CROSSLINGUISTIC STRUCTURAL PRIMING AS A MECHANISM OF CONTACT-INDUCED LANGUAGE CHANGE: EVIDENCE FROM PAPIAMENTO-DUTCH BILINGUALS IN ARUBA AND THE NETHERLANDS

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Studies on language contact suggest that cross-language interactions in individual language use may lead to contact-induced change at the community level. We propose that the phenomenon of crosslinguistic structural priming may well drive this process. We investigated this by focusing on dative sentence production by Papiamento speakers in Aruba and in the Netherlands. In experiment 1, Papiamento speakers in Aruba and in the Netherlands described dative events. The speakers in the Netherlands produced more Dutch-like structures than the speakers in Aruba, especially younger speakers. In experiment 2, speakers from the same populations heard a Dutch prime sentence before describing a dative event in Papiamento. Syntactic choices were influenced by the Dutch prime sentences, and, again, especially younger speakers in the Netherlands produced more Dutch-like dative structures. This combination of results suggests that Papiamento syntactic preferences in the Netherlands are changing as a function of contact with Dutch, and that crosslinguistic structural priming is a likely mechanism underlying this change.*

Keywords: crosslinguistic priming, structural priming, contact-induced language change, bilingualism, dative alternation

1. Introduction. When multiple languages are spoken in the same situation and/or by the same people, this can lead to interaction between these languages, also called language contact. Language contact can be divided into 'synchronic' processes, like cross-language effects in bilingual language processing (e.g. de Groot 2011, Kroll et al. 2012, Schwieter 2015) and code-switching (e.g. Bullock & Toribio 2009, Isurin et al. 2009, Muysken 2000, Myers-Scotton 2002), and 'diachronic' processes, like contact-induced language change (e.g. Heine & Kuteva 2005, Hickey 2010, Matras 2009, Sankoff 2002, Thomason 2001, Thomason & Kaufman 1988, Winford 2003). An intuitively plausible hypothesis is that synchronic processes of language contact in individuals provide the basis from which diachronic outcomes of language contact emerge (Weinreich 1953; see also Backus 2015, Fernández et al. 2017, Hartsuiker 2013, Kootstra & Doedens 2016, Loebell & Bock 2003, Muysken 2013, Torres Cacoullos & Travis 2010).

But how can this transition from synchronic process to diachronic change take place? One mechanism that may play a role here is crosslinguistic structural priming. Structural priming refers to the much-observed phenomenon whereby language users reuse sentence structures that they have just heard or produced (see e.g. Pickering & Ferreira 2008 for a review; see Dell & Ferreira 2016 for recent discussion). Crosslinguistic structural priming is what happens when this takes place between languages in bilingual interaction. Many studies, both experimental and corpus-based, have provided evidence of crosslinguistic structural priming, not only with short-term effects but also with long-term effects (see e.g. Gries & Kootstra 2017, Hartsuiker & Bernolet 2017, Hartsuiker & Pickering 2008, van Gompel & Arai 2018 for reviews). Given its role as a factor driving both short-term and long-term linguistic choices in bilingual discourse, we hypothesize that crosslinguistic priming is a mechanism of how cross-language ac-

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tivation in the bilingual mind is transmitted between utterances in bilingual discourse, which may, in the long run, lead to contact-induced language change.

We investigate the hypothesis of crosslinguistic structural priming as a potential mechanism of language change by examining syntactic choices by Papiamento-Dutch bilinguals in Aruba and in the Netherlands. Compared to Papiamento speakers in Aruba, Papiamento-Dutch bilinguals in the Netherlands are intensively exposed to Dutch and use this language regularly, so it is likely that the Papiamento spoken in the Netherlands is influenced by Dutch. Based on a baseline and a priming experiment, we investigated (i) to what extent syntactic preferences in Papiamento dative sentences differ between speakers in Aruba and speakers in the Netherlands, and (ii) whether this can be explained by crosslinguistic structural priming from Dutch to Papiamento.

We first discuss the literature on crosslinguistic structural priming (§1.1) and how it may lead to contact-induced language change (§1.2). We subsequently discuss our research questions and hypotheses in §1.3. The method and design of the study are presented in §2, and experiment 1 (baseline experiment) and experiment 2 (priming experiment) are presented in §3 and §4, respectively. We conclude with a general discussion (§5).

1.1. STRUCTURAL PRIMING: MORE THAN AN EXPERIMENTAL TOOL. Structural priming offers key insights into many aspects of language use and language learning. It has, for example, been used as an experimental method to measure the representational nature of language production, based on the idea that when information is primable, it represents an existing level of processing (see Branigan & Pickering 2017 for an overview). For example, Bock (1989) and Bock and Loebell (1990), following up on the classic study by Bock (1986), found that structural priming occurs in the absence of thematic, lexical, phonological, and prosodic overlap between the prime and target, thus indicating that syntax is an independent level of representation in language production. Later studies have shown that, even though structural priming operates independently from lexical priming, structural priming effects are boosted by lexical overlap between the prime and target (the lexical boost effect; e.g. Cleland & Pickering 2003, Pickering & Branigan 1998; see Mahowald et al. 2016 for a meta-analysis). These findings indicate that lexical and syntactic representations are connected in the minds of language users (cf. Pickering & Branigan 1998).

Structural priming is also used as a technique to tap into the representational nature of BILINGUAL language processing. An important question in the field of bilingual processing is at which levels of processing bilingual speakers are influenced by the languages they speak (cross-language activation; see e.g. Hartsuiker & Pickering 2008, Kootstra 2015, Kootstra et al. 2009, Kroll et al. 2006, Schwieter 2015). Crosslinguistic structural priming is used to gain insight into this question at the syntactic level: if syntactic information from one language influences syntactic choices in another language, this can only be explained by assuming cross-language activation of syntactic information. Loebell and Bock (2003) were among the first to investigate this. They asked German-English bilinguals to reproduce a dative sentence in a specific language (either German or English) with a double object structure (i.e. Subject-Verb-IndirectObject-DirectObject [‘boy-give-girl-ball’]; henceforth DO structure) or a prepositional object structure (Subject-Verb-DirectObject-Preposition-IndirectObject [‘boy-give-ball-to-girl’]; henceforth PO structure) and then describe a picture representing a dative event in the other language. The sentence indeed primed structural choices in the other language. Similar evidence of structural priming across languages has been found in many other studies with different task varieties, language combinations, and linguistic structures (e.g. Bahtina-

Jantsikene 2013, Bernolet et al. 2007, Cai et al. 2011, Desmet & Declercq 2006, Hartsuiker et al. 2004, Hartsuiker et al. 2016, Jacob et al. 2017, Kantola & van Gompel 2011, Kootstra & Doedens 2016, Schoonbaert et al. 2007). In addition, just as in monolingual studies, it has been found that lexical overlap between the prime and target (i.e. translation equivalents in the prime and target) leads to a boost of the priming effect (Cai et al. 2011, Schoonbaert et al. 2007). These results have informed theories and models on the underlying representations and processing of bilingual language use (e.g. Hartsuiker & Bernolet 2017, Hartsuiker & Pickering 2008, Hartsuiker et al. 2004).

One aspect of crosslinguistic structural priming that has not yet been systematically studied is the question of whether crosslinguistic structural priming also takes place in languages with very strong syntactic preferences. That is, to our knowledge, crosslinguistic priming is typically studied in languages in which the tested structures are indeed existing options in the target language, without a very strong preference for one structure over another. Does crosslinguistic priming also occur when the target language strongly favors one particular syntactic option, thus changing the syntactic preferences of that language? This is a question that we hope to shed more light on in this study.

Importantly, crosslinguistic priming has been found not only in the lab, but also in real-life bilingual discourse (see Gries & Kootstra 2017 for a review). Much work on this has been done by Torres-Cacoullos, Travis, and colleagues (e.g. Torres Cacoullos & Travis 2010, 2016, Travis, Torres Cacoullos, & Kidd 2017). Based on a corpus of natural speech of members of the New Mexican bilingual community, they found that the expression of the Spanish first-person singular subject pronoun (which is variable/optional in Spanish and nearly always obligatory in English) is subject to priming within and across languages: speakers are more likely to use the overt pronoun in Spanish when they have recently used it, either in Spanish or in English. Related corpus-based findings of priming in bilinguals were obtained by Fricke and Kootstra (2016), who analyzed the Bangor-Miami corpus (http://bangortalk.org.uk/) and observed that bilinguals' tendency to code-switch, as well as the grammatical form of code-switched sentences, is subject to priming from the previous discourse.

