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Language Style Matching and Police Interrogation Outcomes

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This research examined the coordination of interrogator and suspects' verbal behavior in interrogations. Sixty-four police interrogations were examined at the aggregate and utterance level using a measure of verbal mimicry known as Language Style Matching. Analyses revealed an interaction between confession and the direction of language matching. Interrogations containing a confession were characterized by higher rates of the suspect matching the interrogators' language style than interrogations without a confession. A sequence analysis of utterance-level Language Style Matching revealed a divergence in the type of matching that occurred across outcome. There was a linear increase in interrogator-led matching for interrogations containing a confession and an increase in suspect-led matching for nonconfession interrogations. These findings suggest that police interrogations play out, in part, at the basic level of language coordination.

Keywords: interrogation, Language Style Matching, confession

Studies of police interrogation have often sought to understand how the ebb-and-flow of dialogue relates to a confession. There is now a considerable body of work examining the effect of questioning style (e.g., Granhag, Montecinos, & Oleszkiewicz, in press; Snook, Luther, Quinlan, & Milne, 2012) and interpersonal tactics (e.g., Beune, Giebels, & Taylor, 2010; King & Snook, 2009; Walsh & Bull, 2012) on suspects' behavior. However, to date, this research has given far less consideration to the impact of language on this interpersonal process. This is surprising, not least because the words that interrogators and suspects use represent the building blocks through which rapport, information gathering, and confessions—true or false—are played out (Kassin & Gudjonsson, 2004). Being able to understand the patterns of language that occur in interrogations will shed light on the interpersonal processes that precede confessions. In this article, we focus on one aspect of language use known as Language Style Matching and consider its relationship with interrogation outcome.

Language Style Matching, Cooperation, and Outcome

A growing body of research suggests that we can learn a great deal about people's thoughts, emotions, and motivations by examining their language use (Tausczik & Pennebaker, 2010). Studies have shown, for example, how increased first-person pronoun use accompanies depression (Rude, Gortner, & Pennebaker, 2004), how changes in words associated with emotionality demarcate the aftermath of crises (Cohn, Mehl, & Pennebaker, 2004; Pennebaker & Lay, 2002), and how language related to information processing, such as words that denote distinctions and connections (e.g., but, also), allow insights into the nature of a person's reasoning (Graesser, McNamara, Louwerse, & Cai, 2004; Pennebaker, Slaticher, & Chung, 2005). The value of this research stems, in part, from its unobtrusive nature and the possibility of studying psychological processes in data that were not initially collected for research. For example, Hancock, Woodworth, and Porter's (2013) examination of crime narratives revealed that psychopathic killers used more rational cause-and-effect descriptors, less social references, and more past tense than their nonpsychopathic counterparts, which they argued reflected the psychological detachment that is typical of this offender group. Of interest, research also suggests that people have an implicit understanding of the value of language. Students tend to rely more on language than other domains when making judgments of guilt (Boydell, Barone, & Read, 2013; Peace & Sinclair, 2012), and they are better at distinguishing true and false confessions from nuances in verbal rather than nonverbal behavior (Willén & Strömwall, 2012). Taken together, this research suggests that language is likely to play an important role in driving the unfolding interactions of interrogations.

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An area of language use that has received renewed interest is the coordination of utterances between speakers. The notion that two speakers coordinate their language use when engaged in a process like an interrogation is not a new one. For instance, Communication Accommodation Theory (CAT; Coupland & Giles, 1988) suggests that speakers can increase or decrease the social distance between themselves and another person by adjusting the content and timing of their speech (Cappella & Panalp, 1981). Similarly, Garrod and Pickering's (2004) Interactional Alignment Theory (IAT) is premised on the idea that people have an innate tendency to align their grammar and word choices over time when engaged in dialogue. IAT predicts that the emergence of a common lexicon between speakers is tied intimately to the emergence of a common understanding of the issue at hand, which provides the basis for cooperation and goal achievement (Garrod & Pickering, 2004).

Recently, researchers have been examining the process of alignment using a quantitative measure of verbal accommodation known as Language Style Matching. The basis of this measure is the observation that the more reliable and predictive elements of language tend to be words that determine the style, rather than content, of an utterance (Pennebaker, 2011). While words relating to content (e.g., nouns, regular verbs) convey "what" the speaker wishes to say, words relating to style—known as function words—shape "how" something is said (Groom & Pennebaker, 2002). As such, function words, which include articles, prepositions and pronouns, occur irrespective of the topic of dialogue and require a shared social knowledge to be comprehended (Meyer & Bock, 1999). Thus, when two speakers are adopting similar levels of formality, emotionality, and cognitive complexity in their function word choices, so they have adopted a common conceptualization of the world (Pennebaker, 2011). Language Style Matching captures this matching by measuring the degree to which two people have a similar use of function words.

