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Recognition without face identification

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Recognition without identification is the finding that participants can recognize recognition test items as having been previously studied when the test items themselves are presented in such a way that their identification is hindered. The present study demonstrates this phenomenon in face recognition. Participants studied names of celebrities before receiving a recognition test containing pictures of celebrity faces. Half of the pictures were of celebrities whose names were studied; half were of celebrities whose names were not studied. Participants attempted to identify each face on the test and also rated the likelihood that each person's name was studied. Among the faces that went unidentified, ratings discriminated between celebrities whose names were studied and celebrities whose names were not studied. This recognition without face identification effect is dependent upon the sense of being in a tip-of-the-tongue state for a particular name. Theoretical implications of the results are discussed.

The Scottish language has a verb to describe the experience of recognizing a face as being familiar without being able to call to mind who the person is. The verb is *tartling*. To tartle is to hesitate in recognizing something or to fail to retrieve the name of a familiar person, thing, or place (Goldstein & Gigerenzer, 1999, p. 37; Reingold, 2000, p. 39). Interest in this phenomenon of recognizing a person on the basis of a sense of familiarity with the person (hereafter termed *tartling* for brevity) spans across many research areas within cognitive psychology, but is perhaps most commonly referenced in the recognition memory literature (e.g., Mandler, 1980, 1991; see Yonelinas, 2002, for a review).

Studying Tartling From a List-Learning Perspective

In the recognition memory literature, researchers attempt to tap into this phenomenon through the use of a list-learning paradigm. Participants study a list of items and are later tested with a recognition test in which the task is to discriminate between studied and nonstudied items. Among those who take a dual-process perspective (see Yonelinas, 2002, for a review), it is thought that people can recognize a test item as having been studied in two ways: They can recognize an item as studied because they are able to recall its earlier occurrence on the list (recollection-based recognition), or they can recognize an item as studied on the basis of a sense of familiarity with the test item itself (familiarity-based recognition).

Many dual-process recognition researchers have argued that this latter basis of recognition in list-learning paradigms is the same as that which gives rise to the common real-life phenomenon of tartling in face recognition. For example, to illustrate the difference between recollection and familiarity, Curran and Cleary (2003, p. 191) stated, "We have all had the experience of knowing a face is familiar despite an inability to recollect details such as the person's name." Similarly, Rajaram (1993, p. 90) wrote, "There are times when we meet someone on the street whom we met at a party a few days ago. Although we know that we met this person at the party, we may not remember actually meeting the person, or his/her name." Other instances in which the tartling experience is cited as an example of familiarity-based recognition can be found in Mandler (1991) and Yonelinas (2002). Although the anecdotal examples of familiarity in this literature are very often of tartling in face recognition, these studies rarely use faces as stimuli for studying familiarity (though see Yovel & Paller, 2004, for an example of a study that recently examined familiarity with faces); more often, the stimuli are words or line drawings.

Also, although references to the phenomenon of tartling in face recognition are common in the recognition memory literature, there are notable differences between the methodology used to study familiarity in typical recognition memory paradigms and the real-life experience of recognizing a face as familiar without recollecting such details as the person's name. As mentioned, the typical recognition memory study uses a list-learning methodology, whereby participants first study a list of items and are then presented with a recognition memory test. Note that whereas the typical recognition paradigm involves the rec-

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ognition of recency (recognition of recent occurrence on a study list), real-life experiences of tartling do not necessarily involve the recognition of recency. Rather, real-life experiences of tartling in face recognition often involve a more general sense of knowing that the person was seen at some point in one's past, and not necessarily a sense that the person was seen recently (e.g., yesterday).

Modeling Tartling in Face Recognition

The interactive activation and competition (IAC) model (see, e.g., Burton, Bruce, & Hancock, 1999; Burton, Bruce, & Johnston, 1990) is a model of face recognition that can explain—among other aspects of face recognition—the real-life experience of tartling in face recognition. In the IAC model, there are several sets of units that play a role in face recognition: face recognition units (FRUs), person identification nodes (PINs), semantic information units (SIUs) containing general semantic information about a person as well as names, and finally, lexical output. Although people's names are stored in the same set of units, their relative distinctiveness makes them more difficult to retrieve than general semantic information.

In this model, different types of information become available at different points in time to give rise to the day-to-day experiences of face recognition. At the earliest stage, there is face familiarity. At this level, a face can be recognized as familiar in the absence of an ability to call specifics to mind. This occurs at the level of the PINs; if a PIN's activation exceeds a given threshold, a face is recognized as familiar. At another level of recognition, a person may have access to semantic information that is associated with the face (such as the person's occupation) in the absence of name retrieval (because general semantic information is easier to access than people's names, making this information available sooner in the processing stream). Because people sometimes have access to information related to a target word that they are trying to retrieve while in a tip-of-the-tongue (TOT) state (see, e.g., Schwartz, 2002), access to semantic information about a person in the absence of access to the person's name may be accompanied by a sense of being in a TOT state for a person's name. Finally, retrieval of the person's name may occur.

The levels of face recognition in the IAC model are based on prior data on the types of errors people make in recognizing faces. For example, although it is common for people to retrieve semantic information about a person without being able to retrieve his or her name, there is little evidence that people can retrieve a person's name in the absence of any semantic information about the person (see, e.g., Hay, Young, & Ellis, 1991; Young, Hay, & Ellis, 1985). It has also long been known that people's names are generally more difficult to retrieve than general semantic information about them (e.g., Bredart & Valentine, 1998; Cohen, 1990; Stanhope & Cohen, 1993). Research has also shown that participants can judge a face as familiar earlier in the processing stream than they can access semantic information about the person (Johnston & Bruce, 1990).