These corpus-based findings indicate that structural priming is not merely a type of experimentally induced linguistic behavior, but an actual mechanism of linguistic choices in spontaneous discourse. Indeed, structural priming is assumed to have important communicative functions, such as creating mutual intelligibility between conversation partners (interactive alignment; Pickering & Garrod 2004) and facilitating selection and planning processes during language production (e.g. MacDonald 2013, Schober 2006; see also Ferreira & Bock 2006). These functions of structural priming complement well-known theories and hypotheses on language use in social interaction, such as speech accommodation (Giles et al. 1991), audience design (e.g. Brennan & Clark 1996, Brennan & Hanna 2009), and Grice's (1975) cooperative principle. Structural priming can be seen as a cognitive mechanism underlying these social aspects of language use.

In addition to these communicative functions, another assumed function of structural priming is implicit language learning. For example, structural priming has been found to persist over several intervening filler items between prime and target (e.g. Bock & Griffin 2000, Hartsuiker et al. 2008) and even between complete experimental sessions (e.g. Kaschak 2007, Kaschak et al. 2011, Kaschak et al. 2012). Similarly, acceptability judgments for specific constructions have been found to increase with repeated exposure to these constructions (Luka & Barsalou 2005), even when there were several days between exposure and task (Luka & Choi 2012). In addition to these long-term priming findings, the notion of structural priming as a form of experience-driven learning is sup-

ported by so-called 'surprisal' effects in structural priming. Priming effects have been found to be relatively strong when the primes are surprising with respect to what the language user would predict based on his/her prior language experience (e.g. Bernolet & Hartsuiker 2010, Jaeger & Snider 2007, 2013). This implies that language users adapt their production preferences and expectations to the linguistic environment, and thus continuously learn and fine-tune their language; there is necessarily more to adapt to when the linguistic environment deviates from prior linguistic experience, that is, when the linguistic environment is 'surprising' (see also Dell & Chang 2014).

Again, similar findings on the relation between priming and learning have been found in the bilingual literature. Fricke and Kootstra (2016), for example, found that code-switching was primed not only by the directly preceding utterance, but also by language-use patterns in the previous ten sentences. Similarly, in a study in which Dutch-English bilinguals performed two crosslinguistic structural priming tasks in two experimental blocks, Kootstra and Doedens (2016) found that participants' syntactic choices in the first experimental block influenced their syntactic choices in the subsequent block, in which the target language was different from the first experimental block. In addition, within each experimental block, they found gradual changes of syntactic choices as a function of trial number, reflecting cumulative priming of syntactic choice. The idea of priming as a form of adaptation to the linguistic environment in bilinguals has furthermore been tested by Fernández and colleagues (2017). They report two experimental studies in which Portuguese-English and Spanish-English bilinguals process and produce language structures in their L1 that contain innovations from their L2. They found that bilinguals and monolinguals differed in their tolerance toward contact-induced linguistic innovations, and that this tolerance of bilingual innovations was related to results of priming of innovative language use between languages.

The findings discussed above provide clear indications that structural priming is a mechanism driving both communicative efficiency and implicit language learning. Importantly, when such experience-based learning takes place repeatedly and continuously, this can lead to cumulative changes in syntactic preferences, as found by, for example, Kootstra and Doedens (2016) and Kaschak and colleagues (2011, 2012). From this perspective, it follows naturally that language use and language learning are difficult, if not impossible, to tease apart, as is also assumed in usage-based perspectives on language and language change (e.g. Bybee 2010, Croft 2000, The Five Graces Group 2009, Tomasello 2003). The next step is to explore whether these aspects of crosslinguistic structural priming can be linked to the notion of contact-induced language change.

1.2. FROM CROSSLINGUISTIC STRUCTURAL PRIMING TO CONTACT-INDUCED LANGUAGE CHANGE. Based on the findings from the previous section, we hypothesize that crosslinguistic priming may be a mechanism of contact-induced language change. The idea is as follows: when crosslinguistic structural priming takes place continuously in real-life discourse and involves learning, as has been found, it is not unlikely that cumulative structural priming effects from one language to the other lead to subtle changes in the frequencies with which certain structures or constructions are used (see also Fernández et al. 2017, Hartsuiker 2013, Loebell & Bock 2003).

This proposed link between priming and language change has also been noted by researchers in the monolingual domain. For example, Jäger and Rosenbach (2008:85) state that 'priming is the "missing link" in evolutionary models of language change in that it provides for a plausible linguistic replicating mechanism, i.e. an "amplifier" of

linguistic units'. Likewise, Garrod and Pickering (2013) point out that the tendency of interlocutors to copy elements of each other's language use in dialogue (i.e. interactive alignment), which is based on priming between interlocutors, can lead to routinization of linguistic expressions as a long-term effect. Another important result comes from Fraundorf and Jaeger (2016), who found that language users not only adapt their processing preferences to the previous discourse, but also generalize these processing preferences to other structures. This step from adaptation to generalization provides insight into how priming effects can spread and influence processing preferences in general.

Now when such priming takes places across languages, it can be hypothesized that crosslinguistic priming may well serve as a psycholinguistically plausible mechanism capturing the microprocesses of contact-induced language change (cf. Fernández et al. 2017, Hartsuiker 2013, Kootstra & Doedens 2016, Kootstra & Muysken 2017, Loebell & Bock 2003, Muysken 2013). The goal of the present study is to explore whether this is indeed the case.

1.3. THE PRESENT STUDY. We tested the idea of crosslinguistic priming as a potential mechanism of contact-induced language change in the Papiamento spoken by Papiamento-Dutch bilinguals in Aruba and in the Netherlands. Papiamento is a Creole language that is spoken on three Caribbean islands, but also by about 100,000 Antillean immigrants in the Netherlands, with a varied sociolinguistic profile (cf. Jacobs & Muysken 2019). Exposure to and use of Dutch differs considerably between speakers of Papiamento in the Caribbean islands and speakers of Papiamento in the Netherlands. That is, although Dutch is an official language in Aruba and Curaçao (especially in institutional and governmental settings), it plays only a minor role as a language of daily communication and is rarely used by most inhabitants of these islands (Kook & Narain 1993, Kouwenberg & Murray 1994, Vedder & Kook 2001). For the speakers of Papiamento in the Netherlands, however, Dutch plays an important role. Because Dutch is the official language of communication, schools, media, labor, and government in the Netherlands, speakers of Papiamento in the Netherlands are intensively exposed to and regularly use Dutch in their daily lives (Kook & Narain 1993, Vedder & Kook 2001). Given these differences in the use of Dutch versus Papiamento between Aruba/Curaçao and the Netherlands, it may well be that the Papiamento spoken by Papiamento speakers in the Netherlands is influenced by Dutch, thus leading to contact-induced language change in this speech community.

One way in which Dutch could influence Papiamento is in the production of dative sentences. Dutch and Papiamento differ strongly in terms of syntactic preferences in dative constructions. Dutch is quite like English in that dative events can be described using either of two structures: a prepositional object construction, as in example 1, or a double object construction, as in example 2, without an absolute preference for either the PO or DO (cf. Bernolet & Hartsuiker 2010, Colleman 2006, Kootstra & Doedens 2016).

(1) Obi geeft het boek aan Pieter. PO: Subj-Verb-DirObj-Prep-IndObj
'Obi gives the book to Pieter.'

(2) Obi geeft Pieter het boek. DO: Subj-Verb-IndObj-DirObj
'Obi gives Pieter the book.'

In contrast to Dutch, Papiamento as spoken on Aruba and Curaçao has a clear preference for only one structure, namely the DO (Bruyn et al. 1999, Kouwenberg 2013). Thus, the Dutch sentences above would most likely have a DO structure in Papiamento, as in example 3. PO structures, as in example 4, are rarely used.

(3) Obi ta duna Pieter e buki.
Obi ASP give Pieter DET book
'Obi gives Pieter the book.'
(4) Obi ta duna e buki na Pieter.
Obi ASP give DET book PREP Pieter
'Obi gives the book to Pieter.'

