are no inhibitory links between the two recently activated nodes.

One possible alternative account of the nominal competitor effect is that it is a relatively short-lived effect analogous to the semantic competitor effect in object naming (Wheeldon & Monsell, 1994). If a participant has recently named an object from a definition (e.g., shark), he or she is slower to name a picture of a semantic associate (e.g., whale) that occurs within a few trials and within a few minutes of the associate (up to 11 trials and approximately 5 minutes). In contrast, the mechanism for the nominal competitor effect proposed by Valentine et al. (1999) is the same as proposed to account for repetition priming in naming; that is, an increase in the weight of links between levels of representation. Repetition priming is known to be long lasting, surviving many intervening items and over many minutes or even hours. Repetition priming of recognition of faces can last days (Bruce, Carson, Burton, & Kelly, 1998) or even years (Maylor, 1998). In a second experiment Valentine et al. (1999) introduced a filler task, between the practice and test phase of the experiment, that required participants to name 48 famous faces. The nominal competitor effect was still observed after this filler task. It was concluded that the nominal competitor effect must be attributed to a different mechanism from that responsible for the semantic competitor effect in object naming because the effect is longer lasting. The data suggest that the nominal competitor effect can be attributed to enhanced competition due to repetition priming of a competitor personal name.

Models of face naming and models of speech production differ in the presence of inhibitory links between lexical nodes. Inhibitory links are included in interactive activation models of face naming that have a simple threshold for selection of an item (Brédart et al., 1995; Burton & Bruce, 1992). Some models of speech production do not include inhibitory links between lexical nodes (Dell, 1986; Levelt et al., 1999), although other models do (e.g., Harley, 1993; Stemberger, 1985). Competitor effects can arise in models without inhibitory connections that use a relative threshold for selection of active items (e.g., the Luce rule implemented in the WEAVER++ model; Levelt et al., 1999; see also Dell, 1986). A simple threshold means that selection of an item is independent of the activation of any competitors; the first item to achieve the threshold is selected. A relative threshold applies some criterion by which the activation of the selected item must exceed any competitor. Use of a relative threshold rule *per se* would make lexical selection slower when there are two highly active lexical nodes representing appropriate names. Therefore, both WEAVER++ and Dell's model could account for the nominal competitor effect. WEAVER++ restricts competitors to items that are permitted responses in the experiment (see Levelt et al., 1999, p. 11). Participants were always instructed to produce the actor's name in the test phase of Valentine et al.'s (1999) experiments. The nominal competitor effect would arise if the character names were competitors. The lexical nodes (lemmas) represent the word's syntax (e.g., Levelt et al., 1999, Footnote 1); therefore lemmas for people's names will be marked as personal proper names. The nominal competitor effect will arise if names denoting real people and fictional characters are classed as permitted responses in the experiment. Practice of the name of a TV series would not slow down lexical selection if the lemma for this name denotes a proper name of a creative work rather than a personal proper name.

If models of speech production can account for the nominal competitor effect it follows that the effect should be observed in a picture naming task that requires production of a common noun. The aim of Experiment 1 was to run an object naming task that was analogous to the Valentine et al. (1999) experiments on face naming. The effect should be differentiated from two effects previously demonstrated in the picture naming literature. First, it has been shown that objects with low name agreement are slower to be named than objects with high name agreement (e.g., Lachman & Lachman, 1980; Vitkovitch & Tyrrell, 1995; Wingfield, 1967, 1968). For objects with low name agreement synonyms are available (e.g., sofa, couch). The availability of alternative names makes selection and production of a name slower. All objects used in the experiments reported here have been selected because they can be named with two alternative names. The recent production history of these names is manipulated in the practice phase of the experiments. Therefore, the nominal competitor effect is a comparison between a competitor being primed by recent production or not, rather than a comparison between the presence or absence of a potential competitor. Second, several authors have studied the time course of activation of semantic and phonological competitors in picture naming tasks (e.g., Jescheniak & Schriefers, 1998; Levelt et al., 1991; Peterson & Savoy, 1998), showing that competitor names are activated during the process of lexicalisation. These are short-term effects (<300 ms), which are inhibited by completion of the lexicalisation process. In contrast the nominal competitor effect is long lasting, survives activation of many intervening items during the practice task and filler task, and lasts over a period of at least several minutes.