Consistent with the earlier work on CAT and IAT, matching of language styles has been shown to be related to cooperation and interaction success. Specifically, greater Language Style Matching is associated with better group problem-solving (Gonzales, Hancock, & Pennebaker, 2010), less negotiator defection (Scissors, Gill, & Gergle, 2008), success in speed dating (Ireland, Slatcher, Eastwick, Scissors, Finkel, & Pennebaker, 2010), and generosity in waitress tipping (van Baaren, Holland, Steenaert, & Van Knippenberg, 2003). Across these studies, the emergence of matched language style went hand-in-hand with positive social behavior (e.g., liking, Ireland et al., 2010) and joint effort toward a goal (e.g., a negotiated resolution, Scissors et al., 2008). Conversely, a desire to distance oneself from an interaction and pursue a malevolent goal has been shown to be associated with the absence of Language Style Matching. For example, Taylor, Dando, Ormerod, Ball, Jenkins, Sandham, and Menacere (2013) found that insiders trying to steal information matched the language of their coworkers far less than their nonstealing counterparts, and this difference increased over time.

Although there are no available studies of Language Style Matching and police interrogations, the literature on police interviews does recognize the importance of verbal mimicry to the information gathering process. The Cognitive Interview protocol includes a 'principle of synchrony' that encourages interviewers to behave in a way that is consistent with what they desire of the interviewee (Milne, 2004; Walsh & Bull, 2012). For example, by

speaking in a calm, relaxed voice, the interviewer can guide the interviewee to behave in a way that is calm and relaxed (Milne, 2004). Consistent with this idea, research has shown that greater verbal accommodation by police officers, for instance by explaining police procedures, predicted citizens' ratings of trust in the police and subsequent compliance with police requests (Barker, Giles, Hajek, Ota, Noels, Lim, & Somera, 2008). Similarly, in their analysis of hostage negotiations, Taylor and Thomas (2008) found that incidents ending in surrender involved greater consistency in Language Style Matching than those that ended with tactical intervention.

This research tentatively suggests that greater Language Style Matching is likely to be associated with cooperation during an interrogation. In a standard interrogation where the authorities seek a suspect's response to their account of the crime (i.e., rather than an information-gathering interview), such cooperation is likely to be most prominent when a suspect responds positively to the interrogator's questioning. In this scenario, the suspect and interrogator accommodate to one another's responses and, in doing so, derive an agreed understanding of what occurred that satisfies the interrogator's evidence-based version of events. At its utmost, this accommodation may result in a capitulation and an omission of guilt by the suspect. This is not to say that cooperation does not come in other forms. For example, an interrogator may be persuaded by the suspect's alternative account of the event and begin to align him or herself with that account. However, this scenario is more likely to emerge later in the interaction after the interrogator shifts away from his or her prior understanding. As a consequence, Language Style Matching will not be as prominent. We therefore predict:

Hypothesis 1: Interrogations containing a confession will contain more Language Style Matching than interrogations devoid of a confession.

When and Why Does Matching Occur?

The proposed association between Language Style Matching and confessions raises the question of how matching emerges during interrogations. It may be the case that both speakers accommodate to the other's language use and they reach a 'middle ground.' Or, it may be the case that one speaker primarily matches the other's language use and that an asymmetric pattern of matching emerges. This second possibility is consistent with research showing that people tend to mimic those with whom they agree or wish to understand. For example, when discussing their favorite holiday destinations, students will show more mimicry toward a confederate with whom they hold a similar view than a dissimilar view (Van Swol & Drury, 2007). In courtroom interactions, lawyers are more likely to match the language of judges who are still deliberating their final case decision and who they still have a chance of persuading than the language of judges who have already made their decision (Danescu-Niculescu-Mizil, Lee, Pang, & Kleinberg, 2011). Research has also shown that drivers who return to find their cars immobilized for incorrect parking will raise their voice in pitch and tone, yet traffic wardens will not (Culpeper, Bousfield, & Wichmann, 2003). As Culpeper et al. argue, the fact that traffic wardens do not accommodate to the language of the driver signals a refusal to empathize with the

driver. By accepting the other speaker's use of language, accommodation is viewed as a step toward accepting the other speaker's perception of the situation.

Capitulating to, and accepting, another's viewpoint is closely related to the nature of the relationship between speakers. People tend to show greater matching of their conversational partner's language style when they perceive that person as dominant or as leading the conversation. This idea is exemplified in Niederhoffer and Pennebaker's (2002) examination of recorded White House conversations between Nixon and his aids during the Watergate affair. The general pattern of language use by Nixon's aids is one of matching the President's language style. There is one exception, however, which occurs in the final conversation between Nixon and his aid, John Dean. At this point in the Watergate affair, Dean was convinced that he was being set up to be the 'fall guy,' and was reportedly no longer supportive of Nixon's actions. Dean's dialogue during this period no longer showed the significant matching of the President's language that typified their other interactions.