Based on these differences between Dutch and Papiamento, we hypothesized that if Dutch syntactic preferences would indeed influence Papiamento syntactic preferences, this should be reflected in (i) a less absolute preference for the DO structure in Papiamento speakers in the Netherlands, compared to Papiamento speakers in Aruba, and (ii) crosslinguistic priming effects from Dutch to Papiamento.

2. METHOD AND DESIGN OF THE STUDY. To investigate the hypotheses, we designed two experiments. Experiment 1 was a baseline task in which Papiamento speakers in Aruba and in the Netherlands described movie clips of ditransitive events in Papiamento, without being primed by Dutch prime sentences. This experiment served to establish the basic syntactic preferences of both groups of speakers when they had to describe these movie clips. If the two groups do not differ in terms of their dative syntactic preferences in Papiamento, there would be no reason to assume that Dutch would have an influence on Papiamento in these structures, to be sure. After establishing the actual use of dative structures in Papiamento, we tested in experiment 2 (with new speakers from the same populations) whether Dutch prime sentences could indeed influence syntactic choice in Papiamento movie-clip descriptions.

The study design meets important requirements for gauging contact-induced language change, as stated by, among others, Poplack and Levey (2010; see also Thomason & Kaufman 1988 for similar points). First and foremost, language change can only be considered contact-induced if it is proven to be contact-induced and not the product of drift (i.e. natural language change as a result of structural imbalances, without an external explanation such as language contact; see e.g. Thomason & Kaufman 1988). We adhered to this point by comparing speakers from a high-contact variety (Papiamento speakers in the Netherlands, who use Dutch regularly in their daily lives) with speakers from a low-contact variety (Papiamento speakers in Aruba, who use Dutch only in formal settings) and by testing syntactic choices in a baseline task (experiment 1) and in a crosslinguistic priming task (experiment 2). The crosslinguistic priming paradigm provides a direct and unequivocal test of cross-language interaction (e.g. Hartsuiker & Pickering 2008). Thus, if we found effects of crosslinguistic priming in experiment 2, this would mean that crosslinguistic influences from Dutch to Papiamento in dative sentence production are possible in principle. Vice versa, if we did not find effects of crosslinguistic priming from Dutch to Papiamento, then it would be difficult to attribute any between-group differences in the baseline task to language contact. A second prerequisite is that it is only possible to speak of change when diffusion of the change has occurred among multiple speakers of the contact variety; if this were not the case, it would only be possible to speak of a mere innovation (see also Backus 2015, Croft 2000). We tackled this by testing multiple speakers of Papiamento (108 in total) and using statistical analyses in which between-group differences are significant only if they are attested relatively consistently among multiple members of the same group (using GEE-modeling; see e.g. Diggle et al. 2002, Snijders & Bosker 2012).

In addition to these central design features, we included several control variables that may influence the likelihood of cross-language interactions, the strength of priming,

and/or the tendency to produce a PO or DO structure (see §3.4 for which variables we included). These control variables were included because syntactic choices can be influenced by many different variables from many different levels (Bresnan et al. 2007). We do not discuss all of these control variables in detail, but in case they significantly influence the results, we discuss how they can be reconciled with the central hypothesis of crosslinguistic priming and contact-induced language change.

3. Experiment 1: unprimed dative sentence production. Experiment 1 focused on unprimed syntactic choices in dative sentence production by Papiamento speakers in Aruba and Papiamento speakers in the Netherlands.

3.1. Participants. The participants were forty-six speakers of Papiamento, of which nineteen resided in Aruba (seven male, twelve female; henceforth 'Aruba-participants') and twenty-seven resided in the Netherlands (twelve male, fifteen female; henceforth 'NL-participants'). None of the Aruba-participants had stayed in the Netherlands for a period of more than three months at any stage of their life. The NL-participants were mostly people who were born in Aruba or Curaçao and had moved to the Netherlands at a later point in their lives.

All participants completed a language-background questionnaire containing factual, behavioral, self-assessment,[1] and attitudinal questions regarding their use of Papiamento and Dutch (see Table 1 for an overview). The NL-participants rated themselves as more proficient in Dutch than the Aruba-participants ($t(44) = -3.56$, $p = 0.001$). They also had more pleasure ($t(44) = -32.48$, $p = 0.017$) and confidence ($t(44) = -34.18$, $p < 0.001$) in speaking Dutch, and found it more important to be able to speak Dutch than the Aruba-participants ($t(44) = -32.87$, $p = 0.006$). These outcomes confirm that Dutch plays a more prominent role in the daily lives of the NL-participants than in the daily lives of the Aruba-participants. Interestingly, the NL-participants gave higher self-ratings on their Papiamento proficiency than the Aruba-participants ($t(44) = -34.28$, $p < 0.001$). This indicates that the NL-participants can be considered proficient speakers of Papiamento. Differences in dative sentence production between the Aruba-participants and the NL-participants are therefore unlikely to arise from a lack of Papiamento proficiency in the speakers from the Netherlands. The two participant groups did not differ significantly on the remaining variables listed in Table 1, including their age of acquisition of Papiamento and Dutch. The reason for this is that until recently, the language of instruction in education in Aruba was Dutch. All Aruba-participants were educated under this Dutch system (even though Papiamento is their primary language of communication in daily life and Dutch does not play a major role in the daily language use of people from Aruba).

3.2. Stimulus materials. The stimuli were sixty-four movie clips of about five seconds each.[2] After playback of a movie clip, a still screen of the movie clip's final frame remained visible on the screen, accompanied by a printed Papiamento verb; see Figure 1 for an example.

[1] Self-rating tests are commonly used as an index of general language proficiency in many L1 and L2 processing studies (cf. Brown 2007).

[2] The stimuli were movie clips that were used with kind permission from Rochester University. We used movie clips instead of the more standard still pictures because the movie clips did well disambiguating the agent from the recipient, captured the action to be described, were visually attractive, and were used in related projects by other colleagues from our team (enabling us to compare outcomes across studies).

	ARUBA-PARTICIPANTS		NL-PARTICIPANTS	
	M	*SD*	*M*	*SD*
Age	32.52	22.34	34.30	13.52
Self-rated Papiamento proficiency *	4.03	0.28	4.54	0.46
Self-rated Dutch proficiency *	3.60	0.74	4.26	0.52
Age of acquisition Papiamento	0.13	0.40	0.30	0.72
Age of acquisition Dutch	5.95	0.52	5.63	2.38
Pleasure in speaking Papiamento	5.00	0.00	4.85	0.46
Confidence in speaking Papiamento	4.95	0.23	4.67	0.68
Importance of speaking Papiamento	4.74	0.56	4.56	0.93
Pleasure in speaking Dutch *	3.32	1.00	4.07	1.04
Confidence in speaking Dutch *	2.95	1.03	4.15	0.91
Importance of speaking Dutch *	3.84	1.42	4.70	0.54
Age of arrival in NL	N/A	N/A	19.11	8.60
Years of residence in NL	N/A	N/A	14.74	14.63

TABLE 1. Characteristics of the participants in experiment 1 (baseline task). Asterisks indicate significant differences between the NL-participants and Aruba-participants.[3]

FIGURE 1. Example of a critical target stimulus in the baseline experiment (experiment 1).

Thirty-two of the movie clips were critical stimuli, representing ditransitive events that could be described using a dative construction (e.g. a woman giving a lamp to a man). The verb accompanying the critical movie clips was always *duna* 'give' (50%) or *mustra* 'show' (50%). The reasons to use only these two verbs in the critical materials were: (i) these verbs are known to be nearly always used with a DO structure in Papiamento (Bruyn et al. 1999, Kouwenberg & Murray 1994), and (ii) it was important to keep the potential influence of verb bias on syntactic choices as low as possible (see e.g. Ferreira 1996, Kootstra & Doedens 2016). The other thirty-two movie clips were fillers, representing transitive and intransitive events. We used seventeen transitive and intransitive verbs in the filler items. The inclusion of the verbs in the movie clips was done to help the participants to produce complete sentences in their descriptions and to ensure that they would indeed use a dative verb in descriptions of the critical movie clips. See Appendix A for a complete list of all movie clips in the critical trials.