In Experiment 1 a specific object name is cued by asking participants to produce either the American English name or the British English name in a manner analogous to the "actor's name" cue used by Valentine et al. (1999) in a face naming task. The condition requiring practice of a "semantic associate" was simulated by a task that required participants to produce the name of an associate of the object pictured. The theoretical account of the nominal competitor effect provided by models of face naming or speech production is not based on a requirement that a specific response is cued.

Therefore, subsequent experiments addressed the issue of whether cueing was a necessary condition. In Experiment 2 the effect of cueing was investigated within an object naming experiment. In Experiment 3 the effect of cueing was investigated in a face naming experiment. In all experiments an interpolated filler task was used to establish that any effects observed were long lasting (cf. Valentine et al., 1999, Exp. 2).

EXPERIMENT 1

Method

Participants

Sixty native British English speakers participated in Experiment 1; 32 were male, 28 were female; their mean age was 26.5 years.

Stimuli

A set of 12 line drawings of common objects were selected from the Snodgrass and Vanderwart (1980) set. Each object was commonly named by a different term in American and British English. The line drawings were digitised as 256 × 256 pixel images with white lines on a black background. A further 48 images of different objects selected from the Snodgrass and Vanderwart set were used in the filler phase.[2]

Apparatus

Images were displayed in the centre of a PC screen at a resolution of 640 × 480 pixels on a 14-inch screen. The Micro Experimental Laboratory (MEL2) software package was used to control the display of stimuli and record vocal naming latency using a voice key. A throat microphone was used to detect the participants' vocal responses. The experimenter manually coded each response in the test phase to allow misfiring of the voice key and inappropriate responses to be excluded from the analysis.

Design

The experiment consisted of three tasks: a practice task, a filler task, and a test task. The nature of the practice phase formed a 3 (practice type: one name, two names, semantic associate) × 2 (name: British name, American name) between-participants design. Each stimulus was seen four times with each name cue in all of the practice conditions. In the two names condition

[2] A list of all of the names of the stimuli used in the experiments reported can be requested via email from the corresponding author.

participants were instructed to name each picture with the instruction either "American name" or "British name" presented under each picture. In the semantic associate condition participants were cued to either name each stimulus with one object name or to name a semantic associate. Cues for the semantic associates consisted of a sentence about each object. The last word of the sentence was replaced by the first letter of a missing word and a series of dots indicating the number of letters. In the one name condition participants practised naming the objects using only one name. The use of the American name and the British name in the one name and the semantic associate conditions was counterbalanced between participants with the appropriate instruction presented below the picture on the screen.

The practice phase was followed by a filler task in which participants named 48 unrelated pictures of objects. Finally, in the test task participants were asked to name the 12 stimulus object pictures once as quickly as possible. They were instructed to produce either the American name or the British name appropriate to the experimental condition to which they were assigned. The dependent variable was the latency of correct responses in the test phase.

Procedure

Practice task. The following details applied to all experimental conditions. A set of written instructions was displayed on the computer screen to explain the procedure. The experimenter ensured that the procedure was understood before the experiment was started. Each trial began with a 250 ms warning tone. After a 500 ms interval a line drawing of an object was displayed on the screen. A cue appropriate to the experimental condition was displayed below the drawing simultaneously. The drawing and cue remained on the screen until the participant made a vocal response that triggered the voice key. The participant was instructed to name the object aloud with a name that was appropriate to the cue. The participant was informed whether their response was the intended one. If it was not, the experimenter gave the "correct" response and the participant was asked to repeat it aloud. The experimenter used the keyboard to code each response as correct or incorrect. The next trial started 2 s after the experimenter had entered the code. All 12 stimuli were presented once in a random order before any stimulus was repeated. Each stimulus was presented four times with each cue, in a different random order to each participant.

In the one name condition a single cue was paired with each drawing yielding a total of 48 trials. Either "American name" or "British name" was presented as the cue, according to counterbalancing. In the two name condition participants were given cues for both the "American name" and the "British name" yielding a total of 96 trials. In the semantic associate condition the participant saw either a cue for either the "American name" or the "British name" (according to counterbalancing), or a cue for a semantic associate. Participants were instructed to either produce an appropriate object name or an appropriate word to complete the sentence. There were 96 trials in the semantic associate condition.