The idea of an association between dominance and Language Style Matching is also consistent with findings from the related domain of nonverbal mimicry. In two studies, Cheng and Chartrand (2003) found that participants nonverbally mimicked a confederate when she was presented as having a higher power role (e.g., being a leader) than when the power distribution presented was equal. Dalton, Chartrand, and Finkel (2010) extended this finding to show that violations of such expected patterns of mimicry, either in terms of mimicry not occurring when it was anticipated, or vice versa, had the effect of depleting performance on subsequent social tasks. Dalton et al. argued that there are schema-driven rules about who mimics whose nonverbal behavior within interactions, and violations of these schemas can have negative consequences. If one assumes such findings have relevance to the verbal channel, then they suggest there will be important consequences to the direction of Language Style Matching observed within interaction.

The findings of the research on Language Style Matching analyses in other domains, combined with the findings of research on nonverbal mimicry, imply that the ability of an interrogator to obtain a confession may depend on the extent to which a suspect is willing to accommodate to the behavior of the interrogator. Consistent with this idea, Driskell et al. (2013) found a positive association between the length of an investigative interview and the amount of Language Style Matching among suspects and interviewers. However, they did not compare the extent of suspects' matching across an outcome variable (e.g., amount of information provided), such that it is unclear as to whether Language Style Matching is associated with actual suspect cooperation. To date, the only study to examine the direction of matching between speakers and its impact on outcome is Taylor and Thomas' (2008) examination of hostage negotiations. They found that successful negotiations were characterized by the hostage taker matching the police negotiator on linguistic dimensions such as turn taking, reciprocity of positive affect, focus on the present rather than past, and focus on alternatives rather than on competition. By contrast, the unsuccessful negotiations were evenly balanced in terms of who was matching whose dialogue. The police negotiators matched the perpetrator's use of negative statements and negative

emotions, and the tendency to recognize differences between the parties.

The research on Language Style Matching suggests that confessions in interrogations are likely to be characterized by suspects' matching of the language style of the interrogators, because this is when speakers thought processes are aligned. Of course, it is also possible that matching may occur in the opposite direction such that, in nonconfession interrogations, the interrogator accepts the suspects' account of the situation and so begins to match his or her language. If it exists, this complementary pattern of accommodation will serve to magnify the association between suspect's matching of the interrogator and his or her confession. Thus, we predict that whether or not a suspect confesses (irrespective of whether or not the confession is true) will be a function of the direction of matching between suspect and interrogator. Specifically:

Hypothesis 2: A confession is more likely to occur when the suspect is matching the linguistic style of the interrogator rather than the reverse.

Changes in Language Style Matching Across Time

Theoretical and empirical accounts of language alignment (e.g., Garrod & Pickering, 2004) suggest that Language Style Matching will increase incrementally over time as interrogator and suspect converge to one another's dialogue. For example, Garrod and Anderson (1987) showed that partners engaging in a maze task begin to align on expressions that refer to direction until they reach a point where they are coordinated in their choice of descriptors. On a more dynamic level, Donohue and Roberto (1996) have shown that hostage negotiations move through stages where parties increase or decrease the similarity of their behavioral orientation over time. The extent of this matching in the final stages of interaction is related to negotiation success, with greater coordination around relational (e.g., trust and affiliation focused) and instrumental (e.g., task focused) issues being more likely to lead to a successful resolution (Olekals & Smith, 2000; Taylor, 2002; Taylor & Donald, 2003). Similarly, Taylor and Thomas (2008) showed that, while consistently high levels of language style matching characterized successful negotiations, it was oscillating periods of high and low matching that characterized unsuccessful negotiations. Collectively, this evidence suggests that the relationship between Language Style Matching and cooperation is one of incremental growth over time. At the outset, control of linguistic style could be claimed by either interrogator or suspect. For a confession to ensue, the interrogation should progress to a situation where the suspect increasingly matches the linguistic style of the interrogator. We predict:

Hypothesis 3: Interrogations that end in confession will progress toward a situation where the suspect increasingly matches the linguistic style of the interrogator.

Method

Data

Data were transcripts of 64 suspect interrogations that were conducted by a Canadian police organization between June 2000

and December 2008 (16 occurred between 2000 and 2004, while 48 occurred between 2004 and 2008). All of the interrogations were conducted in a small private room within an official police building. All were accusatorial in nature, with the suspect and police officer discussing the time surrounding a recently committed offense of which the suspect was accused. The interactions lasted between 9 and 125 min ($M = 32.8$, $SE = 7.59$) and they were characterized by exchanges of closed and probing questions, with the occasional use of open questions (cf. Gudjonsson & Pearse, 2011; Snook et al., 2012). In a small number of the interrogations a second police officer, or the suspect's lawyer, contributed to the dialogue. On all occasions these contributions were no more than three utterances, and the segment of dialogue was removed before analysis.