[3] The measures Self-rated Papiamento proficiency, Self-rated Dutch proficiency, Pleasure in speaking Papiamento, Confidence in speaking Papiamento, Importance of speaking Papiamento, Pleasure in speaking Dutch, Confidence in speaking Dutch, and Importance of speaking Dutch are based on a five-point scale, where 1 indicates 'very bad/not confident/no pleasure/not important' and 5 indicates 'very good/confident/much pleasure/very important'. The proficiency self-ratings are based on the mean of six subdomain ratings, namely speaking, listening, writing, pronunciation, understanding, and grammar. See also Table 3.

The movie clips were randomized into four lists, in which we made sure that no more than two critical movie clips occurred consecutively. No movie clip was used twice in the same experiment.

3.3. PROCEDURE. Participants were tested individually in a quiet room. They began by completing a language-background questionnaire. They then received instructions for the movie-clip description task (in Dutch; the experimenter was not proficient in Papiamento). The participants were instructed to watch the movie clip and verbally describe it in a complete sentence, using the depicted verb. They were told that there was no right or wrong way of describing the movie clips. After each movie-clip description, the participant had to press a key to start the next movie clip. In order to prevent metalinguistic processing, participants were encouraged to respond quickly.

The experiment started with six practice trials (which were always filler movie clips). The participants then continued with the sixty-four experimental trials. The movie clips were presented on a laptop using E-prime 2.0. Descriptions were recorded and subsequently transcribed by a research assistant who is a native speaker of Papiamento with training in linguistics. The experiment took about thirty minutes.

3.4. SCORING AND ANALYSIS. Critical movie-clip descriptions were scored by the researchers and the Papiamento-speaking research assistant as (1) double object, (2) prepositional object, or (3) 'other'. The 'other' responses were descriptions that were unscorable because no ditransitive construction was used or because of recording failure. The statistical analyses were based on all responses except the 'other' responses.

The dependent variable in the analyses was the likelihood of using a PO structure (i.e. the proportion of PO responses out of all PO and DO responses). As the first essential step in the analyses, we examined whether there were indeed differences between the speakers in Aruba and the speakers in the Netherlands in terms of their syntactic choice preferences. We did this by analyzing whether the dependent variable was influenced by Participant group (Aruba-participants vs. NL-participants). As a second step, and as explained in §2, we analyzed to what extent syntactic choices in each participant group were influenced by speaker-specific control variables that we had obtained from the background questionnaire (i.e. Age, Self-rated Papiamento proficiency, Self-rated Dutch proficiency, Age of acquisition Papiamento, Age of acquisition Dutch, Pleasure in speaking Papiamento, Confidence in speaking Papiamento, Importance of speaking Papiamento, Pleasure in speaking Dutch, Confidence in speaking Dutch, Importance of speaking Dutch, Age of arrival in NL, Years of residence in NL; all of these variables were measured on a continuous scale) and one item-specific variable, namely, the verb that had to be used in the target movie description ('Target verb', measured as a categorical variable with two values: 'duna' and 'mustra').

We initially included these predictors simultaneously in a full model, but this led to unclear patterns where none of the predictors reached significance (possibly due to correlations between some of the control variables). Therefore, we chose to include the variables for each participant group by starting with an empty model and then testing each variable one by one. Only those variables that had a significant effect as a single predictor were considered for the final model, in which they were included simultaneously.[4]

[4] Variables that yielded significance in these separate analyses per group were also included as control predictors in the first step of our analysis, which tested for differences between participant groups. We also attempted to include these control predictors in interaction with participant groups (which would render the separate group analyses unnecessary), but these models led to nonconvergence, even when using generalized estimating equations. This is why we included the separate analyses per group.

The analyses were done with generalized estimating equations (GEE), using the geepackage in R (R Core Team 2018). GEE is a technique for analyzing a variety of distribution and link functions to handle different data types and error distributions, including binomial responses in a multilevel data structure. Correlations between repeated measures within the same participants and/or items (i.e. random variables) are accounted for when calculating the effects of fixed variables (see e.g. Diggle et al. 2002, Snijders & Bosker 2012 for more information). We chose to analyze the data with this technique rather than the more standard mixed-effects modeling (e.g. Baayen et al. 2008) because the use of mixed-effects modeling on the data did not produce converging models—a problem that has also been noted by other researchers (e.g. Barr et al. 2013). A likely reason for this convergence problem is that mixed-effects models, with their strong focus on estimating individual by-participant random variation, can have difficulty estimating by-participant random effects when participants in the sample show no or hardly any variance. This is exactly what can be expected in the present experiment, because of the strong preference for the DO structure in Papiamento (according to the literature). Because generalized estimating equations do not focus on the estimation of individual by-participant variance, but rather on the calculation of a population average while keeping in mind the correlations between the repeated responses within single participants in repeated-measures designs (as is our design), GEE seemed a good alternative for analyzing the data.[5]

The GEE-models are summarized by reporting each predictor's parameter estimate, robust standard error of the parameter estimate ('robust' means that within-participant/within-items correlations are taken into account, as opposed to naive standard errors, which do not take such correlations into account), the robust *z*-value, and the *p*-value associated with the robust *z*-value. Because GEE-analysis does not have the option of including crossed random effects (i.e. by-participant and by-item random effects in the same analysis), we performed the GEE-analysis based on a participant analysis and an item analysis (like F1/F2 analyses when using ANOVA; see Clark 1973). We used mean-centered coding for both categorical and continuous variables and set the covariance structure of the models to 'exchangeable'.[6] In the participants analysis, all speaker-specific control variables were treated as between-participants; the item-specific variable Target verb was treated as within-participants. Vice versa, in the item analysis, all speaker-specific control variables were treated as within-items, and the item-specific variable Target verb was treated as between-items. To be conservative in our interpretation of these analyses, only those effects that were significant in BOTH the participant and item analyses were regarded as significant.

3.5. RESULTS. The experiment yielded a total of 1,472 responses in critical trials (608 from Aruba-participants, 864 from NL-participants), of which 126 were scored as 'other' and hence removed from the analyses (sixty-two from Aruba-participants, sixty-four from NL-participants). The analyses were based on the remaining 1,346 responses (546 from Aruba-participants, 800 from NL-participants).

Table 2 shows the descriptive statistics for both participant groups. As can be seen in this table, both participant groups tend to use the DO structure, but this tendency appears

[5] In those cases where the use of mixed-effects modeling did lead to model convergence, the results of the GEE-models were comparable to those of the mixed-effects models. This supports our use of GEE-modeling.

[6] In a few cases, the 'exchangeable' function did not lead to convergence. In these cases, we used the slightly less optimal 'independent' option. Importantly, the information provided in n. 5 (i.e. the results of the GEE-models were comparable to those of those mixed-effects models that converged) was also the case when we used 'independent' as the covariance structure. We indicate for which analyses we used the 'independent' function in the results sections.

to be stronger for the Aruba-participants than for the NL-participants. This is confirmed in the GEE-analysis, which yielded a significant effect of Participant group (participants analysis:[7] estimate = 1.494, robust *SE* = 0.735, robust *z*-value = 2.032, $p = 0.042$; item analysis: estimate = 1.494, robust *SE* = 0.256, robust *z*-value = 5.831, $p < 0.001$).

	ARUBA-PARTICIPANTS	NL-PARTICIPANTS
Total *N* PO responses	19	103
Total *N* DO responses	527	697
Proportion PO responses		
M	*.03*	*.12*
SD	*.06*	*.27*

TABLE 2. Syntactic choices in experiment 1. *SD*s were calculated based on the mean proportions of PO responses per participant.

In addition to this difference in syntactic preference between the two participant groups, we explored whether there were additional variables influencing syntactic choices. In the Aruba-participants, the only effect reaching significance was Target verb (participants analysis: estimate = 0.028, robust *SE* = 0.004, robust *z*-value = 6.146, $p < 0.001$; item analysis: estimate = 1.33, robust *SE* = 0.569, robust *z*-value = 2.341, $p = 0.019$). When participants used the verb *mustra* 'show', the likelihood of using a PO construction turned out to be higher than when participants had to use the verb *duna* 'give'. In the NL-participants, Target verb did not reach significance, but the participants' age did (participants analysis:[8] estimate = −0.035, robust *SE* = 0.014, robust *z*-value = −2.398, $p = 0.016$; item analysis: estimate = −0.036, robust *SE* = 0.007, robust *z*-value = −5.133, $p < 0.001$). The parameter estimates of the age effect are negative, indicating that the tendency to produce PO constructions (i.e. the dependent variable) became weaker with older age; put differently, the tendency to use a PO structure was higher in younger participants.