Filler task. The filler task was identical for all participants. Instructions displayed on the screen informed participants that they would see another series of line drawings of objects, and they should say aloud the first appropriate name that came to mind as quickly as possible. At the start of each trial a fixation point was presented in the centre of the screen for 750 ms. A 250 ms warning tone was presented at the same time as the fixation point was presented. A line drawing was presented until a vocal response was detected by the voice key. The line drawings were selected from the Snodgrass and Vanderwart (1980) collection and presented at the same resolution as the images used in the practice task. All of the objects were different from those used in the practice phase. The experimenter coded each response as correct or incorrect. No feedback was given. A list of 48 objects was presented for naming. This task took a minimum of 5 minutes to complete.

Test task. The test phase was identical for all participants. The 12 line drawings of objects presented in the practice phase were each shown once. Participants were instructed to name the objects with either the "American name" or the "British name" throughout the task, depending on counter-balancing. The images were presented in a different random order for each participant. No feedback was given. The experimenter coded whether the name given for the picture was correct. If the inappropriate response was given it was coded as incorrect and excluded from analysis (e.g., the British name when instructed to give "the American name").

Results

The mean number of objects named correctly was 11.1 out of a maximum of 12 ($SEM = .16$). Accuracy is shown as a function of experimental condition in Table 1. Two separate analyses were conducted; a two-way ANOVA taking participants as the random factor with practice type and name as between-participants factor (F_1); and a two-way ANOVA taking items as the random factor with practice type as a within-items factor and name as a between-items factor (F_2). A Mauchly test showed that the assumption of homogeneity of variance was violated in the by-items analysis. The Green-house Geisser correction was used to adjust degrees of freedom accordingly. The effect of name was significant, $F_1(1, 54) = 16.0$, $MSE = 1.13$, $p < .001$, $\text{eta}^2 = .23$; $F_2(1, 22) = 24.0$, $MSE = 0.52$, $p < .001$, $\text{eta}^2 = .52$. Objects were named with the British English name more accurately than with the

TABLE 1
Accuracy of naming responses in the test task of Experiment 1 as a function of the name produced and the practice type (standard error of the mean is given in parentheses)

	One name	*Two names*	*Semantic associate*	*Mean*
British	11.9 (.10)	11.2 (.36)	11.9 (.1)	11.7 (.14)
American	10.7 (.42)	10.1 (.31)	10.9 (.50)	10.6 (.24)
Mean	11.3 (.25)	10.6 (.26)	11.4 (.27)	11.1 (.16)

American English name. The effect of practice type was significant in the items analysis and approached significance in the analysis by participants, $F_1(1, 54) = 2.9$, $MSE = 1.13$, $p = .06$, eta$^2 = .10$; F_2(adjusted values 1.6, 34.5) $= 6.0$, $MSE = 0.71$, $p = .01$, eta$^2 = .21$. Accuracy was lower when two names were practised than in the other two conditions. The interaction was not significant in either analysis (both F ratios < 1).

In all of the experiments reported here naming latency of correct responses was analysed in the following way. Response times of less than 200 ms were excluded on the grounds that they were either caused by preparatory or anticipatory vocalisations or by the voice key being triggered by some other cause. Responses over 3 s were excluded on the grounds that these were occasions on which the participant was in a tip-of-the-tongue state or was temporarily unable to produce the target name. The median naming latency of correct responses between 200 and 3000 ms in the test task was calculated for each participant. The means of the median correct naming latencies in each experimental condition are shown in Figure 2. Two separate ANOVA analyses were conducted, one by participants and one by items. A Mauchly test showed that the assumption of homogeneity of variance was violated in the by-items analysis. The Greenhouse Geisser correction was used to adjust degrees of freedom accordingly. There was a significant effect of practice type, $F_1(2, 54) = 10.5$, $MSE = 408{,}439.0$, $p < .001$, eta$^2 = .28$; F_2(adjusted values 1.5, 33.4) $= 70.54$, $MSE = 442{,}216.7$, $p < .001$, eta$^2 = .76$. Pairwise comparisons with Bonferroni correction for multiple comparisons showed that objects were named more slowly in the two names condition than in either the one name condition or the semantic associate condition ($p < .001$ by participants and by items). The naming latency in the semantic associate condition was not significantly different from the latency in the one name condition in either the by-participant or by-items analysis. No other effects were significant in both the by-participant and by-items analyses.