The offenses discussed in the interrogations varied from robbery of a convenience store through to homicide. In order of descending frequency, 45.3% ($n = 29$) of the suspects were accused of fraud offenses (e.g., check counterfeiting), 23.4% ($n = 15$) of sexual assault, 17% ($n = 11$) of common assault, 7.8% ($n = 5$) of armed robbery, and 6.2% ($n = 4$) of homicide. The majority of the suspects were men (93.6%, $n = 60$).

Of the 64 interrogations, 39% ($n = 25$) contained a confession by the suspect. This is comparable with that reported in previous research, such as the 50% confession rate reported for Atlantic Canadian police interrogations (King & Snook, 2009; see also Smith, Stinson, & Patry, 2009). To ensure our analysis focused on the language matching that led up to the confession, and not the matching postconfession, we removed all of the postconfession dialogue. Thus, we compared the preconfession dialogue for the 25 confession interrogations with the complete dialogue in the 39 nonconfession interrogations. The mean length of the confession interrogations was 3,944 words ($SD = 4173$; Range: 376–14,593) while the mean length of the nonconfession interrogations was 6,796 words ($SD = 5,338$; Range: 1,169–24,939).

Because of the nature of the real-world data, it was not possible to experimentally manipulate the ground truth of the confessions. This means that we were unable to rule out the possibility that some of the confessions were false. However, the low instances of false confessions generally reported suggest that this risk is minimal for the majority of the cases analyzed. For example, Bedau and Radelet (1987) reported that in a sample of 350 confessions, 49 were false, a rate of 11.4%. Other research reports much lower instances of false confession, such as 3.9% and 1.2% (Gudjonsson, Sigurdsson, Bragason, & Einarsson, 2004; Gudjonsson, Sigurdsson, & Einarsson, 2004).

Measuring Language Style Matching

Consistent with previous research (Gonzales et al., 2010; Ireland & Pennebaker, 2010; Ireland et al., 2010; Taylor & Thomas, 2008), we examined language matching using an established measure known as Language Style Matching. To calculate an overall Language Style Matching score for each interrogator-suspect pair, we followed the procedure described in Ireland et al. (2010). We first segmented the transcripts by speaker to produce two speaker-specific text files for each interrogation. These texts were then submitted to analysis by the text analysis software Linguistic Inquiry and Word Count (LIWC; Pennebaker, Booth, & Francis, 2007). LIWC analyzes a text file on a word-by-word basis to

calculate the percentage of total words in a text that match a number of linguistic categories, including the nine function word categories that are used to calculate Language Style Matching. Table 1 contains examples of these nine categories. These function words cover more than half of the vocabulary of daily speech (Rochon, Saffran, Berndt, & Schwartz, 2000) and correlate with social behaviors such as dominance, deception, and social bonding (Chung & Pennebaker, 2007).

The resulting LIWC scores were then used to calculate separate Language Style Matching measures for each of the nine categories. This was achieved using the following formula (the articles category is used here as an example):

$$LSM_{\text{articles}} = 1 - [(|\text{articles}_I - \text{articles}_S|) / (\text{articles}_I + \text{articles}_S + .0001)],$$

where articles_I is the percentage of articles used by the police interrogator, articles_S is the percentage of articles used by the suspect, and the denominator addition of .0001 is used to prevent division by zero (see Gonzales et al., 2010; Ireland et al., 2010). The resulting nine category-specific Language Style Matching scores were then averaged to produce a single score for interrogator-suspect matching. This score varies between .00 and 1.00, with a higher score indicating greater Language Style Matching between interrogator and suspect. In some sense, then, the Language Style Matching metric may be thought of as a correlation, with a higher metric indicating greater similarity in the language used by both speakers. However, it is not appropriate to infer meaning from the absolute level of Language Style Matching, because the average scores observed in previous research have varied (e.g., .77 for interactions between romantic partners, Ireland et al., 2010; .88 for groups rated as highly cohesive, Gonzales et al., 2010). The value of the Language Style Matching metric is comparing it in relative terms across conditions.

Utterance matching. While the overall measure of Language Style Matching gives an indication of matching across the interaction as a whole, it provides little information about the relative coordination between the two speakers. To examine the contributions of each speaker, we examined Language Style Matching scores at each utterance of the interaction (see Niederhoffer & Pennebaker, 2002; Taylor & Thomas, 2008). This analysis exam-

Table 1
Function Word Categories Used in the Calculation of a Linguistic Style Matching Score

Category	Example words	Example in context
Adverbs	Very, well	"It turns out that that very guy is going about mouthing me off"
Articles	A, the	A statement about this matter
Auxiliary verbs	Am, have	"I was told that I could call"
Conjunctions	But, therefore	"But you went to bingo after that?"
Indefinite pronouns	This, it	"No, no doubt about it"
Negations	No, not	"Not in there"
Personal Pronouns	I, you, we	"I look like Mike when Mike was younger do I?"
Prepositions	In, around	"I turned around and decided to get two or three taxis"
Quantifiers	Many, few	"Buy a few rounds of tickets"

ined the extent to which the style of a police interrogator's utterance at a given point in the interaction was matched by the style of the suspect's response, and, subsequently, how the suspect's response was then matched by the interrogator's next utterance. A comparison of suspect-led matching with an equivalent measure of interrogator-led matching enabled an analysis of whether it was the interrogator or suspect who was leading the interaction and being matched by the other.