Linking the Recognition Memory and Face Recognition Literatures

The IAC model is essentially a model of general knowledge of faces and their corresponding information. That is, known faces and their corresponding information are stored in a network, and the model specifies how this information is accessed for use in day-to-day face recognition. As such, the model is useful for explaining everyday experiences of tartling in face recognition, but how it could be made to fit with the recognition memory literature is less obvious. Whereas dual-process models of recognition memory (see, e.g., Reder et al., 2000; Yonelinas, 2002) attempt to account for everyday tartling experiences through familiarity-based discrimination between studied and nonstudied items in list-learning paradigms, the IAC model was not explicitly developed to account for this type of familiarity-based recency discrimination (since it was not intended to account for this type of recognition). Furthermore, whereas the IAC model contains several levels of recognition (recognition based on familiarity, recognition based on access to semantic information, but not the person's name, and recognition accompanied by access to the person's name), dual-process recognition memory theories generally contain two mechanisms of recognition—retrieval of the studied episode versus a more general feeling of familiarity with the test item.

The present study attempts to link the recognition memory literature with the face-recognition literature (namely, the IAC model of face recognition) through the use of a relatively new methodological paradigm that has been previously used to elicit familiarity-based recognition in list-learning situations. The method used here is a variation of that which has been used to elicit a phenomenon known as the *recognition without identification* (RWI) effect, which is the finding that participants can discriminate between recently and nonrecently presented items even when the items are presented in such a manner that they cannot be identified (Cleary & Greene, 2000).

The RWI effect was first found by Peynircioglu (1990) and was later followed up on by Cleary and Greene (2000). In these two studies, participants were presented with a study list of words followed by a recognition test list containing word fragments (e.g., R_ _ND_ _P). Half of the word fragments on the test corresponded to words that had been studied, and half of the word fragments on the test corresponded to words that had not been studied. For each fragment presented, participants were first asked to attempt to identify the corresponding word. Then, regardless of whether the corresponding word could be identified, participants were asked to rate the likelihood that the fragment came from a studied word. Recognition without identification is the finding that when only ratings given to unidentified fragments are considered, it is apparent that participants could discriminate between fragments coming from studied words and fragments coming from unstudied words. This is demonstrated by the fact that participants give significantly higher ratings to unidentified fragments of studied words than to unidentified fragments of unstudied words.

The recognition-without-identification phenomenon has been shown to occur when the means of hindering identification is the rapid, masked presentation of words (Cleary & Greene, 2004), the fragmentation of line drawings (Cleary, Langley, & Seiler, 2004), and the isolation of particular word features (Cleary, 2004). This finding has also been shown to occur when the unidentified stimuli are the answers to general knowledge questions (Cleary, 2006): Participants give higher recognition ratings to unanswered questions whose answers they have studied than to unanswered questions whose answers they have not studied.

Accumulating evidence suggests that the various manifestations of recognition without identification may reflect instances of familiarity-based recognition. For example, Cleary and Greene (2001) showed that the effect found with word fragments appeared in tasks thought to tap familiarity-based recognition and disappeared in tasks thought to require recollection-based recognition. Cleary and Greene (2005) showed the same to be true of the effect found with rapidly flashed, masked words. These results suggest that the paradigm used to elicit recognition without identification may be a useful technique for isolating instances of recognition that are familiarity based.

The present study sought to determine whether or not the recognition-without-identification effect found in list-learning paradigms could be elicited with faces. Such an effect might present a list-learning variation of tartling in face recognition and, as such, could serve to link the face-recognition literature with the recognition memory literature. It might seem that the ideal application of the recognition-without-identification paradigm to face recognition would involve presenting participants with a study list of faces and then hindering the identification of the faces presented on the later recognition test, through, for example, rapid presentation. However, a potential problem with that approach is that the recognition-without-identification effect found with that method might be contaminated by recollection of studied faces in the absence of an ability to identify them. Participants might recollect having studied a particular face, even though the face corresponds to a name that was never known to the participant in the first place.

For example, if faces of famous people are studied and participants are later asked at test, "Can you identify this person?" (in addition to being asked whether the face was studied), a participant would have to have known a particular face prior to the experiment in order to make the identification. This means that a particular face might go unidentified at test merely for the reason that the participant had not ever known the person in the first place. In such cases, the participant might still be able to recollect the face itself as part of a studied episode despite not knowing the person's name at test. Recognition without identification in these cases might therefore be contaminated by actual recall of studied faces that correspond to names that were never known to the participant. This possibility of recollecting studied faces in the absence of recollecting other contextual details exists with some prior behavioral methods of studying familiarity-based face recognition as well (see, e.g., Yovel & Paller, 2004).

The present methodology both circumvents this issue and attempts to link the IAC model to list-learning studies of face recognition by presenting names of people at study, rather than faces. Specifically, participants studied a list containing names of celebrities (e.g., ADRIEN BRODY, TOM SELLECK). Following this list, participants were presented with a test list containing bitmap images of faces, half of which corresponded to names presented at study (e.g., a picture of Adrien Brody's face) and half of which corresponded to names not presented at study.

This method circumvents the aforementioned issue because the specific studied episodes (to potentially be recalled at the time of test) would be the names of people. From a dual-process recognition perspective, recalling a studied episode in response to a face on the test should then lead to identification of the face. Faces that go unidentified, therefore, would represent instances in which the name could be neither accessed from the general knowledge store (as is modeled by the IAC model) nor recalled from the study list (as in recollection-based recognition in list-learning research).

