

8 Lexical Repetition and Syntactic Priming in Dialogue

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There are good reasons to assume that dialogue is the most natural or basic form of language use. For instance, children acquire language through dialogue, and all normal adult speakers can take part in a dialogue. In contrast, the production and comprehension of monologue is much harder and is far from being a universal skill. Dialogue is of course used in a range of very different situations and in very different ways. For example, it is used in casual conversation and for very clear purposes (e.g., asking for information, negotiating deals), in different settings (e.g., face to face or by telephone), and can be formal (e.g., in interviews or interactions between shop assistants and customers) or informal. Thus types of dialogue differ from each other to a great extent, perhaps as much as dialogue differs from monologue.

However, a striking fact about experimental psycholinguistics is that research on any type of dialogue has been very limited in comparison with research on monologue, as Clark (1992) in particular has pointed out. Typical experimental methods explore language use by investigating how a single speaker produces or comprehends isolated words and sentences. Thus they have investigated language use as an individual process. One reason for this may be that in experiments it is easier to control the variables of interest. In contrast, in a dialogue there are many other variables that may have an impact on how language is produced: when turn taking should take place, how much shared knowledge there is between the listener and speaker, the use of interruptions and gestures, and so on (Clark 1996; Clark and Marshall 1981; Horton and Keysar 1996). However, it is possible to devise experimental methods for studying language use in dialogue under controlled circumstances. In this chapter, we will describe one such method, which we call *confederate scripting* (cf. Branigan, Pickering, and Cleland 2000). We show how this method can be used to study syntactic processing in dialogue, and then outline a number of studies that we have conducted using this method.

Dialogue is intrinsically an interactive process, a joint action that emerges when speakers and listeners perform their individual actions in coordination (Clark 1996). Many studies have demonstrated that dialogue should not be regarded as the sum of two monologues, and that language processing in dialogue cannot be explained in terms of the actions of two autonomous cognitive systems. Both production and comprehension in dialogue are sensitive to the communicative context and in particular to the behavior of other participants. For example, the way speakers describe objects depends in part on their assumptions about their listeners' knowledge (e.g., Fussell and Krauss 1992; Isaacs and Clark 1987). Equally, comprehension in dialogue is a far from passive process: listeners' comprehension is seriously impaired when they are unable to interact with the speaker (Schober and Clark 1989). It should be clear that any account of language processing that relies solely on evidence from experiments in monologue will be inadequate to account for dialogue. Instead, any complete account of language processing must be based at least in part on evidence from research on dialogue.

In this chapter, we explore syntactic processing in dialogue, and specifically the way speakers construct syntactic structure. We are particularly concerned with the interplay between lexical and syntactic processing. To do this, we exploit one of the most striking and pervasive aspects of naturalistic language production: its repetitiveness. We argue that this repetitiveness is tied in with the fact that interlocutors tend to become aligned during dialogue—if interlocutors come to understand each other, they must develop representations that are very similar in ways that are central to the dialogue. For example, if two people are discussing a particular topic, they can only understand each other if much of their knowledge of that topic is shared. This partly means that they will share knowledge of the "facts" being discussed, but also means, for instance, that they will generally use similar language to refer to the topic (e.g., referring expressions).

Of course, both monologue and dialogue can be repetitive, but repetitiveness is particularly apparent in dialogue, as demonstrated by both corpus studies (e.g., Aijmer 1996; Schenkein 1980; Tannen 1989; Weiner and Labov 1983) and experiments (Brennan and Clark 1996; Garrod and Anderson 1987; Garrod and Doherty 1994; Levelt and Kelter 1982; Wilkes-Gibbs and Clark 1992). One aspect of linguistic repetition is the tendency for individual speakers to repeat particular words, phrases, or semantic structures. As an example, Garrod and Anderson (1987) found a tendency for speakers describing mazes to reuse particular types of description—for instance in terms of paths between nodes or as row-column indices. In addition to such within-speaker repetition, there is also substantial evidence of between-speaker repetition in dialogue. In particular, speakers seem to converge on common patterns of linguistic

behavior through the course of a dialogue. For example, just as individual speakers tend to repeatedly use the same type of descriptions in maze descriptions, pairs of speakers gradually converge on the same descriptions.