3.6. DISCUSSION OF EXPERIMENT 1. Experiment 1 confirms our prediction that the tendency to produce DO structures is stronger for Aruba-participants than for NL-participants. This may be caused by crosslinguistic influences from Dutch syntactic preferences, which can be assumed to be stronger for the NL-participants than for the Aruba-participants.

This potential explanation of contact-induced differences in syntactic preference is strengthened by the effect of the participants' age, which was significant only in the NL-participants. Given that the age effect was not found in the data from Aruba, it is not a domain-general effect of drift, but rather an effect specific to the NL-participants. When linking age to language use in this population, it is interesting to note that younger speakers of Papiamento in the Netherlands use Dutch relatively often as their language of communication (Kook & Narain 1993, Vedder & Kook 2001). This makes it especially likely for younger speakers to be influenced by Dutch, which indeed seems to be reflected in the data. We delve deeper into this issue in the general discussion (§5).

Another finding was the effect of the target verb. While this effect does not play a central role in the research questions and was mainly included as a control variable, it is interesting because it may suggest that the strength of the DO preference in Papiamento

[7] The covariance structure of this analysis was set to 'independent', because it did not converge with the 'exchangeable' function.

[8] The covariance structure of this analysis was set to 'independent', because it did not converge with the 'exchangeable' function.

may to a certain degree depend on the verb used (i.e. verb bias; see also e.g. Bernolet & Hartsuiker 2010, Colleman 2006, Ferreira 1996, Kootstra & Doedens 2016, Oehrle 1976). It should be kept in mind, though, that this effect was based on a limited number of observations with only two target verbs: in the entire data set from Aruba there were only nineteen PO responses (out of 546 data points), of which fifteen were with the verb *mustra* and four with the verb *duna*. Although the effect reached significance, more research with a larger variety of target verbs is needed to draw firm conclusions about the role of verb biases in Papiamento.

The most important conclusion from experiment 1 is that there are differences in syntactic preferences between Papiamento speakers in the Netherlands and Papiamento speakers in Aruba. This is possibly a result of differences in intensity of language contact with Dutch between the NL-participants and the Aruba-participants, especially because the age effect in the NL-participants can also be related to differences in intensity of language contact as a function of age. To test the plausibility of this explanation, it is necessary to confirm that it is indeed possible that exposure to Dutch dative sentence constructions influences the subsequent production of dative sentences in Papiamento. We tested this by means of a crosslinguistic structural priming experiment.

4. EXPERIMENT 2: CROSSLINGUISTIC PRIMING IN DATIVE SENTENCE PRODUCTION. Experiment 2 focused on the question of whether syntactic choices in the production of dative sentences in Papiamento can be primed by Dutch dative sentences.

4.1. PARTICIPANTS. The priming experiment included a total of sixty-two new participants from the same population as in experiment 1, of which twenty-five were Aruba-participants (eleven male, fourteen female) and thirty-seven were NL-participants (eighteen male, nineteen female). Their background characteristics are given in Table 3.

	ARUBA-PARTICIPANTS		NL-PARTICIPANTS	
	M	*SD*	*M*	*SD*
Age	39.88	13.87	34.27	14.25
Self-rated Papiamento proficiency	4.61	0.54	4.45	0.69
Self-rated Dutch proficiency *	3.37	0.85	4.39	0.53
Age of acquisition Papiamento	0.00	0.00	0.22	0.58
Age of acquisition Dutch *	5.88	0.83	4.35	2.32
Pleasure in speaking Papiamento	4.96	0.20	4.70	0.78
Confidence in speaking Papiamento	4.96	0.20	4.59	0.98
Importance of speaking Papiamento	4.92	0.28	4.70	0.62
Pleasure in speaking Dutch *	3.08	1.32	4.27	0.93
Confidence in speaking Dutch *	2.60	1.29	4.27	0.93
Importance of speaking Dutch *	3.92	1.35	4.89	0.31
Age of arrival in NL	N/A	N/A	19.49	11.90
Years of residence in NL	N/A	N/A	14.61	10.08

TABLE 3. Characteristics of the participants in experiment 2 (priming task). Asterisks indicate significant differences between the NL-participants and Aruba-participants, and see n. 3 above.

The NL-participants rated themselves as being more proficient in Dutch than the Aruba-participants ($t(60) = 5.83$, $p < 0.001$). They also had more pleasure ($t(60) = 4.16$, $p < 0.001$) and confidence ($t(60) = 5.92$, $p < 0.001$) in speaking Dutch, found it more important to be able to speak Dutch ($t(60) = 4.22$, $p < 0.001$), and had started to learn Dutch earlier in their lives than the Aruba-participants ($t(60) = -3.14$, $p = 0.003$), although it has to be noted that both groups started to learn Dutch at a relatively early age. The participant groups did not differ significantly from each other in terms of their self-ratings on their Papiamento proficiency.

4.2. STIMULUS MATERIALS. A trial in the priming task consisted of an auditorily presented (prime) sentence in Dutch, followed by a (target) movie clip to be described in Papiamento. See Figure 2 for an illustration of how the prime sentences were combined with the movie clips. Apart from this addition of a Dutch prime sentence the stimuli were the same as in experiment 1. See Appendix B for a list of all critical prime-target items.

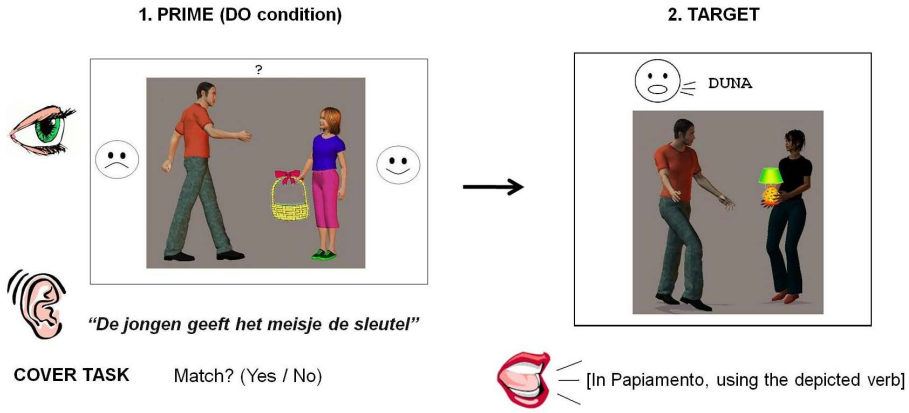

FIGURE 2. Illustration of the task procedure in the priming experiment (in this case with a prime sentence in the DO condition) (experiment 2).

As shown in Table 4, the prime sentences in the critical trials were Dutch PO and DO sentences. The table further shows that not only priming of sentence structure was manipulated, but also whether the verb in the prime sentence was a translation equivalent of the verb in the target movie clip. This was done to explore the potential influence of a so-called translation-equivalent boost of structural priming (e.g. Cai et al. 2011, Schoonbaert et al. 2007). Although not a central question in this study, we were interested in whether this manipulation would influence syntactic choices in the current priming task.

PRIME	TRANS EQUIV VERB?	AUDITORY PRIME SENTENCE	TARGET MOVIE CLIP
PO	Yes	De jongen geeft de sleutel aan het meisje. 'The boy gives the key to the girl.'	See Fig. 1 (with *duna* 'to give')
DO	Yes	De jongen geeft het meisje de sleutel. 'The boy gives the girl the key.'	
PO	No	De jongen toont de sleutel aan het meisje. 'The boy shows the key to the girl.'	See Fig. 1 (with *duna* 'to give')
DO	No	De jongen toont het meisje de sleutel. 'The boy shows the girl the key.'	

TABLE 4. Examples of the experimental conditions in the priming task. See Fig. 2 for a depiction of the priming-task procedure.

The prime-target items and filler items were combined into four lists. Each prime-target item occurred in a different condition across lists, and within lists all conditions occurred equally often (Latin-square design). Each list was pseudo-randomized into three versions, in which primes and targets of a prime-target pair were never interrupted by filler items and in which filler items themselves were ordered randomly around the prime-target pairs. No more than two critical prime-target trials occurred consecutively. Practice items for each version were based on six randomly selected filler trials.