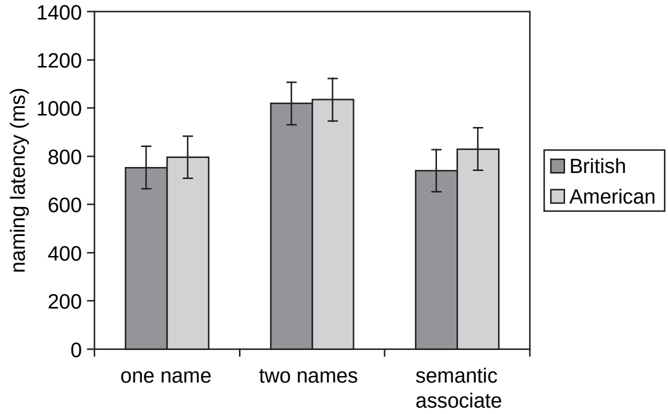

Figure 2. The mean latency to name objects in the test task of Experiment 1, plotted as function of the number of names practised and cueing at test. Participants in the one name condition practised producing either the British name only or the American name only. Participants in the semantic associate condition practised producing either the British name or the American name, and the name of a semantic associate. Participants in the two name condition practice producing both the American and British name. The name practised in the one name and semantic associate condition was the required response at test and was counterbalanced across participants. Error bars indicate the 95% confidence interval.

Discussion

The results of Experiment 1 clearly demonstrate a nominal competitor effect in naming objects. Recent production of two alternative names slowed naming latency of objects compared to the naming latency of participants who have recently produced only one name. Participants who practised producing one name for each object and a semantic associate were no slower to name the objects than participants who practised production of a single name only. Thus when two object names are available then competition slows the lexicalisation process but there is no competition between a semantic associate and an object name. The filler task between the practice and the test phases demonstrates that the nominal competitor effect persists after naming many intervening items. It cannot therefore arise from the same mechanism as the semantic competitor effect (Wheeldon & Monsell, 1994). Furthermore, the nominal competitor effect cannot be attributed to a speed–accuracy tradeoff. Naming responses were less accurate after practice with two names than after practice with only one name. Experiment 1 extends the nominal competitor effect, previously observed only in naming celebrity faces, to production of object names. This finding supports the contention that the cognitive processes involved in name production are common to both tasks.

A cue to produce a specific name was given during the test phase of Experiment 1. Valentine et al. (1999) used a similar procedure in a face naming task. However, none of the models of speech production or of face naming address the effects of cueing. Therefore, the aim of Experiment 2 was to investigate further whether cueing a specific response was a necessary condition to elicit the nominal competitor effect in an object naming task.

Experiment 1 showed that naming latency following practice naming a semantic associate and an object name was equivalent to that following practice producing one name only. The effect of producing a semantic associate was not relevant to the experimental hypothesis concerning the effect of cueing; therefore this condition was not included in Experiment 2.

Production of the American English and British English name was counter balanced in Experiment 1. The nominal competitor effect was observed when either name was produced. In order to simplify the experimental design all participants in the one name condition in Experiment 2 were instructed to practice the British name. Participants in the cued conditions were cued to produce the British name during the test phase.

EXPERIMENT 2

Method

Participants

Seventy-two participants took part in this experiment. Their mean age was 24.0 years; 17 were male and 55 were female. All participants were students whose first language was British English, and had lived in the UK all their lives.

Stimuli

The stimuli were digitised line drawings of everyday objects. All images were presented as white line drawings on a black background. One set of images comprised 12 objects that were used in the practice and test tasks. Some of these objects were taken from the set of Snodgrass and Vanderwart (1980). Other line drawings in a similar style were added to the set in order to improve the set of clear drawings that had different names in American and British English.[3] A further 48 images of different objects selected from the Snodgrass and Vanderwart images were used in the filler phase. These images were the same as used during the filler task in Experiment 1.