Experimental demonstrations of these convergence effects have focused on semantic and lexical alignment (Brennan and Clark 1996; Clark and Schaefer 1989; Clark and Wilkes-Gibbs 1986; Garrod and Anderson 1987; Garrod and Clark 1993; Garrod and Doherty 1994; Schober and Clark 1989). These studies have been particularly interested in alignment with respect to the repetition of referring expressions. Brennan and Clark (1996) showed that speakers come to use the same term to refer to the same object. For instance, a shoe might come to be commonly described by one pair of speakers as a *pennyloafer*, whereas another pair of speakers will end up calling it a *dock-sider*. Garrod and Anderson (1987) showed that speakers tend to converge on common interpretations for a particular word. For example, in the context of a maze, pairs of speakers came to use the word *square* in the same way, to mean either an individual node or a configuration of multiple nodes.

Garrod and Anderson (1987) explained such convergence in terms of a principle that they called *input-output coordination*. Essentially, they argued that there are functional benefits to be gained from speakers reusing the principles of interpretation that were required to interpret the most recent input, whenever they formulate an utterance. This minimizes computational load, by reducing the number of decisions that must be made from scratch. In more mechanistic terms, both within- and between-speaker lexical repetition can be interpreted as a lexical priming effect (Scarborough, Cortese, and Scarborough 1977). Prior access of a particular lexical item raises its activation; residual activation from this initial activation then facilitates subsequent access, raising the probability of its use in subsequent production. The same type of account could explain semantic repetition effects.

Although most research has concentrated on lexical, and to a lesser extent, semantic repetition, there is also good evidence that speakers in dialogue repeat syntactic structure. Corpus studies noted an apparent tendency for the repetition of syntax (Schenkein 1980; Tannen 1989), and Levelt and Kelter (1982) presented an experimental demonstration of syntactic convergence in question-answer pairs. We would expect syntactic repetition in dialogue as well, because there is good evidence that it occurs in monologue. Under the guise of a memory test, Bock (1986) had speakers alternate between repeating prime sentences and describing semantically unrelated target pictures. She manipulated the syntactic forms of the sentences that speakers repeated. For example, the prime sentence might use the *prepositional-object (PO)* form of an alternating dative verb in one condition (e.g., *A rock star sold some cocaine to an undercover*

agent) and the *double-object* (DO) form in the other condition (e.g., *A rock star sold an undercover agent some cocaine*). The target pictures could be described using either form. Participants tended to produce a PO target-picture description after a PO prime, a DO target-picture description after a DO prime, and so on. Bock also found similar effects for active/passive sentences. In other studies, Bock and colleagues provided good evidence that the effects were truly syntactic and could not be entirely explained at other levels of syntactic structure (Bock 1989; Bock and Loebell 1990). There are many other demonstrations of syntactic priming in monologue, using different paradigms, different constructions, and different languages (Hartsuiker and Westenberg 2000; Pickering and Branigan 1998). Potter and Lombardi (1998) found priming between comprehension and production in a monologue context. These experiments therefore suggest that syntactic repetition is at least partly due to priming of representations and processes associated with syntactic rules that underlie language production (see Pickering and Branigan 1999 for a review). It therefore seems likely that the corpus evidence for syntactic repetition in dialogue is likely to hold in experimental contexts.

More recently, Branigan, Pickering, and Cleland (2000) provided an explicit experimental demonstration of syntactic repetition in dialogue. Using a confederate-scripted method (described in more detail below), they asked pairs of participants (a subject and a confederate) to take turns describing pictures to each other, including ditransitive events. Branigan and colleagues found that subjects tended to produce descriptions that had the same syntactic structure as that of an immediately prior description. For example, after hearing a *Prepositional-Object* (PO) description like *the chef giving the cake to the swimmer*, subjects tended to produce another PO description for an immediately subsequent picture (e.g., *the nun handing the apple to the doctor*). Conversely, after hearing a *Double-Object* (DO) description like *the chef giving the swimmer the cake*, subjects tended to produce another DO description (e.g., *the nun handing the doctor the apple*). Of particular interest for the current chapter was the finding that, although such syntactic alignment occurred in the absence of any open-class lexical overlap, it was considerably enhanced when both the prime and target cards involved the same verb (e.g., *the chef giving the cake to the swimmer* and *the nun giving the apple to the doctor*). In such cases, speakers produced 55 percent more syntactically aligned than nonaligned descriptions, compared to 26 percent when the prime and target cards involved different verbs. The effects of manipulating verb repetition were comparable to the effects reported by Pickering and Branigan (1998) for isolated sentence production (though the overall magnitude of priming is much larger in dialogue).