4.3. PROCEDURE. The participants were tested individually in a quiet room. They first completed the language-background questionnaire and were then seated in front of a computer to receive instructions and perform the experiment. To disguise the priming paradigm, the participants were told that they would do a listening task in which they had to determine whether a Dutch auditory sentence (i.e. the prime sentence) matched the movie clip that they saw on the screen of their computer. The participants had to press a key marked with a happy face to indicate that the sentence matched the clip and a key with a nonhappy face to indicate that the sentence did not match the movie clip. After the decision task, they were shown another movie clip (i.e. the target movie clip), which they had to describe in Papiamento, based on the same instructions as in experiment 1. Just as in experiment 1, the participants could perform the task at their own pace but were encouraged to respond quickly in order to avoid metalinguistic processing. See Fig. 2 above for a depiction of the task procedure. An entire session lasted about one hour.

4.4. SCORING AND ANALYSIS. The data from the priming experiment were scored, analyzed, and reported in the same way as in experiment 1. To analyze the role of the Dutch prime sentence on Papiamento dative sentence production, we included the variable Primed structure (PO or DO) as a predictor in the statistical model (coded as a within-participants and within-items predictor). As an additional priming predictor, we included the potential role of verb repetition between the prime and target (again coded as a within-participants and within-items predictor). As a second step, after the central analysis, we further explored the potential role of the same speaker-specific and item-specific variables that were explored in the baseline experiment, for each participant group. We followed the same procedure as in experiment 1 for these analyses.

4.5. RESULTS. The experiment yielded a total of 1,984 responses in critical trials (800 from Aruba, 1,184 from the Netherlands), of which seventy-three were scored as 'other' and hence removed from the analyses (thirty-five from Aruba, thirty-eight from the Netherlands). The analyses were based on the remaining 1,911 responses (765 from Aruba, 1,146 from the Netherlands).

Table 5 displays the descriptive results for the priming experiment. The GEE-analysis resulted in a significant main effect of Primed structure (participants analysis:[9] estimate = 0.801, robust *SE* = 0.205, robust *z*-value = 3.907, $p < 0.001$; item analysis: estimate = 0.764, robust *SE* = 0.196, robust *z*-value = 3.881, $p < 0.001$). Participants had a stronger tendency to produce a PO structure after a PO prime than after a DO prime (and vice versa for DO primes and targets). A second significant effect was a main effect of Participant group (participants analysis: estimate = −1.522, robust *SE* = 0.607, robust *z*-value = −2.506, $p = 0.012$; item analysis: estimate = −1.670, robust *SE* = 0.199, robust *z*-value = −8.355, $p < 0.001$): the overall number of PO structures in the priming experiment was, perhaps rather surprisingly, higher in the Aruba-participants than in the NL-participants. This is the case not only in the PO condition, but also in the DO condition, so even after DO primes Aruba-participants sometimes used a PO construction, and more so than the NL-participants. There was no interaction effect of Primed structure with Participant group, so the observed priming effect was the same for the Aruba-participants and the NL-participants. We found no effects of whether the verbs in the primes and targets were translation equivalents.

[9] The covariance structure of this analysis was set to 'independent', because it did not converge with the 'exchangeable' function.

	ARUBA-PARTICIPANTS		NL-PARTICIPANTS	
	PRIME = PO	PRIME = DO	PRIME = PO	PRIME = DO
Total *N* PO responses	62	30	32	10
Total *N* DO responses	327	346	534	570
Proportion PO responses				
M	*.16*	*.10*	*.06*	*.02*
SD	*.26*	*.22*	*.11*	*.04*

TABLE 5. Descriptive statistics of syntactic choices in the priming experiment. *SD*s were calculated based on the mean proportions of PO responses per participant.

The subsequent analyses of other item-specific or speaker-specific variables resulted in significant effects only in the NL-participants, where we again found a significant effect of the participants' age (participants analysis:[10] estimate = −0.082, robust *SE* = 0.034, robust *z*-value = −2.422, $p = 0.015$; item analysis: estimate = −0.082, robust *SE* = 0.020, robust *z*-value = 4.116, $p < 0.001$). Like the baseline experiment in the Netherlands, the tendency to produce PO structures was stronger in younger participants. No further item-specific or speaker-specific variables had a significant influence on the participants' tendencies to use DO or PO in this task, either as a main effect, or in interactions.

4.6. COMBINED ANALYSIS OF THE PARTICIPANTS' AGE. Before we move on to the discussion of the results, we delve a bit more deeply into the observed age effects, which we found for the NL-participants in both experiment 1 and experiment 2. The scatterplot presented in Figure 3 provides a depiction of this effect, for experiments 1 and 2 combined. To gain more insight into the influence of age in the data set, and especially into the question of the extent to which the age effect may be related to language contact with Dutch in the NL-participants, we combined the data from experiments 1 and 2 and performed a correlation analysis of the participants' age with the other background variables that we had gathered from the background questionnaire (i.e. self-assessment on the participants' language proficiency and further attitudinal questions regarding their use of Papiamento and Dutch in terms of confidence, importance, and having fun when speaking Dutch or Papiamento; see Tables 1 and 3). We performed this analysis separately for the NL-participants and for the Aruba-participants.

It turned out that, in the NL-participants, age correlated significantly with confidence ($r = 0.373$, $p = 0.002$) and self-perceived proficiency ($r = 0.330$, $p = 0.008$) in Papiamento, as well as with importance of speaking Papiamento ($r = 0.288$, $p = 0.021$): the younger the speakers were, the less confident and less proficient they were in Papiamento, and the less importance they attached to speaking Papiamento ($r = 0.288$, $p = 0.021$). Interestingly, however, similar correlations were also found with respect to their Dutch: the younger speakers from the Netherlands were, the less proficient ($r = 0.277$, $p = 0.027$) and confident ($r = 0.369$, $p = 0.003$) they judged themselves to be in Dutch. Critically, these correlations of age with language proficiency and attitude self-ratings were hardly present in the speakers from Aruba. The only significant correlation we found was that younger speakers from Aruba tend to judge Dutch as more important than older speakers from Aruba ($r = -0.301$, $p = 0.047$). This does not seem to have played a role in their syntactic choices, however, as we did not observe any age effects or other speaker-specific effects in the Aruba data.

[10] The covariance structure of this analysis was set to 'independent', because it did not converge with the 'exchangeable' function.

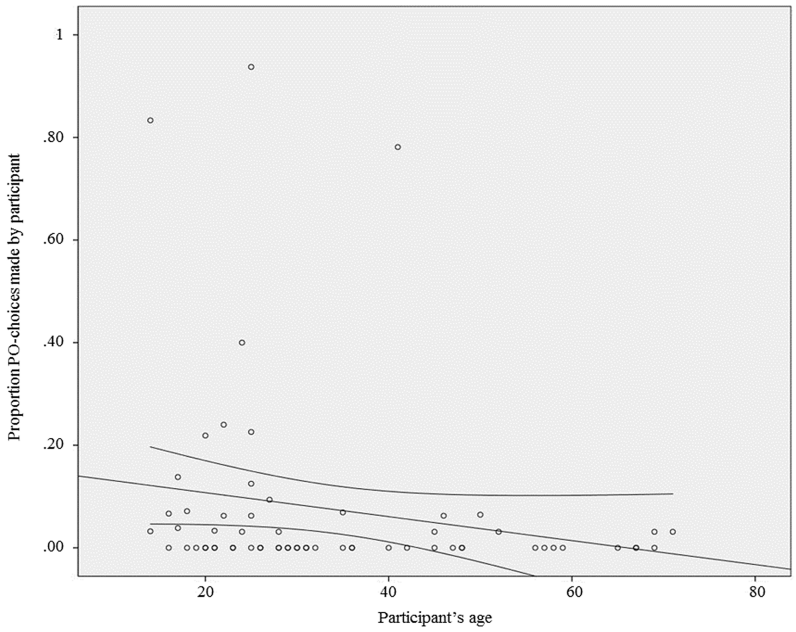

FIGURE 3. Scatterplot of the age effect in the NL-participants, experiments 1 and 2 combined. The curved lines represent 95% confidence intervals.