This utterance level analysis was achieved by calculating LIWC scores for the nine function word categories for each utterance of the interrogation. These scores were then organized into two complementary sets. The first set considered interrogator-led matching and paired the interrogator's utterance with the suspect's subsequent response (e.g., Interrogator_{Time 1} with Suspect_{Time 1}). The second set considered suspect-led matching and paired each of the suspect's responses with the interrogator's subsequent utterance (e.g., Suspect_{Time 1} with Interrogator_{Time 2}). For both of these sets, we then used the algorithm above to calculate a Language Style Matching score for each utterance pair, and we averaged across the pairs to derive an aggregate utterance level Language Style Matching score. The result of this procedure is two Language Style Matching scores for each transcript; one measuring the extent to which the suspect matched the interrogator's language, and the second measuring the extent to which the interrogator matched the suspect's language.

Although this approach offers a useful and fine-grained analysis of the degree of Language Style Matching across an interaction, it is subject to two limitations. First, the focus on utterances restricts the number of words examined in any one calculation of Language Style Matching, which may lead to low and highly variable individual scores (Gonzales et al., 2010). In our analysis we seek to minimize the impact of this issue by focusing on aggregated turn-by-turn scores, except for within our final sequence regression analysis, where the existence of high variability serves only to make it harder (i.e., more conservative) for us to observe significant differences across interrogation outcome. Second, the focus on immediate matching overlooks the possible impact of delayed matching, where word matching occurs across utterances beyond the immediately preceding one. While it is impossible to rule out the potential for lag turn-by-turn Language Style Matching, research on other aspects of verbal mimicry (e.g., semantic matching) suggests that the largest proportion of a matching effect occurs for adjacent utterances (Branigan, Pickering, Stewart, & McLean, 2000). In line with previous research (Taylor & Thomas, 2008), we therefore restrict our focus to immediate turn-by-turn matching.

Internal consistency of the Language Style Matching measures. We assessed the internal consistency of the Language Style Matching measures by examining the extent to which the nine function word categories produced similar scores. Specifically, in separate analyses, the interaction-level and utterance-level scores for the nine function word categories were submitted to a reliability analysis using Cronbach's α . There was good internal consistency at the interaction level for interrogator ($\alpha = .79$) and suspect ($\alpha = .77$), and at the turn-by-turn level metric for both interrogator ($\alpha = .87$) and suspect ($\alpha = .88$; cf. Ireland & Pennebaker, 2010).

Results

To test our prediction that Language Style Matching would be higher in interactions that result in a confession, we compared the mean Language Style Matching across confession and nonconfession interrogations. The mean Language Style Matching for interrogations in which the suspect confessed was .85 ($SE = .01$; 95% CI [.83 .87]), while the mean for the no confession interrogations was .86 ($SE = .01$; 95% CI [.85 .88]). An independent t test suggested that there was no significant difference in Language Style Matching across interrogations ending with and without a confession, $t(62) = 1.03$, $p = .307$, $d = .20$, 95% CI [-2.7, .81], all reported tests are two-tailed.

To test our prediction that the positive role of language matching may be moderated by the unfolding direction of matching within the interaction, we examined Language Style Matching as a function of the two utterance-level matching scores. Figure 1 presents the mean utterance matching scores as a function of speaker and interaction outcome. A 2 (outcome: confession vs. no confession) \times 2 (lead speaker: interrogator vs. suspect) mixed ANOVA revealed a main effect of speaker, $F(1, 62) = 4.20$, $p = .044$, $d = .66$, 95% CI [.42, .90], that was subsumed by a significant interaction between outcome and lead speaker, $F(1, 62) = 4.58$, $p = .036$, $d = .67$, 95% CI [.43, .91]. As shown in Figure 1, interrogations containing a confession gradually progress toward a state where matching occurs to a greater extent from the suspect to the interrogator's language style than from the interrogator to suspect's style. In interrogations where a confession is not forthcoming, there is no overall difference in the direction of matching between speakers.