Our interest was in those faces that could not be identified at test. Our goal was to determine if people could discriminate between faces of people whose names were studied and faces of people whose names were not studied when the faces themselves could not be identified. This method presents a means of tapping into recency detection of a name, in the absence of an ability to retrieve the name either from one's general knowledge base or from episodic memory for the list.

The method used here could prove useful for linking the recognition memory and the face recognition literatures for the following reasons. First, because the IAC model is a model of general knowledge of faces and their corresponding information, if the IAC model is to be made relevant to familiarity-based recognition in list-learning situations, a role of existing knowledge of faces and their corresponding information should be demonstrated in a list-learning study of face recognition. The present method uses famous faces to assess memory for famous names presented recently; therefore, a role of existing knowledge of the names and faces would have to be involved. Thus, the present method could potentially make the IAC model relevant to the recognition memory literature by demonstrating a role of preexisting knowledge of names and faces in a recognition-without-face-identification effect elicited using a list-learning paradigm. Second, the IAC model of face recognition was not explicitly developed to explain recency detection in the absence of name retrieval. However, if an existing implicit recency detection mechanism can be found, or if an explicit mechanism can be incorporated in the IAC model, the IAC model could potentially be used to account for the RWI effect with faces and, hence, integrated with recognition memory research. Third, the IAC model contains three relevant mechanisms of face recognition, whereas dual-process theories of recognition contain only two. Therefore, if made relevant to recognition in list-learning paradigms, the IAC model may be able to inform theories of recognition memory as well.

EXPERIMENT 1

Experiment 1 examined whether participants could discriminate between faces of celebrities whose names were studied and faces of celebrities whose names were not studied when the names could not actually be recalled from memory. Participants studied a list of names and then were presented with a test list of celebrity faces, half of whose names had been previously studied and half of whose names had not been studied. At test, participants were asked to name each person shown, as well as to indicate their confidence that the person's name had appeared at study.

Method

Participants. Twenty Iowa State University undergraduates participated in exchange for credit toward an introductory psychology course.

Materials. The experiment was run on a computer using E-prime software. The program used 120 images of celebrities' faces, which were selected from the Internet Movie Database (www.imdb.com) and saved as bitmap files. Some examples of faces used were those of Adrien Brody, Jennifer Connelly, Danny Glover, and Brittany Murphy.

The names corresponding to the pictures were also used. Of the 120 celebrities used, 75 were male and 45 were female. At study, each name was presented in capital letters in the upper left corner of the monitor. At test, each image was presented singly in portrait orientation in the top center of the screen. The images ranged in size from 60 × 90 pixels to 100 × 140 pixels; because of photo availability on the Internet Movie Database, 112 images were presented in color and 8 images were presented in black and white.

Procedure. For each participant, the computer program randomly assigned each of the 120 images of faces and their corresponding names to one of four study–test blocks. A block consisted of a 15-name study list followed by a 30-picture test list in which half of the pictures corresponded to studied names and half corresponded to nonstudied names. For each participant, the program randomly determined which particular 15 names within a block would appear at study. The experimental procedure was explained to participants via instructions that appeared on the screen before and during the actual experimental run.

The 15 names were presented during the study phase of a given block in the upper left-hand corner of the monitor for 2 sec each, with an interstimulus interval of 1 sec. During the test portion of a given block, each face was presented singly at the top center of the screen and remained there until all questions pertaining to it had been asked.[1] When a face appeared, participants were first prompted to identify the person via a textbox that appeared below the face. Participants could respond either by typing a name into the textbox and pressing "Enter" or by merely pressing "Enter." After pressing "Enter," they were prompted to rate the likelihood that the name corresponding to the face was studied using a scale of 0 (*definitely not studied*) to 10 (*definitely studied*). They were asked to give a rating even if they could not think of the name in question.

If the face was successfully identified on the first attempt, then, after giving a rating, the participant was immediately presented with the next face on the test list. However, if the face was not successfully identified on the first attempt, the participant was given a second chance to identify the person following the rating response. To ensure a stringent criterion for determining what constituted an unidentified face, the data were checked separately by two people for misspelled names, for instances in which participants typed only a first or last name or the name of the character played by a particular actor or actress, and for names resembling the correct names; such instances were classified as "identified" faces and taken out of the pool of interest.

Results and Discussion

Because the interest in the present study was in the recognition judgments given to faces that could not be identified at test, it is important to first consider the identification rates themselves. Overall, the proportion of items identified was comparable to the proportion of questions answered in Cleary's (2006) study of general knowledge questions and their corresponding answers. Participants identified a greater proportion of people whose names had been studied ($M = .33$, $SD = .23$) than of people whose names had not been studied ($M = .15$, $SD = .12$) [$t(19) = 5.72$, $SE = .03$, $p < .001$]. This result replicates priming effects that have been shown in the literature (e.g., Bruce & Valentine, 1985). Although items that were correctly identified on the second chance rather than the first were included in the pool of items labeled as *identified*, most of the correct identifications actually occurred on the first chance. The average number of items that went unidentified on the first chance but were then subsequently identified on the second chance was 0.80.