[3] A list of all of the names of the stimuli used in the experiments reported can be requested via email from the corresponding author.

Apparatus

The apparatus used was identical to that used in Experiment 1 with the following exceptions. The experiment was programmed using the E-prime experiment generation software. The microphone was mounted on a boom attached to a set of headphones that the participant wore during the experiment, although no sound was presented through the headphones themselves.

Design

This experiment was similar in design to Experiment 1 with the following exceptions. The semantic associate practice condition was not included. Thus there were only two conditions in the practice task. In the one name condition, participants were required to practise the British English name for all objects. In the two name condition they practised both the British and American English names. The instruction used during the test task formed a second between-participant factor. In the cued condition all participants were required specifically to produce the British English name that had been practised. Any other response was coded as an error. In the uncued condition they were instructed to produce any appropriate name. However, only responses of one of the two practised names were recorded as correct. In summary, the experiment had a 2 (number of names practised: 1 or 2) $\times$ 2 (cue condition: cued or uncued) between-participants design. The dependent variable was the naming latency of correct responses.

Procedure

The procedure was the same as described for Experiment 1, except that no warning tone was presented prior to presentation of to-be-named items.

Results

The mean number of correct responses is shown as a function of experimental condition in Table 2. These data were subjected to two separate 2×2 ANOVAs by participants and by items. The number of names practised and the cue type at test were between-participants factors and within-items factors. No effects were statistically significant in either analysis.

Means of median naming latency of correct naming responses are shown as a function of experimental condition in Figure 3. Two separate 2×2 ANOVAs showed that there was a significant main effect of number of names, $F_1(1,\ 68) = 27.8$, $MSE = 15{,}759.1$, $p < .001$, $\text{eta}^2 = .29$; $F_2(1,\ 11) = 49.2$, $MSE = 5335.1$, $p < .001$, $\text{eta}^2 = .82$. No other effects were significant in both the by-participant and by-items analyses.

TABLE 2
Accuracy of naming responses in the test task of Experiment 2 as a function of the naming instruction at test and the practice type (standard error of the mean is given in parentheses)

	One name	*Two names*	*Mean*
Cued	11.5 (.24)	10.8 (.34)	11.1 (.21)
Uncued	10.8 (.34)	10.6 (.28)	10.7 (.22)
Mean	11.2 (.22)	10.7 (.22)	10.9 (.15)

Discussion

Experiment 2 demonstrated that the nominal competitor effect is observed in object naming irrespective of whether one specific name is cued. Practice producing a British and an American English object name slowed production of the British name, compared to participants who practised producing only one name. This demonstration of the nominal competitor effect in object naming in the absence of cueing is consistent with WEAVER++ and other models of speech production. The prediction derived from the models was based on the normal process of producing a spoken response on seeing a picture. No effect of cueing a specific response was considered when deriving the prediction. Therefore the results of Experiment 2 provide a better match between the empirical data and the modelling work than did Experiment 1. The models of speech production can explain the nominal competitor effect as a consequence of competition in the lexicalisation process between highly available alternative names. The competition could affect selection of the lemma (or lexical node) or selection of the lexeme (or phonological specification of the word) or both processes.

Having demonstrated that the nominal competitor effect is observed in an object naming task, without cueing a specific response from two competitor names, the question remains of whether cueing a specific name is a necessary condition to observe the effect in face naming. Valentine et al. (1999) used a cued instruction during the test phase of both of their face naming experiments. However, the theoretical account offered by the interactive activation model (Brédart et al., 1995) does not model cueing and so there is no a priori reason to suppose that cueing is a necessary condition for the nominal competitor effect in face naming. The aim of Experiment 3 was to investigate the role of cueing in the nominal competitor effect in face naming using a design analogous to Experiment 2.