We also conducted a 2 (outcome: confession vs. non confession) \times 2 (lead speaker: interrogator vs. suspect) \times 5 (crime type: armed robbery, common assault, fraud, murder, and sexual assault)

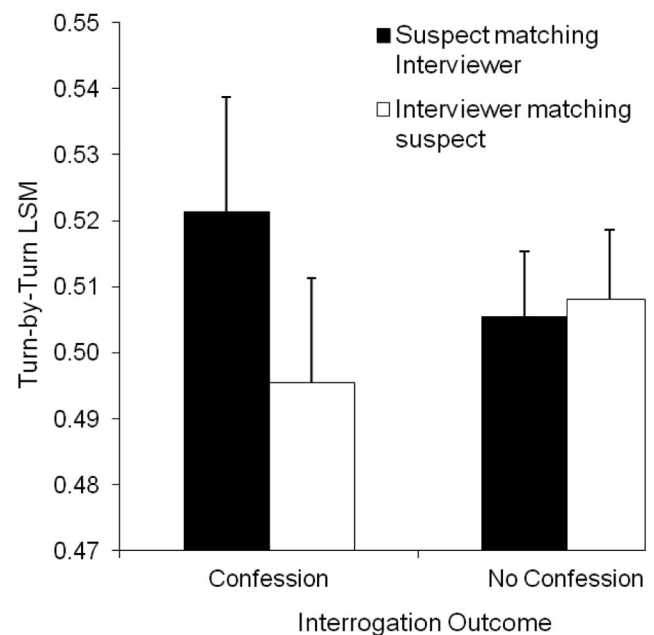


Figure 1. Mean turn-by-turn matching as a function of lead speaker and interrogation outcome. Error bars represent 95% CI.

mixed ANOVA on Language Style Matching. This analysis revealed no significant interaction between crime type and the direction of matching (i.e., lead speaker) and no significant three-way interaction between outcome, lead speaker and crime type (both $F_s < 1$, ns). This analysis should be treated with caution because of the small number of cases associated with some of the crime types.

To further explore the interaction, we examined the utterance level style matching scores at the category level. Table 2 contains these category-specific utterance level scores as a function of outcome and lead speaker, along with F values for the interaction effect that were significant in the aggregated data. As can be seen in Table 2, four of the nine language categories were found to be of particular importance to the observed levels of Language Style Matching. There were significant interaction effects, equivalent to that observed for the overall utterance Language Style Matching analysis, for personal pronouns, $F(1, 62) = 5.41$, $p = .002$, $d = .66$, 95% CI [.37, .89], auxiliary verbs, $F(1, 62) = 5.30$, $p = .025$, $d = .63$, 95% CI [.34, .83], prepositions, $F(1, 62) = 4.94$, $p = .030$, $d = .54$, 95% CI [.30, .78], and quantifiers, $F(1, 62) = 4.29$, $p = .042$, $d = .66$, 95% CI [.42, .90]. In all of these instances, there was greater matching of the interrogators' language use by the suspect in confession than in nonconfession cases.

Our final analysis examined how the difference in Language Style Matching across confession and nonconfession interrogations emerged on an utterance-by-utterance basis as the interaction unfolded. This provides a picture not only of immediate matching but shows how the process of matching unfolds gradually over time. We did this by regressing Time, measured as the number of utterances in each interrogation, onto a difference score that represented the Language Style Matching for suspect matching interrogator minus the Language Style Matching for interrogator interviewer matching suspect. A difference score above .00 indicated that the suspect matched the interrogator to a greater extent, while a score below .00 indicated the interrogator matched the suspect to a greater extent. In computing the regression, we checked the assumption of dependence in error was not violated using Durbin-Watson test (D-W; Savin & White, 1977); in all instances the D-W score was higher than the upper-bounds for the model, indicating the assumption was not violated (Confession D-W = 2.58, Nonconfession D-W = 2.83).

In running this kind of regression there are several ways to handle the differing lengths of each transcript. One approach is to use data from utterances up to and including the average length of the interrogations. Use of the transcripts' average length is appropriate because it represents the optimal point of balance between including data within the analysis and minimizing the bias of the regression line to the data of longer interactions. Figure 2 presents the difference scores for all of the interrogations by outcome, across the first 193 turns of the interrogation ($M_{\text{length}} = 193.1$, $SE = 22.10$). As can be seen in Figure 2, when interactions result in a confession, there was an increasing tendency for suspects to match the language style of the interrogator over time (i.e., a positive difference score), $b = .323$, $t(191) = 4.71$, $p < .001$, $d = .68$, 95% CI [.51, .82]. By contrast, interactions that ended with no confession showed a slight increase in the extent to which the interrogator matched the language style of the suspect, although this was not significant, $b = -.112$, $t(191) = -1.56$, $p = .12$, $d = .23$, 95% CI [-.06, .47]. The slope for the confession interrogations was significantly greater than the slope for the nonconfession interrogations, $t(384) = 3.10$, $p = .002$, $d = .32$, 95% CI [.22, .52], indicating that confession interrogations were characterized by increased matching from the suspect to the interrogator compared with nonconfession interrogations. An equivalent analysis based on all utterances for the entire course of each interrogation across all available data showed the same difference (confession, $b = .013$; nonconfession, $b = -.010$), $t(629) = 3.06$, $p = .002$, $d = .24$, 95% CI [.15, .32].