The data of primary interest were the recognition ratings given to faces that could not be identified on the recognition test. As can be seen in Table 1, participants gave higher recognition ratings to unidentifiable faces of people whose names were studied than to unidentifiable faces of people whose names had not been studied [$t(19) = 2.78$, $SE = .23$, $p < .05$]. This result shows that in the absence of face identification, participants could still distinguish between faces of people whose names had been studied and faces of people whose names had not been studied. This effect, which we refer to *recognition-without-face-identification*, held even when items were treated as participants [$t_{\text{items}}(118) = 2.14$, $SE = .18$, $p < .05$]; across items, the mean rating for unidentified faces of people whose names were studied was 3.68 ($SD = 1.51$), and the mean for unidentified faces of people whose names were not studied was 3.30 ($SD = 1.11$).[2] Thus, the recognition-without-face-identification effect does not appear to be an artifact resulting from a few particular items; rather, this discrimination ability appears to reflect the study status of the names corresponding to the unidentified faces in question.

The recognition-without-face-identification effect did not change across blocks. A 2 × 4 study status (studied vs. nonstudied) × block (1 vs. 2 vs. 3 vs. 4) repeated measures

Table 1
Mean Recognition Ratings Given to Identified and Unidentified Faces in Experiment 1

	Studied		Unstudied		
Faces	*M*	*SD*	*M*	*SD*	Cohen's *d*
Unidentified	3.95	1.24	3.30	1.19	0.64
Identified	9.28	1.21	0.46	0.88	6.51

ANOVA on ratings given to unidentified faces revealed no significant main effect of block [$F(3,60) < 1.0$], and no significant study status × block interaction [$F(3,60) < 1.0$]. The only effect that emerged from this analysis was a significant main effect of study status [$F(1,20) = 6.30$, $MS_e = 1.90$, $p < .05$].

Occasionally, a participant successfully typed in correct information about a test face that could not be named. For example, the participant might type the name of a character played by that particular celebrity in a movie, or the name of a movie in which that celebrity had played a role, but fail to name the person. Across all participants, there were a total of 8 such instances for faces of people whose names were studied and a total of 11 such instances for faces of people whose names were not studied. When the recognition ratings for these particular items are examined, the mean for the 8 faces corresponding to studied names is 2.0, and the mean for the 11 faces corresponding to nonstudied names is 3.13. Moreover, when the ratings corresponding to these items are removed from the pool of ratings data under consideration for unidentified faces, the mean rating is 3.97 for unidentified faces of celebrities whose names were studied and 3.31 for unidentified faces of celebrities whose names were not studied.

The more peripheral aspects of the ratings data are consistent with other studies of recognition without identification. First, a 2 × 2 identification status (identified vs. unidentified) × study status (studied vs. nonstudied) repeated measures ANOVA revealed a significant main effect of identification status [$F(1,19) = 19.59$, $MS_e = 1.58$, $p < .001$]: Ratings were higher for faces that were identified than for faces that were unidentified (see Table 1). This finding is typical in studies of recognition without identification (e.g., Cleary & Greene, 2000, 2001, 2004, 2005). Second, there was also a main effect of study status [$F(1,19) = 634.28$, $MS_e = .71$, $p < .001$]: Faces of people whose names were studied received higher recognition ratings overall than faces of people whose names had not been studied. Finally, the interaction between identification status and study status was significant [$F(1,19) = 419.07$, $MS_e = .80$, $p < .001$]. This interaction was such that the difference between ratings given to faces of people whose names were studied and faces of people whose names were not studied was greater when the faces had been identified than when they had not been identified (see Table 1). None of these peripheral effects are surprising, given that they replicate other studies of the recognition-without-face-identification effect (see, e.g., Cleary & Greene, 2000, 2001, 2004, 2005) and have been previously explained in those studies. Therefore, these aspects of the data will not be discussed further.

EXPERIMENT 2

In Experiment 1, an empirical demonstration of recognition without face identification was shown in a list-learning paradigm. In the absence of an ability to identify celebrity faces at test, participants could discriminate between faces of celebrities whose names were studied earlier and faces of celebrities whose names were not studied earlier. Although the IAC model of face recognition does not contain a mechanism that is explicitly aimed at explaining discrimination between recently and nonrecently presented names in the absence of an ability to access those names, a possible mechanism may be implicit in the model.

One possible mechanism would equate the ability shown in Experiment 1 with TOT states for people's names. As mentioned, the ability to access semantic information about a person is generally easier than accessing the person's name, and when semantic information is available in the absence of name retrieval, one may feel as if one is in a TOT state for the person's name (Schwartz, 2002). Therefore, within the context of the IAC model of face recognition, participants may be more likely to indicate a TOT state when there is access to semantic information about the person in question without concurrent access to the person's name. If studying a person's name results in an increase in the likelihood of this experience at test, then the recognition-without-face-identification effect could reflect a greater frequency of TOTs for names that were studied than for names that were not studied. In fact, like researchers of recognition memory, researchers of the TOT phenomenon often use the example of tartling in face recognition to illustrate the TOT experience. For instance, Schwartz (2002, p. 114) stated, "You see an acquaintance approaching. Instantly, you are hit with a TOT. You cannot retrieve the person's name, although you are sure that you know it." This statement suggests that experiencing feelings of familiarity with faces may in fact be related to experiencing TOT states for people's names.

In short, it is possible that studying people's names in Experiment 1 increased the likelihood of experiencing a TOT state for those names when later presented with the corresponding faces. If so, then the discrimination ability shown in Experiment 1 could reflect a greater frequency of TOTs for faces of people whose names were studied than for faces of people whose names were not studied.