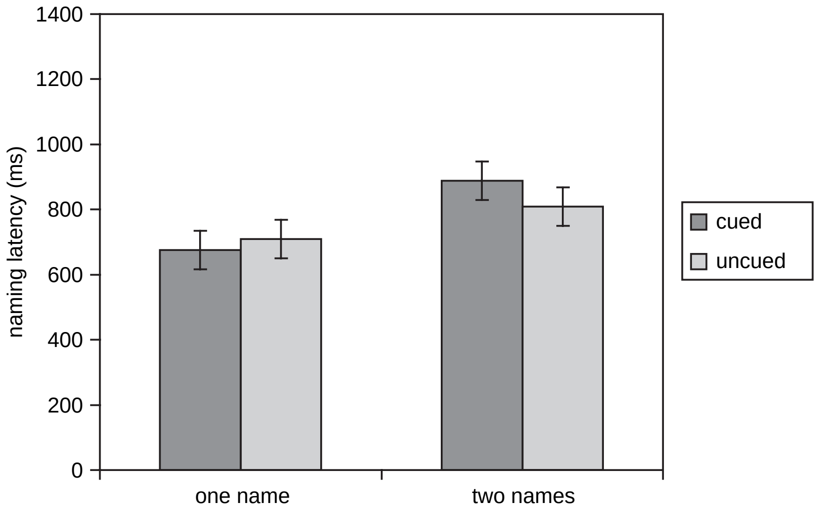

Figure 3. The mean latency to produce the British name of objects in the test task of Experiment 2, plotted as function of the number of names practised and cueing at test. Participants in the one name condition practised producing the British name only, participants in the two name condition practised producing both the American and British name. Participants were either cued to produce the British name at test (cued condition) or permitted to produce either name (uncued condition). Error bars indicate the 95% confidence interval.

EXPERIMENT 3

Method

Participants

Eighty-two participants took part in this experiment. Data from 10 participants were excluded because insufficient correct responses were recorded to reach the criterion accuracy in the test phase. The remaining 72 participants had a mean age of 24.3 years; 23 were male, 49 were female. All participants were students whose first language was English, and had lived in the UK all their lives.

Stimuli

The stimuli used in this experiment were all high-resolution greyscale bitmap images of celebrities. All images were 300 pixels in height, although the width of the images varied according to the shape of the original image. The images were always presented in the centre of the screen against a black background. In some conditions (see procedure section below) a text message was presented below them that read either "Actor Name" or "Character Name".

There were two sets of images. One set comprised 12 faces of actors strongly associated with a well-known TV character which were presented in the practice and test phases of the experiment. A further 48 faces comprised the set of famous faces that were presented during the filler phase. These fillers comprised an assortment of celebrities such as TV presenters, actors, sportsmen and women, and politicians.[4]

Apparatus

The hardware and software used to run the experiment was the same as that used for Experiment 2.

Design

The design was the same as Experiment 2.

Procedure

The procedure was the same as for Experiment 2, with the following exceptions. In this experiment all stimuli were famous faces rather than objects. In the one name condition participants always practised the actor's name only. In the two name condition participants practised both the actor's and the character's name. In the test phase participants were instructed to produce either name (in the uncued condition) or to produce the actor's name only. The photographs were of actors in the appropriate character role. However, during the practice phase participants occasionally produced the name of a different character that the actor had played when instructed to produce the character name. For the purposes of this experiment only the character name of the role depicted was acceptable. Participants were given this name during feedback in the practice phase and the specific character name was repeated by the participant.

Results

The mean number of correct responses are shown as a function of the experimental condition in Table 3. These data were subjected to two separate 2×2 ANOVAs by subjects and by items. Number of names and cue type were between-participants and within-items factors. No effects were significant in both analyses.

Means of median naming latency of correct naming responses are shown as a function of experimental condition in Figure 4. Two separate 2×2 ANOVAs showed that there was a significant main effect of number

[4] A list of all of the names of the stimuli used in the experiments reported can be requested via email from the corresponding author.