It becomes clear from this combined analysis that the age effect in the NL-participants is correlated with other variables that can be linked to language contact. In the general discussion below, we further explain the implications of these results for our hypothesis about the relation between crosslinguistic priming and contact-induced language change.

5. GENERAL DISCUSSION. We now bring together the results and implications of both experiments. In the experiments, we found multiple forms of evidence of contact-induced differences between NL-speakers and Aruba-speakers, and of the idea of crosslinguistic structural priming as a plausible mechanism underlying contact-induced language change.

The first line of evidence supporting the idea of contact-induced language change in NL-Papiamento comes from experiment 1: speakers of Papiamento in the Netherlands produced significantly more PO structures than speakers of Papiamento in Aruba. It is very likely that this difference is caused by Dutch syntactic preferences influencing Papiamento syntactic choices in the NL-participants. After all, speakers of Papiamento in the Netherlands are more frequently exposed to Dutch than speakers of Papiamento in Aruba, and Dutch plays a more important role in the daily lives of the NL-participants, compared to the Aruba-participants. An interesting additional point to make here is that most of the NL-participants gave relatively high self-ratings on their Papiamento proficiency, which means that the observed differences between the NL-participants and the Aruba-participants could even be considered conservative.

The second line of evidence is the age effect observed in both experiments: younger speakers tended to use more PO structures than older speakers. Importantly, this age effect was only the case in the NL-speakers, so it was not a general age effect independent from language-contact explanations. As already touched upon in the discussion of ex-

periment 1, this effect may well have arisen from the fact that the linguistic environment of younger speakers of Papiamento in the Netherlands is more heavily shaped by Dutch than the linguistic environment of older speakers of Papiamento in the Netherlands. (Incidentally, the age effect also shows the value of testing participants with a large variation in age, as we did. Given that most laboratory experiments in psycholinguistics use students as participants, this is not a trivial point to make. We would never have found this age effect if we had only tested students.)

The language-contact explanation of the age effect is supported by the correlation analysis on the combined data, which indicated that younger speakers of Papiamento in the Netherlands were less confident and less proficient in Papiamento, and found it less important to speak Papiamento, compared to older speakers of Papiamento in the Netherlands. Although these variables themselves did not significantly predict syntactic choices, these correlations with confidence and proficiency could be seen as suggesting that the younger speakers identify more with Dutch than the older speakers and, given the strong relation between proficiency and frequency of language use (e.g. Ellis 2002), may have had a higher level of exposure to and interaction in Dutch. It should be emphasized, however, that these patterns are based on self-evaluations. More systematic research that includes (standardized) tests is needed to further test this potential link between age and proficiency and confidence.

In addition to the language-contact explanation of the age effects, it should be noted that age is of course an important factor in general when it comes to language change. Age-stratified differences in patterns of language use have, for example, been used as an operationalization of language change in progress (e.g. Chambers 2013, Labov 2001). The age differences in structural preferences observed in the NL-speakers can thus be regarded as a change in progress, with a contact-induced explanation. In addition, language variation and rates of change tend to be relatively strong in younger people (especially adolescents), leading to the suggestion that younger people are important transmitters of language change (e.g. Chambers 2013, Kerswill 1996, Kirkham & Moore 2013). While this phenomenon is often explained in social terms (e.g. acts of identity: Cornips 2008, Holmes & Meyerhoff 2003, Kerswill 1996, Le Page & Tabouret-Keller 1985, Milroy & Gordon 2003, Tagliamonte & D'Arcy 2009), in the case of language-contact situations it may also be that the higher intensity of language contact in younger speakers (at least in younger speakers of Papiamento in the Netherlands) leads to a higher degree of variation in daily language use and linguistic environment. Priming mechanisms, which play a central role in social interaction (e.g. Pickering & Garrod 2004), may in turn lead to transmission of this contact-induced variation of language use, possibly resulting in contact-induced language change. From this perspective, sociolinguistic and psycholinguistic explanations of the role of age in contact-induced language change appear to complement and strengthen each other.

The third and surely most important line of evidence supporting the contact-induced argument is the crosslinguistic priming effects observed in experiment 2: in both participant groups, Dutch prime sentences influenced syntactic choices in Papiamento. These priming effects provide unequivocal evidence that exposure to Dutch sentences can indeed influence syntactic choices in Papiamento. This direct evidence strengthens the contact-induced explanation we provided for the findings in experiment 1, and corroborates and extends earlier results of crosslinguistic priming in bilinguals. An important aspect of the findings is that cross-language priming can take place even in a situation in which one of the primed structures (in this case, the PO structure) is not preferred, and is rarely used in the target language. Earlier studies on cross-language syntactic

priming were focused mostly on languages in which both primed structures are used on a relatively regular basis. Apparently, cross-language activation in the bilingual mind can take place even when one of the syntactic alternatives is not preferred.

How do the priming findings support the hypothesis of crosslinguistic priming as a mechanism underlying contact-induced language change? Crosslinguistic structural priming is not only a methodological tool to measure and confirm the existence of cross-language syntactic activation; it is also a key mechanism of language use itself, driving communication fluency and transmission of syntactic choices between interlocutors, as well as implicit, experience-based language learning. It is exactly these real-life functions of priming that make it a plausible mechanism of language change. There are indications that the learning function of structural priming is also at work in the data. That is, we found in experiment 2 that the Aruba-participants produced more PO structures than the NL-participants. This may seem to contradict the findings from experiment 1, but it is in fact consistent with the phenomenon of surprisal effects on structural priming (e.g. Bernolet & Hartsuiker 2010, Jaeger & Snider 2007, 2013). In the case of Papiamento speakers in Aruba, it can be argued that PO dative sentences are surprising forms of input, even when the input is in Dutch. This may cause the speakers from Aruba to adapt relatively strongly to the PO datives they are exposed to, hence producing a relatively high number of PO sentences in the priming task. These surprisal effects reflect experience-based learning in which learners continuously adapt their production preferences and expectations to the linguistic environment (e.g. Dell & Chang 2014, Jaeger & Snider 2013).

Interestingly, the surprising input did not result in a stronger priming effect, but rather in a stronger tendency in general to produce PO structures: the Aruba-participants produced a relatively high number of PO sentences not only after PO primes, but also after DO primes (see Table 5). This indicates that priming does not just involve a 'local' effect within one single prime-target item, but also a global, longer-term effect, in which priming transcends the level of single trials. This observation is consistent with previous findings of long-term priming in experiments (e.g. Bock & Griffin 2000, Fricke & Kootstra 2016, Hartsuiker et al. 2008, Kaschak et al. 2011, Kaschak et al. 2012, Kootstra & Doedens 2016) and is also partly related to Fraundorf and Jaeger's (2016) results, who observed that language users generalize primed syntactic-processing preferences to new structures. In the data reported here, participants generalized primed processing preferences beyond single prime-target items, thus suggesting the potential of priming as a mechanism of longer-term language change.

The link with the learning function of structural priming in the data strengthens the idea of crosslinguistic priming as a mechanism of language learning that can lead to language change. Still, it is important to acknowledge that the evidence for the hypothesis that crosslinguistic priming may drive contact-induced language change is circumstantial rather than direct: differences in syntactic preferences between Aruba-participants and NL-participants are stronger in younger NL-participants, and crosslinguistic priming took place from Dutch to Papiamento, involving patterns of results that are consistent with the notion of priming as a form of continuous, implicit learning. These findings are consistent with our hypothesis, but do not directly prove that cross-language structural priming drives contact-induced language change. We would like to emphasize, however, that directly proving a link between priming and language change is difficult, because it requires measurements at different time dimensions and levels of aggregation: structural priming is measured at the individual level within one experiment or conversation, but language change is measured at the community level—and measuring the ac-

tual process of language change as it occurs outside the lab without alluding to cross-sectional analyses would require a longitudinal study. Moreover, in studying the mechanisms and actual trajectory of contact-induced change in a naturalistic setting, it will be difficult to control for the various factors and mechanisms influencing syntactic choices and therefore to distinguish the relative contributions of, for instance, speaker-level processing mechanisms from community-level mechanisms of language spread. Contact-induced language change is probably based on a dynamic interaction of these mechanisms. Crosslinguistic priming should therefore be seen not as the principle causal mechanism underlying contact-induced language change, but rather as one of many mechanisms that is likely to be involved in contact-induced change. This perspective on crosslinguistic priming in relation to language change is consistent with theories on language as a dynamic, complex, and adaptive system (e.g. de Bot et al. 2007, The Five Graces Group 2009, Larsen-Freeman 1997).