This finding is striking in that it suggests some interaction between syntactic and lexical levels of processing. It raises the question of whether the prevalence of repeti-

tion effects in dialogue at different levels of structure might reflect not only residual activation of representations at each of those levels, but also interactions between different levels. In particular, interaction between lexical and syntactic processing might explain why syntactic repetition effects have been noted in corpus studies (there is presumably much lexical repetition in corpora).

Unlike experimental studies of monologic production, where great care is taken to exclude lexical and semantic relationships between adjacent utterances, dialogue inherently involves the repeated use of particular lexical and semantic representations. This is not simply because those representations are primed: more fundamentally, topics of conversation in normal dialogue are introduced and maintained across a number of turns. Hence the same concepts (and labels for those concepts) occur repeatedly across utterances. A dialogue in which each speaker introduced a new (unrelated) topic of conversation in each utterance would be unnatural and incoherent in the extreme. Thus lexical and semantic repetition arises naturally in dialogue.

What are the consequences for syntactic repetition? Dialogue does not intrinsically require the repetition of syntactic structure: the maintenance of particular topics of conversation does not in itself need the reuse of particular sentence forms, because it is normally possible to convey a particular message using more than one sentence form. In that case, one might expect syntactic repetition in dialogue to be less prevalent than corpus evidence suggests. Certainly, it would be difficult to explain why syntactic priming appears stronger in dialogue than in monologue (Branigan, Pickering, and Cleland 2000).

However, syntactic repetition is likely to occur in dialogue at least in part for the same reasons that it occurs in monologue—because particular syntactic representations are primed. But if lexical and syntactic processing interact, syntactic repetition might be enhanced in natural dialogue. Syntactic repetition might be highly prevalent both because syntactic structures can be primed by prior use, and because the particular lexical items that appear in those structures also occur repeatedly (through topic maintenance and lexical priming), resulting in an enhanced syntactic repetition effect.

As we have noted, Branigan, Pickering, and Cleland (2000) found some evidence for enhanced syntactic repetition between sentences where the verb was repeated. Because the topic was not maintained between sentences, the effect can be localized to a specific effect of lexical repetition on syntactic repetition. There was no evidence concerning repetition of nouns, perhaps a more likely source of lexical repetition in dialogue, because topic maintenance normally involves talking about the same entities and not talking about the same actions. This was the focus of a series of studies reported fully in Pickering, McLean, and Branigan 2002. The studies examined whether

repetition of noun-phrase arguments influenced the repetition of syntactic structure. All of the experiments used the same experimental technique, the confederate-scripted dialogue (Branigan, Pickering, and Cleland 2000). We begin by giving a full account of the method.

Confederate-Scripted Dialogue Technique

The confederate-scripted dialogue technique employs a picture-matching task, in which two participants alternate in describing pictures to their partner and finding cards from the set on the table that match their partner's descriptions. One of the participants is a confederate of the experimenter and reads picture descriptions from a script. The other participant is a naive subject. Throughout the experiment, the experimenter and the confederate act as if the confederate is a genuine subject and the subject believes that they are taking part in a genuine dialogue. We are interested in whether the subject is influenced in syntactic structure by the structure used by the confederate.

Figure 8.1 shows the experimental setup. In the experimental room the confederate and subject sit on opposite sides of a table with a divider between them. Throughout the experiment they cannot see each other. On each side of the table, there are two boxes and an array of piles of cards. One box contains a set of cards that are to be described to the other participant (description set) and the other box is for cards that have been selected. The cards on the table include the cards that are to be selected. The verb is written on the bottom of all the cards and the cards are stacked in piles alphabetically by verb. There is also one distractor card per verb pile. These are included to ensure that the subject has to look carefully at all the cards before they identify the prime card.