TABLE 3
Accuracy of naming responses in the test task of Experiment 3 as a function of the naming instruction at test and the practice type (standard error of the mean is given in parentheses)

	One name	*Two names*	*Mean*
Cued	9.9 (.49)	10.5 (.28)	10.2 (.28)
Uncued	9.8 (.36)	9.0 (.54)	9.4 (.33)
Mean	9.8 (.30)	9.8 (.26)	9.8 (.22)

of names $F_1(1, 68) = 18.0$, $MSE = 50{,}033.7$, $p < .001$, eta$^2 = .21$; $F_2(1, 11) = 15.2$, $MSE = 28{,}739.3$, $p < .005$, eta$^2 = .58$. Naming latency was slower in the two names than in the one name condition. There were no significant effects of cue type, $F_1 < 1$, $F_2 = 1.23$, or of the two-way interaction between cue type and number of names, $F_1 < 1$, $F_2 < 1$.

Discussion

In terms of naming latency Experiment 3 has replicated the nominal competitor effect in face naming, and showed that there is no effect of cueing

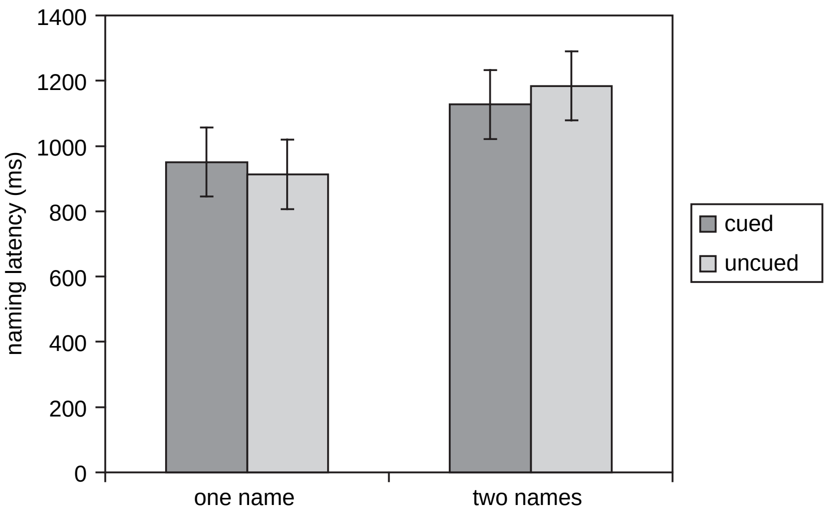

Figure 4. The mean latency to produce the actor's name in the test task of Experiment 3, plotted as function of the number of names practised and cueing at test. Participants in the one name condition practised producing the actor's name only, participants in the two name condition practised producing both the actor's and the character's name. Participants were either cued to produce the actor's name at test (cued condition) or permitted to produce either name (uncued condition). Error bars indicate the 95% confidence interval.

a specific name. A novel finding is that the effect of a competitor name is observed in the absence of instructions to produce one specific name to a celebrity's face (i.e., the actor's name).

GENERAL DISCUSSION

Experiments 1 and 2 demonstrate for the first time that the nominal competitor effect occurs in object naming. Competition from an alternative, appropriate name, which was highly available through facilitation from recent priming, slowed naming latency. The effect cannot be attributed simply to response competition because priming the name of a semantic associate did not slow naming (Experiment 1). Cueing a specific response was not a necessary condition for the nominal competitor effect to occur in object naming (Experiment 2). All of the objects included in the object naming experiments had alternative names. Low name agreement *per se* is not the cause of the effect. The competition is attributable to the recent history of naming the objects in the practice phase of the experiments. Experiment 3 demonstrated that the nominal competitor effect in naming celebrity's faces was shown to be present even when a specific name was not cued at test.

An effect of the availability of a competitor name in increasing naming latency can be explained by a model of lexical selection that incorporates either a relative threshold for selection (e.g., WEAVER++) or mutually inhibitory connections (e.g., Brédart et al., 1995; Stemberger, 1985). Experiment 3 replicates the nominal competitor effects reported in face naming by Valentine et al. (1999), who also reported a simulation of the effect using an interactive activation model (Brédart et al., 1995). The finding reported here, that the nominal competitor effect in face naming occurs in the absence of cueing, is perfectly consistent with the original simulation.

In summary, the finding that a nominal competitor effect is observed in both face and object naming adds further evidence to the view that the cognitive processes involved in producing people's names can be modelled satisfactorily by models of speech production. On the grounds of parsimony models of speech production that account for a wide range of evidence should be preferred over models specifically designed to account only for face naming.