However, some evidence suggesting that this may not be the case comes from a recent study on the RWI phenomenon and TOT experiences (Cleary, 2006). In that study, participants studied answers to general knowledge questions and were subsequently presented with general knowledge questions at test. The answers to half of the test questions were seen at study and the answers to the other half were not. Participants attempted to answer each question on the test, but also rated the likelihood that the answer was studied when the question could not be answered. Participants were able to discriminate between questions whose answers were studied and questions whose answers were not studied, in the absence of an ability to access the answers themselves from memory. In two experiments, the relationship between this phenomenon and the TOT experience was examined, and it was shown that studying an answer beforehand did not lead to an increased likelihood of reporting a TOT state for that answer at test. This result suggests that the sense of being in a TOT state and the RWI phenomenon were not identical in this study; the detection of an answer's recency was driven by something other than the TOT state itself.

Moreover, if the recency discrimination effect found in this study could be equated with TOT states for question answers, one would expect to find a pattern such that when conditionalized on TOT state versus non-TOT state, ratings would not differ for recently versus nonrecently presented items, but instead would differ only for TOT versus non-TOT state. This was not the case. Ratings were still higher for unretrievable answers that had been presented recently than for unretrievable answers that had not been presented recently. This result further suggests that the RWI effect could not be equated with TOT states. Thus, although it is possible that they share a common mechanism (or mechanisms), the RWI effect for unretrievable question answers and the TOT phenomenon for question answers do not appear to be identical.

The purpose of Experiment 2 was to examine the relationship between the recognition-without-face-identification effect and the TOT phenomenon. If the recognition-without-face-identification effect shown in Experiment 1 can be equated with TOT states for celebrity names, then two patterns should be found. First, studying a celebrity's name should increase the likelihood of a TOT for that name. Second, when recognition ratings for unidentified faces are conditionalized on a TOT versus non-TOT state, there should be no discrimination between recently and nonrecently presented names; rather, ratings should be higher when participants report being in a TOT state than when they report not being in a TOT state. If ratings still discriminate between recently and nonrecently presented names, then this would suggest that another mechanism besides the mere presence or absence of a TOT state for a person's name is involved in the detection of name recency for names that cannot be retrieved.

Method

Participants. Twenty-five Iowa State University undergraduates participated in exchange for extra credit in an introductory psychology course.[3]

Materials. The materials used were the same as those used in Experiment 1.

Procedure. The procedure was the same as that used in Experiment 1, with the exception that after giving a recognition rating for an item that went unidentified upon first attempt, participants were asked to judge whether they were in a TOT state. The instructions given to participants regarding TOT states were modeled after those used by Schwartz (2001, p. 119). Specifically, they were told, "A tip-of-the-tongue state (abbreviated TOT) means that you feel as if it is possible that you could recall the person's name, and that you feel as if recalling the name is imminent. It is as if the person's name is on the 'tip of your tongue,' about to be recalled, but you simply cannot think of the name at the moment." When prompted to indicate whether or not they were in a TOT state, participants were asked to type "1" if they felt they were in a TOT state and "2" if they felt they were not in a TOT state. Following this, participants were given a second chance to identify the face and were asked to take a guess if the name was still not known.

Results and Discussion

The identification rates followed the same pattern as those in Experiment 1: Participants identified a greater proportion of celebrities whose names had been studied ($M = .19$, $SD = .23$) than of celebrities whose names had not been studied ($M = .09$, $SD = .14$) [$t(23) = 3.89$, $SE = .03$, $p < .01$]. As in Experiment 1, the majority of correct identifications occurred on the first chance. Participants averaged only 0.46 correct identifications on the second chance. Because TOT responses were recorded in Experiment 2, it is also important for one to consider the proportion of TOT responses given in each condition. These did not differ significantly for studied ($M = .31$, $SD = .21$) and nonstudied ($M = .33$, $SD = .21$) names [$t(23) = 1.28$, $SE = .02$, $p = .21$] and are comparable to the TOT rates found in Cleary (2006). In short, studying a celebrity's name did not increase the likelihood of experiencing a TOT for that name at test.

The recognition ratings from Experiment 2 are presented in Table 2. Paired-samples t tests revealed that a recognition-without-face-identification effect was present for faces that induced TOT states [$t(23) = 2.69$, $SE = .33$, $p < .05$], but not for faces that did not induce TOT states [$t(23) = -.65$, $SE = .16$, $p = .52$]. This pattern held even when items were treated as participants: An items analysis revealed a recognition-without-face-identification effect for faces that induced TOT states [$t_{items}(109) = 2.94$, $SE = .30$, $p < .01$], but not for faces that did not induce TOT states [$t_{items}(118) = -0.07$, $SE = .15$, $p = .95$].

A 2 × 2 TOT state (TOT vs. non-TOT) × study status (studied vs. nonstudied) repeated measures ANOVA revealed a significant interaction [$F(1,23) = 6.96$, $MS_e = .85$, $p < .05$], so that the recognition-without-face-identification effect was significantly larger for faces that elicited TOT states. These findings suggest that although the two are not identical, the recognition-without-face-identification effect shown here is related to the TOT phenomenon: The effect only occurred when participants reported experiencing TOT states. Furthermore, a significant main effect of TOT state [$F(1,23) = 4.88$, $MS_e = .77$, $p < .05$] revealed that participants thought it more likely that a person's name was studied when in a TOT state than when not in a TOT state; in short, participants behaved as if TOT states themselves were diagnostic of study status, even though studying a name did not increase the likelihood of a later TOT for that name. This result replicates the pattern that Cleary (2006) obtained with the RWI effect for answers to general knowledge questions. Also noteworthy in that study, even though TOT states should not have been diagnostic of study status (since TOTs were no more likely for studied answers than for nonstudied answers), participants thought it was more likely that an answer to a question was studied when in a TOT state than when not in a TOT state.