Discussion

Although much is known about the types of strategies that elicit information and confessions, we know surprisingly little about the basic processes of how language unfolds during an interrogation. Our findings suggest that interrogations are played out, in part, at the basic level of language use through a process whose characteristics are consistent with theories of communication accommodation (e.g., CAT). In line with studies in other domains (e.g., Taylor & Thomas, 2008), we found significant differences in the degree to which interrogators and suspects coordinated their language use, and we found that these differences were related to interrogation outcome. However, unlike in previous studies where

Table 2
LSM for the Nine Function Word Categories as a Function of Interrogation Outcome and Lead Speaker

Category	Confession		No confession		$F_{\text{Interaction}}(\eta^2)$
	Interrogator led	Suspect led	Interrogator led	Suspect led	
Adverbs	.093	.085	.105	.104	.178 (0.17)
Article	5.10*	5.42*	4.60	5.43*	1.47 (0.02)
Auxiliary verb	12.10*	10.94*	10.20*	9.23	5.30* (.092)
Conjunctions	6.24*	7.23*	5.99	7.22*	.592 (.006)
Indefinite pronouns	6.80	7.83*	7.12*	7.71*	.648 (.001)
Negations	4.27*	1.77	4.80*	2.20	0.74 (.001)
Personal Pronouns	15.44*	14.10*	16.97*	16.00*	5.41* (.087)
Preposition	15.90*	11.42*	10.67	11.68	2.409* (0.69)
Quantifiers	1.91	1.75	1.74	1.70	3.08* (.049)

* $p < .05$, two-tailed.

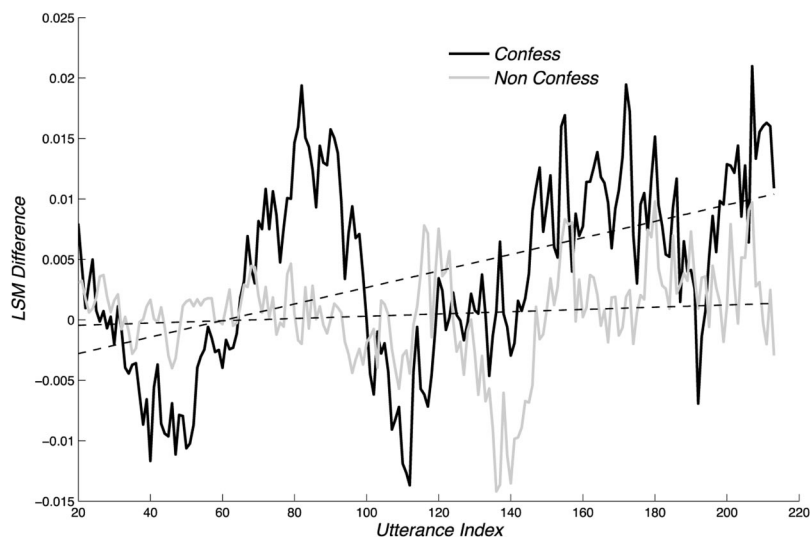


Figure 2. Turn-by-turn Language Style Matching difference scores as a function of interrogation outcome. Positive values indicate a suspect matching the interrogators' language style. Negative values indicate an interrogator matching a suspects' language style. As recommended by Wei (1994), adjacent data points on the Figure were smoothed using 5-utterance moving averages. The analyses reported in the text were conducted on the scores for nonsmoothed data.

absolute levels of Language Style Matching have been linked to interaction outcome (e.g., Gonzales et al., 2010), we found outcome to be contingent on the direction of matching between interrogator and suspect. Confessions were associated with increased matching of the interrogator's language style by the suspect, while nonconfessions were associated with similar levels of matching from both interrogator and suspect. This suggests that "who matches who" plays a critical role in determining whether or not a confession emerges within interrogation.

Our category based analysis showed that four types of matching were particularly responsible for the difference observed across confession and nonconfession interrogations. Compared with suspects who did not confess, those who confessed tended to match interrogators in two ways: in terms of their specificity in describing issues, as achieved through auxiliary verbs (e.g., 'ought,' 'should'), prepositions (e.g., 'among,' 'beneath') and quantifiers ('many,' 'few'), and in terms of their point of reference, as suggested by the fact that he or she adopted similar use of personal pronoun use (e.g., 'I,' 'we'). This was supported by the fact that, in confession interrogations, interrogators used these linguistic categories more compared with nonconfession interrogations, suggesting it may be possible that the interrogator was encouraging an increase in this type of language from the suspect. Increased matching on these categories is consistent with the idea that the suspect is accommodating to the 'world-view' of the interrogator, such that they are beginning to accept their version of the offense story before actually confessing to the offense. Of course, we cannot rule out the possibility that, in some instances, the police officer may be interviewing a person who they believe to be innocent (at least at the outset). However, the impact of such cases on our analysis would be to reduce the differences observed across outcome, because nonconfession interrogations would be expected to show higher levels of Language Style Matching.