The interpretation of the nominal competitor effect within the cognitive models of speech production suggests that the effect is determined by categorical structure. Competition from recent activation of an object name slows production of an alternative object name, and recent activation of a person's name slows activation of a different personal name. In contrast, activation of names of associated properties do not induce competition. The models make some clear predictions for further experiments.

Categorising a picture of a famous cartoon character as a "mouse", a "duck", or "cat" should not increase the time taken to subsequently name the character, even if the category label is included in the name (e.g., "Mickey Mouse", "Daffy Duck", "Top Cat"). The response in a categorisation task requires access to a common noun and therefore a different lemma (or equivalent) from the lemma representing a personal name phrase. The two different lemmas would not be represented by units with mutually inhibitory links (Brédart et al., 1995), or be within the same response set (WEAVER + +).

Another variation may be to instruct participants to produce the name of an associate that is within the response set or the same category. For example, a picture of David Beckham may be presented with instruction to name the person depicted or to name his spouse. Would practice producing the spouse's name compete with subsequent production of the celebrity's own name? In this case both responses are personal names (and therefore in the response set) but only one is the name of the picture. To the extent that the spouse's name is associated with the celebrity, it would be a competitor for the naming response. However, in this case the celebrity's own name is likely to be much more strongly activated and win the competition rapidly, because it is directly activated rather than only via associative links. Therefore, it would be predicted that, if any effect of the competitor was observed at all, it would be much weaker than that observed in the experiments reported here. The cognitive models of face naming and speech production predict that the necessary and sufficient conditions for the nominal competitor effect are that the competing names should both be appropriate to the picture to be named and drawn from the same category.

The constraints on the nominal competitor effect in object naming could be explored in future research. Objects may be named at superordinate or subordinate levels. For example, a picture might be named as a Collie, a dog, or an animal. In the experiments reported here the alternative names practised were at the same level (e.g., lorry vs. truck, trousers vs. pants). These alternative names from British and American English are likely to be optimal because the specificity of the semantic features associated with the names is likely to be similar and therefore maximise overlap of semantic activation. A superordinate category name (e.g., animal) will activate some but not all of the semantic features of a dog. Whether a difference in the level of category label will make a potential competitor less effective is an empirical question that remains to be explored.

The techniques of cognitive neuroscience are likely to play an important role in resolving some of the disputed issues in speech production and face naming. Event related potentials (ERP), which can be recorded from the scalp during cognitive processing, provide good time resolution and are particularly useful in this area. Abdel Rahman, van Turennout, and Levelt (2003) used the lateralised readiness potential to measure the relative timing of semantic and phonological information becoming activated during object naming. Their data support the contention that semantic and phonological representations can be activated simultaneously as postulated by models which allow interactive connectivity between semantic and phonological representations (e.g., Dell, 1986), rather than the strict serial order of activation postulated by Levelt (1989) and Levelt et al. (1999). The lateralised readiness potential methodology has also been employed in an ERP study to establish the time course of semantic and phonological activation in face naming (Abdel Rahman, Sommer, & Schweinberger, 2002). These data showed strong support for parallel models of face processing (Brédart et al., 1995; Burton & Bruce, 1992) over a serial model (Bruce & Young, 1986). Huddy, Scheinberger, Jentzsch, and Burton (2003) reported that ERP recorded during a semantic category matching task to famous faces showed a different topography from that observed during a task which required a judgement of whether the names of pictured celebrities matched. They concluded that different brain substrates mediate access to semantic and name information. These data are consistent with the models of speech production cited above and with the Brédart et al. (1995) model of face naming. However, the data are more difficult to reconcile with Burton and Bruce's (1992) model of face naming in which both semantic and name information are represented in the same pool of processing units. The conclusions that can be drawn from this study are limited by the poor spatial resolution of ERP. Functional MRI would be a more suitable method to establish dissociation based on topography of brain activity. Nevertheless, these three studies illustrate the potential for the methods of cognitive neuroscience in general, and ERP in particular, to disentangle some issues that have proved fairly difficult to address definitively through experimental work and cognitive modelling alone.

Original manuscript received June 2004
Manuscript accepted May 2005
First published online 25 January 2006

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