Although many participants did not have enough responses in every category (e.g., studied TOT, nonstudied TOT, etc.) of every block for an analysis of block, an anal-

Table 2
Mean Recognition Ratings Given to Unidentified Faces in Experiment 2

	Studied		Unstudied		
	M	*SD*	*M*	*SD*	Cohen's *d*
TOT-state reported	5.21	2.41	4.32	2.41	0.56
Non-TOT-state reported	3.48	1.47	3.58	1.42	−0.14

Note—TOT, tip of the tongue.

ysis of the ratings of those that did have enough responses revealed no effects of block. A 2 × 2 × 4 study status (studied vs. nonstudied) × TOT state (TOT vs. non-TOT) × block (1 vs. 2 vs. 3 vs. 4) ANOVA revealed no significant main effect of block on ratings given to unidentified faces [$F(3,39) < 1.0$], no significant block × TOT state interaction [$F(3,39) = 2.19$, $MS_e = 2.38$, nonsignificant], no significant block × study status interaction [$F(3,39) < 1.0$], and no significant block × TOT state × study status interaction [$F(3,39) < 1.0$]. The only effects that emerged from this analysis were a main effect of TOT state on ratings [$F(1,13) = 8.60$, $MS_e = 35.87$, $p = .01$] and a significant TOT state × study status interaction [$F(1,13) = 20.28$, $MS_e = 0.78$, $p = .001$].

Like Experiment 1, participants occasionally typed in correct information about a test face that could not be named. Across all participants in Experiment 2, there were a total of five such instances for faces of people whose names were studied and a total of seven such instances for faces of people whose names were not studied. When further categorized according to TOT status, there were a total of three such instances for TOT states for studied names, three for TOT states for nonstudied names, two for non-TOT states for studied names, and four for non-TOT states for nonstudied names. When the recognition ratings for these particular items are examined, the mean for the five faces corresponding to studied names was 2.60, and the mean for the seven faces corresponding to nonstudied names was 3.80. When further categorized according to TOT status, the means were 0.67 for TOT states for studied names, 1.67 for TOT states for nonstudied names, 5.50 for non-TOT states for studied names, and 4.67 for non-TOT states for nonstudied names. Moreover, when the ratings corresponding to these items were removed from the pool of ratings data under consideration for unidentified faces, the mean rating was 5.26 for unidentified faces eliciting TOT states for studied names, 4.33 for unidentified faces eliciting TOT states for nonstudied names, 3.47 for unidentified faces eliciting reported non-TOT states for studied names, and 3.58 for unidentified faces eliciting reported non-TOT states for nonstudied names.

GENERAL DISCUSSION

Summary of the Present Findings

The findings reported in the present study provide a novel empirical demonstration of recognition without face identification. The paradigm used to elicit this recognition-without-face-identification effect was an offshoot of the RWI paradigm first used by Peynircioglu (1990) and later used by Cleary and colleagues (Cleary, 2004, 2006; Cleary & Greene, 2000, 2001, 2004, 2005; Cleary, Langley & Seiler, 2004). In our application of the RWI technique, participants studied a list of celebrities' names and were then tested on their recognition of celebrities' faces. In Experiment 1, we demonstrated that participants could recognize faces as corresponding to names that were presented on the study list, even when they could not actually retrieve the names themselves. In Experiment 2, we showed that this ability to recognize unidentifiable celebrity faces occurred only when participants reported experiencing TOT states for celebrities' names.

The Relationship Between RWI for Faces and the TOT Phenomenon

The fact that the recognition-without-face-identification effect may be related to TOT experiences is interesting in light of the fact that studying a celebrity's name did not increase the likelihood of a later TOT when viewing that person's face. Because the likelihood of a TOT for a name when presented with a face was not influenced by whether the name was recently presented, the mere presence of a TOT state should not have been diagnostic of the study status of a given celebrity's name. Yet, discrimination between recently and nonrecently presented names only occurred for unidentified faces when participants reported being in a TOT state.

Thus, as was found in Cleary's (2006) study with general knowledge questions and their corresponding answers, although the present study suggests that the recognition-without-face-identification effect may be related to TOT states for people's names, the results reported here also suggest that the two are distinguishable. First, TOT states were not diagnostic of study status. Second, discrimination between studied and nonstudied names occurred even when only those recognition ratings that were accompanied by reported TOT states were considered. The report of a TOT experience is a more general indication that a celebrity's name is in one's knowledge base, whereas the recognition-without-face-identification effect found when only ratings accompanied by TOT states were considered is an indication of the detection that the person's name was presented recently. That participants were still able to detect the fact that inaccessible names were presented recently when only reported TOT states were considered suggests that the recognition-without-face-identification effect reported here results from something other than the mere attribution of a TOT state to studied status (and a non-TOT state to nonstudied status).

The Present Results Within the Context of the IAC Model of Face Recognition

The recognition-without-face-identification effect presented here does not appear to result from the attribution of the mere presence or absence of a TOT state to study status; therefore, another theoretical mechanism is needed to explain it. Because the recognition-without-face-identification effect reported here involves existing knowledge of faces and their corresponding name information, it may be possible to link the present finding to the face recognition literature—namely to the IAC model of face recognition (see, e.g., Burton et al., 1999; Burton et al., 1990).