To begin the experiment, the confederate takes the first card from their box to be described (the confederate's description set). They read from a script a sentence that is appropriate for the card. For example, for the card in figure 8.1 this could be a PO sentence (e.g., *the chef giving the jug to the swimmer*), or a DO sentence (e.g., *the chef giving the swimmer the jug*).¹ Once they have described the card, they place it at the back of the box. The subject hears the description and turns to the array of cards on their table. Because this card uses the verb *give*, they turn to the *give* pile and select the card that matches the description. Once they find the card, they put the card in the empty box for selected cards. It is then the subject's turn to describe a card. They select the first card in their "to be described" box (the subject's description set), look at the picture and the verb, and produce a sentence to describe the card. The confederate finds the

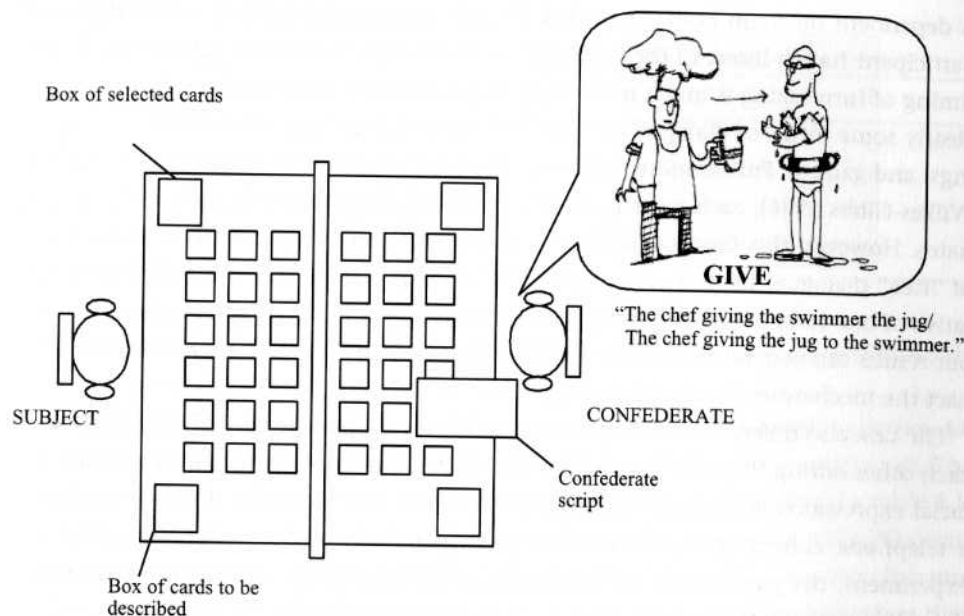


Figure 8.1

An overhead diagram of the confederate-scripted dialogue technique.

card and places it in their selection box. The confederate then describes their next card. The experiment continues until all the cards had been described. The cards are arranged so that the confederate always produces a prime card before the subject produces a target card. The experimenter instructs the subject and the confederate that the experiment investigates how well people communicate when they cannot see each other. They are told that they can say their descriptions and "Please repeat," to request repetition of a description, but nothing else.

Most of our studies have investigated the dative alternation, involving verbs like *give*. The first response the subject produces is coded as PO (if the patient of the action immediately follows the verb and is followed by the preposition *to* and the beneficiary); as DO (if the beneficiary immediately follows the verb and is followed by the patient); or Other (other response).

We believe the task mirrors natural dialogue in a number of ways. It involves a picture-matching game in which participants have to gain information from one another to attain a goal. This means that the task is interactive. It is a joint activity in which the participants take turns being the speaker and the listener and the result

is dependent on them both doing this. Thus it incorporates turn taking so that each participant has to listen to the “speaker” in order that the correct card is found. The timing of turn taking is much more fixed than in most (casual) conversations (though clearly some forms of dialogue involve rigid turn taking—e.g., some interviews, meetings, and games). Furthermore, unlike many other studies of dialogue (e.g., Clark and Wilkes-Gibbs 1986), each participant has an equally important role and neither dominates. However, this form of dialogue is manifestly more restrictive than many forms of “free” dialogue, such as casual conversation. Our view is that this task is representative of one form of comparatively structured dialogue. It is an open question whether our results can generalize to other forms of dialogue, and whether such differences impact the mechanisms underlying alignment.