This finding presents an interesting development for research on Language Style Matching (Niederhoffer & Pennebaker, 2002) because it suggests that confessions are predicted, not by differences in the degree to which people matched one another's dialogue, but by the type of conversational engagement. Language characterized by an increased amount of auxiliary verbs and prepositions signifies numerous references to concrete and impersonal objects or events (Pennebaker & King, 1999). This is consistent with Taylor and Thomas' (2008) finding that it was the type of negotiator engagement that determined the outcome of hostage crises. Conversational dominance captures the dynamic in which one negotiator makes concrete arguments that the other cannot answer, thereby diminishing the confidence or credibility of the perpetrator (Loewenstein, Morris, Chakravarti, Thompson, & Koppelman, 2005).

Our sequence analysis provided insights into how Language Style Matching emerges over the course of an interaction. The analysis showed the juxtaposition between a set of local-level fluctuations in the matching of style, and a macrolevel alignment that emerges from this local process. The pattern of matching was consistent with Communication Accommodation Theory and Interaction Alignment Theory. It is also consistent with research on linguistic priming that observes a strong tendency for one speaker to recreate the structural content of another speaker (Pickering & Garrod, 2004). Specifically, hearing another speaker use a certain linguistic form activates production of this same linguistic form in another speaker (Branigan et al., 2000). This priming mechanism goes somewhat toward understanding why, in some cases, suspects began to match the interrogator's language style.

The analysis also raises interesting questions about what triggers this change over time and why it occurs in some interrogations but not others. In addressing such a question it is important to avoid searching for individual-level explanations of what triggers

'matching,' because theoretical accounts of this phenomenon make clear it emerges as a result of joint action. It will, however, be useful and important to discover the context in which such a change occurs. For example, it may be the case that these suspects would have confessed but did not do so because the interrogator did not maintain control of how the offense was discussed. It is also possible that interrogators agreed with the suspect's assertion of his or her innocence, and proceeded to accommodate to the suspect's language as a result.

The nature of our analysis means that it is impossible to draw conclusions about a causal relationship between Language Style Matching and confessions. Specifically, while our finding that Language Style Matching diverges before a confession tends to favor an account in which behavioral matching engenders cooperation, which in turn leads to a confession, we cannot rule out that other factors (e.g., evidence strength) had an independent effect on the suspect's behavior or that the opposite dynamic occurred, namely, that a suspect's desire to confess (e.g., because of perceived evidence) led him or her to match the interrogator's language and that the delay in confessing stemmed from the structure of the interrogation (i.e., the suspect was waiting for the opportunity to confess). Our demonstration that the degree of matching increases over time and before the confession favors the former explanation, but it is not possible to rule out the latter possibility completely. To achieve that would require research in which suspects provide cognitive feedback on their thinking at various points in the interview. Such a rich data source will be difficult to derive within real world police interactions because of the evidential nature of what suspects report. It might be more feasible, however, to obtain cognitive feedback from interrogators while reviewing the recorded interrogation where they accommodated the suspects' language.

The above possibilities are illustrations of the broader fact that we did not have access to information about the ground truth of suspects' confessions. Although the low reported instances of false confessions (e.g., 3.9%; Gudjonsson et al., 2004) suggests that this was not the case for the majority of interrogations we analyzed, it is not something that can be ruled out. The absence of this information did not prevent us from testing our hypotheses, because they were about the relationship between language coordination and confession and not about the nature of the confession itself. However, future research with access to ground truth may provide valuable insights into what role verbal mimicry, and Language Style Matching in particular, has in promoting a false confession. One might predict, for example, that vulnerable adults are particularly susceptible to matching (Gnisci & Bakeman, 2007), or that language matching primarily occurs in uncoerced false confessions (Willén & Strömwall, 2012) where the interrogator inadvertently encourages the suspect to confess. Indeed, the link between language coordination and confession identified in this study suggests that this process may be a real candidate for understanding more about how false confessions emerge, but this is not something we can test in the current data.

There are a number of other practical applications of our results and the Language Style Matching measure. Our results suggest that investigators have access to a relatively simple measure for conducting postinterrogation evaluations, where they can use the Language Style Matching measure to identify and reflect on positive and less positive periods of dialogue. Such a measure would

be particularly valuable to interrogator training. Moreover, while the patterns that we describe occurred naturally in dialogue, several studies have suggested it is possible to mimic strategically. For example, waitresses who were instructed to verbally mimic their customers by repeating the orders back verbatim received larger tips than those who were instructed not to mimic (van Baaren et al., 2003). Similarly, negotiators who actively converge on the lexical choices and metaphors of their partner create a sense of unity and increase their inclusion within an agreement (Huffaker, Swaab, & Diermeier, 2011). Such findings suggests that it may be possible for investigators to use aspects of Language Style Matching to refine their implementation of the 'principle of synchrony' proposed in the Cognitive Interview (Milne, 2004). However, more needs to be understood about the nature of this unique interpersonal language layer in police interrogations before any strategic benefits can be put into practice.

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