The IAC model involves existing knowledge of faces and their corresponding information and can thus easily account for the real-life experience of recognizing a face as familiar when the person's name cannot be accessed; however, the model does not have an explicit mechanism for handling the recency discrimination for inaccessible names shown in the present study. Still, there may be mechanisms implicit in the model that would allow such recency discrimination in the absence of name retrieval. Some possibilities are explored here.

One possibility is that rather than attributing the mere presence or absence of a TOT to the study status of an unidentifiable person's name, participants attribute the strength of a TOT experience for the name to its study status. Specifically, if TOTs tend to be stronger for faces of people whose names were studied than for faces of people whose names were not studied, then discrimination could be based on TOT strength. One way in which the IAC model might account for such a TOT effect would be through differences at the level of the SIUs. Specifically, participants may have greater access to semantic information for faces corresponding to studied names than for faces corresponding to nonstudied names. They may also have less access to semantic information for faces that do not elicit TOTs than for faces that do elicit TOTs. Ultimately, this could lead to the pattern reported here in the following way. If faces corresponding to studied names elicit access to more semantic information, they may in turn lead to a stronger sense of being in a TOT than faces corresponding to nonstudied names. Thus, it may be a matter of degree of TOT rather than the mere presence or absence of a TOT that drives the ratings pattern reported here for unidentified faces. Faces not eliciting TOTs at all may elicit the least amount of semantic information, leading the ratings to line up in the manner shown in the present study (ratings in TOT states for studied names > ratings in TOT states for nonstudied names > ratings in non-TOT states).

This account seems unlikely for the following reasons. First, if studying a name strengthened the later TOT state for that name via increased access to semantic information, one would expect that studying names would also have increased the likelihood of a TOT state for those names. However, it did not. Second, instances in which participants typed in correct information about celebrities that could not be named were examined. In both Experiments 1 and 2, the ratings given on these occasions were not in the direction that one would expect if access to semantic information were driving the effect; thus, when these instances were removed from the pool of data under consideration, the recognition-without-face-identification pattern remained.

Third, the reason why semantic information is easier to retrieve than names in the IAC model is because names should be more distinct than general semantic information (having fewer connections between them and other information). However, the names and faces of people used in the present study were all of somewhat popular American celebrities (actors and actresses from the Internet Movie Database); therefore, they shared much of their general semantic information (e.g., occupation). Having such general semantic information in common with one another would mean that retrieval of general semantic information for these faces may have been less differentiating than for faces used in other face-recognition studies in the literature. That is, the kind of semantic information that may have differentiated one celebrity from the next (e.g., particular role played in a movie) may not have differed in terms of distinctiveness from the celebrity's names themselves (see, e.g., Stanhope & Cohen, 1993). When the differentiating semantic information is no less distinctive than the person's name, the general semantic information should not be easier to retrieve than the name information. Moreover, the names themselves were presented at study, rather than any general semantic information, which should have worked to increase the accessibility of the names at test in comparison with semantic information. Therefore, if the names and the differentiating semantic information were, in fact, similar in distinctiveness, the presentation of the names at study should have made the names more accessible at test than the differentiating semantic information.

In short, although previous studies have shown that names are generally more difficult to retrieve than semantic information about a person (e.g., Bredart & Valentine, 1998; Cohen, 1990; Stanhope & Cohen, 1993), this is likely not to be the case under the circumstances of the present study. Still, if it were the case that studying a celebrity's name led to greater accessibility of semantic information later on than of the studied name itself, this would be very interesting from the perspective of the list-learning literature, since it would imply that the peculiar difficulty in retrieving proper names from memory applies to list-learning studies of recognition memory as well.

Another possibility is that within the context of the IAC model, semantic information (from the SIUs) is accessed at test that was also accessed at study. That is, rather than accessing more semantic information for faces whose names were studied than for faces whose names were not studied (as in the TOT strength explanation described above), semantic information may be reinstated at test that had been self-generated at study. In the IAC model, the presentation of a known person's name at study should lead to access of semantic information about that person at the time of study, as well as access to the face representation. Presenting a picture of the person's face at test may also lead to access of the same semantic information that was self-generated at study. If so, then what would be needed in the IAC model is some sort of recency tag or episodic link to the fact that that semantic information was recently experienced at study.

This explanation, too, seems unlikely. First, examination of those instances in which participants successfully identified semantic information about an unnamable face in the presentation study did not support this idea (the ratings for these items were not higher when the names were studied than when the names were not studied). Second, from the theoretical perspective of the dual-process recognition memory literature, it is unclear why the presentation of a person's name at study should lead to self-generation of corresponding semantic information about that person at encoding, but when the person's face is presented at test, the only accessible information would be the self-generated semantic information and not the name that led to the self-generation of that information. For example, if when presented with the name "Jennifer Connelly" at study, a participant generated the semantic information, "She played Alicia Nash in *A Beautiful Mind*," why at test would the participant then be able to generate "She played Alicia Nash in *A Beautiful Mind*" in response to Jennifer Connelly's face, recognize that the information had been generated at study (via a recency tag or episodic link), yet not be able to retrieve the name "Jennifer Connelly?"

As mentioned, from the perspective of the face recognition literature, it has long been known that people's names are particularly difficult to remember (Bredart & Valentine, 1998; Cohen, 1990; Stanhope & Cohen, 1993), and that semantic information about people can generally be more easily accessed than their names. This is the reason why the IAC model contains connections so that semantic information is more accessible than name information. Very little work has been done on proper-name retrieval in list-learning paradigms. Therefore, the idea that semantic information self-generated in response to a name at study may be more accessible in response to the corresponding face at test than the studied name itself is an interesting one from the perspective of list learning.