The task also differs from many natural dialogues in that the participants cannot see each other during the task. This means that they are not able to take into account any facial expressions or gestures that a participant may use. However, it is very similar to a telephone conversation, where each participant uses auditory cues alone. In our experiment, the participants are copresent in the same room so they can hear when the other participant places the card in the selected card box.

In an initial experiment (experiment 1), Pickering, McLean, and Branigan (2002) used the confederate-scripted technique to examine whether priming was enhanced by repetition of all three noun phrases in the prime and target. Participants described to each other sets of cards that included cards depicting ditransitive actions involving an agent, a patient, and a beneficiary. The cards involved a variety of verbs (e.g., *give*, *show*). Other cards depicted transitive actions and these were included as fillers. For all the cards, the appropriate verb was printed below each picture. So this experiment (like the others discussed here) was similar to the experiment reported by Branigan, Pickering, and Cleland (2000) except that repetition of noun-phrase arguments rather than verbs was manipulated.

Prime-target pairs were created by pairing ditransitive cards from the confederate’s description set (prime card) and ditransitive cards from the subject’s description set (target card). The identity of the depicted entities was manipulated so that they were either all the same on the prime and target cards, or all differed. The verb always differed between prime and target. Each target was paired with the four different prime conditions: PO all entities the same (PO-same), DO all entities the same (DO-same), PO all entities different (PO-diff), DO all entities different (DO-diff). The prime conditions were assigned in a Latin square. In each script, half the primes were assigned PO descriptions, and half were assigned DO descriptions. To analyze the results, only the proportions of PO target responses were calculated because there were very few Other

Table 8.1
Mean proportion of PO target responses for experiment 1

Prime description	Mean PO target response
PO-same	.94
DO-same	.18
PO-diff	.80
DO-diff	.43

sentences produced. Therefore, the proportion of DO target responses is approximately $1 - (\text{proportion of PO target responses})$.

Pickering, McLean, and Branigan (2002) found that having overlapping entities did affect the sentence structure that the subjects used to describe their target card. The proportions of PO target responses for each prime condition are shown in table 8.1. This table shows that subjects produced more PO target descriptions after the PO prime conditions than the DO prime conditions (87 versus 31 percent). However, the proportion of PO targets was higher when the entities remained the same than when they were all different. The different-entities part of this experiment provides a replication of Branigan and colleagues’ (2000) findings. The same-entities part involves no repetition of the verb, but there is a great deal of lexical repetition overall, because all three nouns are repeated.

In combination with the findings of Branigan and associates (2000), the results suggest open-class lexical repetition tends to increase syntactic repetition. Obviously, the repetition of verbs and the repetition of noun-phrase arguments only constitute two possible types of open-class lexical repetition, but the results lend support to a general class of account in which repetition at one linguistic level leads to increased priming at an associated level (Pickering and Garrod, in press). However, Cleland and Pickering (2003) report three experiments concerned with the repetition of noun-phrase structure using the confederate-scripting technique. In these experiments, subjects produced descriptions like *the red sheep* or *the sheep that’s red*. Subjects produced the relative-clause construction after a relative-clause prime (e.g., *the book that’s red*), whereas they almost never produced it after a simple noun-phrase prime (e.g., *the red book*). Most interestingly, however, the tendency to repeat syntactic structure was enhanced if the head noun was repeated between prime and target (e.g., *the sheep that’s red*), or even if the prime and target were only semantically related (e.g., *the goat that’s red*). These results allow us to conclude that priming is enhanced by repetition of verbal and nominal heads, and nominal arguments.