Again, what would be needed in the IAC model is a means of linking retrieved semantic information at test with a studied episode; however, examination of ratings given in cases in which semantic information about an unnamable person was identified did not support this explanation for the present pattern of results. Instead, the model may be able to account for the present findings with the addition of an episodic link or recency tag between faces and their corresponding name information, without involving additional semantic information. However, this would not explain the pattern shown for TOT versus non-TOT states in the present study.

Yet another possibility is that within the context of the IAC model, PINs corresponding to names presented at study receive a boost in activation when their corresponding names are presented at study. Because PINs can produce a sense of familiarity with a face that cannot be identified, a boost in the activation level of the PINs corresponding to studied names could result in an increased sense of familiarity with faces at test that correspond to studied names. Therefore, one way in which the IAC model could account for the recognition-without-face-identification effect shown in the present study is through criterion placement along the PIN activation continuum: Each rating would reflect a different point along the continuum so that higher ratings indicate higher activation values and lower ratings indicate lower activation values. Because faces corresponding to names that were studied will have, on average, PINs with higher activation values than faces corresponding to names that were not studied, discrimination can occur.

In fact, such a mechanism would be somewhat similar to the mechanism of familiarity-based recognition in the source of activation confusion (SAC) model, which is a dual-process model of recognition memory (Reder et al., 2000). The SAC model incorporates existing knowledge representations into its mechanism of familiarity-based discrimination between studied and nonstudied items. In this model, familiarity at test is the activation level of the node within the semantic network that represents the test item; thus, a higher activation level for a word's representation means that greater familiarity will be elicited by that word's presentation at test. A given word's current activation level will be raised either by its immediate presentation or through semantic priming of its representation. A word's activation level is also influenced by its baseline (resting) activation level, which reflects the frequency of prior exposure, and will thus be higher for frequent than for infrequent words. Familiarity-based discrimination in list-learning paradigms occurs in the following way. When an item is presented at study, its representation in the semantic knowledge store receives an increment in its baseline activation level. Because each studied item will have received this increment, studied items—on average—will have higher baseline activation levels than nonstudied items on the recognition test. Thus, studied items will seem more familiar, allowing for familiarity-based discrimination.

Similarly, within the IAC model, a PIN may receive an increment in its baseline activation level when a name is presented at study, allowing for greater familiarity with the corresponding face than would otherwise occur. This could account for the discrimination ability reported here (between faces corresponding to studied and those corresponding to nonstudied names in the absence of name retrieval). To account for the TOT pattern reported here, one can assume that the PIN activation levels are higher overall for faces eliciting TOT states than for those not eliciting TOT states (in much the same way as baseline activation values are higher for high-frequency words than for low-frequency words in the SAC model). This assumption would simply mean that the baseline activation levels of the PINs were higher for faces eliciting TOTs than for those not eliciting TOTs, and would suggest a relationship between PIN activation and TOT states for people's names. Note that PIN activation in the IAC model is meant to signal face familiarity in the sense that a face is known to a person, even though the name and other corresponding information cannot be retrieved. Thus, PIN activation that exceeds a given threshold in the model is usually signaling the presence of the person in one's general knowledge store. The same can be said of the TOT state: It is an indication of the presence of general knowledge about the person. Thus, it is plausible that PIN activation may relate to TOT states for people's names.

On the Generalizability of the Present Findings to Other Types of RWI

Given the relation of both the present results and the findings of Cleary (2006) to the TOT phenomenon, it is possible that all instances of RWI may relate to the TOT phenomenon. However, both the present variation of the RWI phenomenon and that of Cleary (2006) are somewhat unique in requiring a role of existing semantic knowledge. In other variations of the RWI phenomenon, such as with words and corresponding unidentifiable word fragments (see, e.g., Cleary & Greene, 2000, 2001) or with pictures and corresponding picture fragments (e.g., Cleary et al., 2004), the critical aspect may be the overlap between structural features presented at study and structural features (e.g., letters, geometric features) presented at test. Therefore, caution should be exercised in attempting to generalize the pattern of results reported here and in Cleary (2006) to all variations of the RWI phenomenon. There may be other variations of RWI that do not relate to the TOT experience in the manner shown here.

Summary and Conclusions

In summary, the phenomenon that the ancient Scottish verb *tartling* was meant to describe (recognizing a face as familiar in the absence of bringing to mind specifics about the person) spans across many areas of cognitive psychology. The present study was an attempt to link two rather disparate literatures on the topic: the recognition memory literature and the face-recognition literature. Toward this end, the present study reports a novel empirical recognition-without-face-identification effect. The effect reported here could potentially link the recognition memory and face recognition literatures. First, it involves a role of preexisting knowledge of faces and their corresponding names, which potentially makes the IAC model relevant to the effect and to list-learning studies more generally. Second, it presents a novel empirical effect that both theories of face and name recognition and theories of recognition memory will need to account for.

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NOTES

1. The reason for presenting the names in the upper-left corner at study was to make it easy for participants to know where to look at study (because the first letter of each word would then appear at exactly the same location on the monitor for every presentation). To minimize how far participants would have to shift their gaze at test (from the picture of the face to the dialog box into which they were typing), each face was presented directly above the dialog box, which appeared in the center of the screen.

2. One face was identified 100% of the time in the studied condition (Al Pacino); therefore, this face could not be included in the items analysis for ratings given to unidentified faces (which explains the degrees of freedom for the items analysis).

3. One participant did not indicate any TOT states for any of the items; thus, the data for this person were excluded because there were no ratings corresponding to TOT-state items.

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