Table 8.2

Mean proportion of PO target responses for experiments 2 and 3

Prime description		Mean PO target response
Experiment 2	PO	.83
	DO	.70
	PO-for	.67
	HA	.69
	INT	.72
Experiment 3 (all entities repeated)	PO	.95
	DO	.15
	PO-for	.91
	INT	.70

Two further experiments explored prepositional object sentences in which the preposition was *for* instead of *to* (e.g., *the witch making the sandwich for the knight*). Bock (1989) found priming between *to* and *for* PO structures, which suggests that different closed-class words in the prepositional phrase do not affect priming. Pickering, McLean, and Branigan (2002) decided to investigate whether this result could be replicated using the confederate-scripted dialogue technique.

In the first closed-class experiment (experiment 2), none of the entities between the prime and target were repeated. Thus the experiment was similar to Bock 1989. This experiment also included a high-attached (HA) prime condition (e.g., *the skier hitting the juggler in the forest*). This sentence has the same constituent order as the PO condition but a different syntactic structure, in that the prepositional phrase is an adjunct rather than an argument. An intransitive (INT), baseline condition (e.g., *the witch crying*) was also included because this would give an indication of the number of PO sentences that subjects produced without priming, and hence we would be able to gauge the amount of priming each condition elicited. Thus in this experiment there were five prime conditions (PO-to, DO, PO-for, HA, and INT).

The proportions of PO target responses are shown in table 8.2. Pickering and colleagues found that the PO-for prime structure did not prime a PO-to target structure. Subjects produced fewer PO-to target responses after a PO-for prime than after a PO-to prime. Furthermore, the proportion of PO target responses for the PO-for condition was no different than those after the intransitive condition. The HA prime condition was also no different from the baseline. This result was in contrast to Bock's (1989) study and suggested that priming is only found if exactly the same structure is used in the prime and the target and if the same closed-class items are used, when open-class words differed. However, the effects in general were fairly small.

In the second closed-class experiment (experiment 3), all the entities between the prime and target overlapped. In this experiment the high-attached condition was not included because this prime condition was not part of this research. Thus, there were four prime conditions (PO-to, DO, PO-for, and INT). Across the pairings, the prime and target card involved the same three entities (agent, patient, beneficiary), though obviously the intransitive only contained one entity (the agent). In all the pairings, the prime and target cards had different verbs to describe the action taking place.

The proportions of PO target responses for each prime condition are shown in table 8.2. Pickering, McLean, and Branigan (2002) found that when the entities overlapped between prime and target, there was priming between PO-to and PO-for structures. Thus when there are overlapping entities between the prime and target, the proportions of PO target responses after PO-to prime and PO-for prime are very similar. The PO-for prime was also different from the intransitive prime condition. This suggests that PO-for structures do prime as strongly as PO-to structures when all the entities overlap. In addition, the level of priming after the PO-to prime with all entities overlapping was similar to those found in the first experiment.

A series of experiments also investigated low-attached sentences that use the preposition *to*, as a prime condition (e.g., *the witch burning the letter to the princess (LA-to)*), where the prepositional phrase modifies the noun (here, *letter*) rather than the verb (*burning*). These sentences have the same constituent order but vary in syntactic structure. Three experiments were conducted that investigated whether it was possible to prime ditransitive sentences using a low-attached sentence structure and whether any particular phrase within the sentence was essential for priming.

In the first low-attached experiment (experiment 4), there were four prime conditions (PO-to, DO, LA-to, and INT). Across the pairings, the prime and target card involved the same three entities (agent, patient, beneficiary). For the low-attached pairings, the agent and the patient were the same, but the beneficiary was not present in the picture. The beneficiary was indicated by their name printed in an entity occurring in the picture (e.g., *for the witch burning the letter to the princess*, the letter was addressed to the princess). In the intransitive prime-target pairing only the subject was the same. In all the pairings, the prime and target cards had different verbs to describe the action taking place.

Pickering, McLean, and Branigan (2002) report that when all the entities between the prime and target overlap, the level of priming is the same for the PO and LA-to prime conditions. The proportions of PO target responses for each prime condition are shown in table 8.3. The LA-to prime was also different from the intransitive prime condition. This suggests that LA-to structures prime as strongly as PO-to