What makes the study of crosslinguistic priming in relation to contact-induced language change particularly interesting is that it is a plausible cognitive mechanism accounting for how linguistic preferences can be transmitted from one speaker to the other (cf. Pickering & Garrod 2004). Thus, priming can be seen as a micro-mechanism of change at the individual level that may in the long run involve changes at the community level. This is also proposed by Jäger and Rosenbach (2008), who state that priming entails 'atomic steps' of adaptation leading to a diachronic trajectory of language change. In the present study, the focus was exactly on these atomic steps (crosslinguistic priming; experiment 2) and on linking it to differences in syntactic preferences between a high-contact and a low-contact variety (NL-participants compared to Aruba-participants), as observed in experiment 1. Thus, the present study provided an important and novel contribution to the literature on contact-induced language change, which often focuses on the outcome of language contact (e.g. Doğruöz & Backus 2009, Otheguy et al. 2007) rather than on the mechanism underlying it.

In addition to indications of a link between crosslinguistic priming and contact-induced language change, there are a number of issues that require further scrutiny. One of these is the potential role of verb bias in Papiamento: there was an effect of target-verb bias in experiment 1, but not in experiment 2. Perhaps this is because experiment 2 included a priming manipulation, which already strongly guided linguistic choices and thus did not provide opportunity for the effect of the target verb to arise. Another important point that should be made about the effect of the target verb is that it was included as a control variable, which the study did not intend to explicitly test; a proper test of the effect of verb biases in these kinds of tasks requires a much stronger manipulation, with many more different target verbs. It may be interesting to further investigate this in future studies, especially given the strong preference for DO structures in Papiamento.

Another issue is the potential role of a translation-equivalent boost, that is, the effect that structural priming is enhanced when the verb in the prime sentence is the translation equivalent of the verb in the target (e.g. Cai et al. 2011, Schoonbaert et al. 2007). This effect was not present in the analysis, and the question is why not. One factor that may have played a role here is the direction of priming investigated in the study. That is, an important aspect of a translation-equivalent boost effect is that it appears to be influenced by the speakers' proficiency in both languages. Cai and colleagues (2011) tested balanced bilinguals and found translation-equivalent boost effects in both priming directions, but Schoonbaert and colleagues (2007) tested nonbalanced bilinguals and only found a translation-equivalent boost effect when priming was tested from the stronger language to the weaker language. The participants in the present study reported themselves as more proficient and more confident in Papiamento than in Dutch (although

differences were small in the NL-participants). Thus, parallel to the asymmetric findings by Schoonbaert and colleagues (2007), it may well be that translation-equivalent boost effects are indeed found when the prime language is Papiamento and the target language is Dutch. Given that we were specifically interested in the influence of Dutch on Papiamento, we did not include this other priming direction in the present study.

An alternative explanation for why we did not find a translation-equivalent boost effect is that the stimuli used in this experiment were not specifically suitable for these effects.[11] That is, like the lexical boost effect, the translation-equivalent boost effect is often regarded as resulting from explicit memory, in the sense that when the verb from the prime sentence (or in this case, its translation) is also encountered during target processing, it functions as an additional memory retrieval cue for the structure of the prime sentence, thus boosting the priming effect (e.g. Chang et al. 2006, Hartsuiker et al. 2008). However, such memory cueing may well be unlikely in this particular experiment, because the sentences and movie clips were extremely similar to each other (i.e. almost all sentences had the same agents and recipients: a boy and a girl) and because only two verbs were used (*duna* and *mustra*). As a result, the given verb may simply not have been effective enough to function as a memory retrieval cue. Therefore, just as is the case with the verb-bias effects, a proper test of the potential role of a translation-equivalent boost in this task requires a stronger manipulation, with many more combinations of verbs in the primes and targets. Future research may shed more light on this issue and may thus also provide information on the link between lexical and syntactic representations in bilinguals, as assumed in psycholinguistic models (e.g. Hartsuiker & Pickering 2008).

To conclude, this study found that syntactic preferences in dative sentences are different between speakers of Papiamento in the Netherlands and speakers of Papiamento in Aruba, which may well be a sign of contact-induced language change in progress. Based on subsequent crosslinguistic priming findings, these changes are likely caused by crosslinguistic priming from Dutch to Papiamento. The interpretation in terms of contact-induced language change is further strengthened by the finding that syntactic choices were more Dutch-like in younger speakers in the Netherlands than in older speakers in the Netherlands—a finding that was not observed in Aruba. Another indication in the direction of contact-induced language change was the fact that some patterns in the data reflect long-term priming beyond single prime-target trials (i.e. the Aruba-participants produced a relatively high number of PO sentences not only after PO primes, but also after DO primes), which suggests that priming can have long-term effects. Thus, cross-language structural priming can be seen as a link between crosslinguistic interactions in bilingual individuals and contact-induced language change at the community level, thereby offering a bridge (both theoretically and methodologically) between psycholinguistics, sociolinguistics, and historical linguistics.

APPENDIX A: LIST OF ALL CRITICAL TARGET MOVIE CLIPS IN THE BASELINE TASK (EXPERIMENT 1)

1	man giving a backpack to another man	9	man giving a bear to a girl
2	man giving a balloon to a woman	10	man giving a belt to another man
3	man giving a basket to a girl	11	man giving a pair of boots to a woman
4	man giving a bell to a boy	12	man giving a flask to a woman
5	man giving a donut to another man	13	man giving an ice-cream to a boy
6	man giving a hotdog to a girl	14	man giving a milkshake to another man
7	man giving a pan to a woman	15	man giving a popsicle to a boy
8	man giving a teapot to a boy	16	man giving a pair of shoes to a girl

[11] We would like to thank a referee for bringing up this potential alternative explanation.

17 man showing a bag to a girl
18 man showing a bear to a boy
19 man showing a cake to another man
20 man showing cornflakes to a woman
21 man showing cookies to a woman
22 man showing a hat to a girl
23 man showing a saucer to a boy
24 man showing a bottle of wine to another man
25 man showing a bike to a girl
26 man showing a book to another man
27 man showing a box to a boy
28 man showing a cake to a woman
29 man showing a jacket to a boy
30 man showing a purse to a girl
31 man showing a teapot to a woman
32 man showing a vase to a man

Appendix B: List of all critical prime sentences and target movie clips in the priming task (experiment 2)

Note: The target movie clips in experiment 2 were the same as the target movie clips in experiment 1.

PRIME	TRANS EQUIV?	AUDITORY PRIME SENTENCE	TRANSLATION	TARGET MOVIE CLIP
DO	Yes	de vrouw geeft het meisje het boek	woman gives girl book	man giving a backpack to another man
DO	No	de vrouw toont het meisje het boek	woman shows girl book	
PO	Yes	de vrouw geeft het boek aan het meisje	woman gives book to girl	
PO	No	de vrouw toont het boek aan het meisje	woman shows book to girl	
DO	Yes	de jongen geeft de man de pen	boy gives man pen	man giving a balloon to a woman
DO	No	de jongen toont de man de pen	boy shows man pen	
PO	Yes	de jongen geeft de pen aan de man	boy gives pen to man	
PO	No	de jongen toont de pen aan de man	boy shows pen to man	
DO	Yes	het meisje geeft de man de lamp	girl gives man lamp	man giving a basket to a girl
DO	No	het meisje toont de man de lamp	girl shows man lamp	
PO	Yes	het meisje geeft de lamp aan de man	girl gives lamp to man	
PO	No	het meisje toont de lamp aan de man	girl shows lamp to man	
DO	Yes	de vrouw geeft het meisje de telefoon	woman gives girl telephone	man giving a bell to a boy
DO	No	de vrouw toont het meisje de telefoon	woman shows girl telephone	
PO	Yes	de vrouw geeft de telefoon aan het meisje	woman gives telephone to girl	
PO	No	de vrouw toont de telefoon aan het meisje	woman shows telephone to girl	
DO	Yes	de jongen geeft de vrouw de tas	boy gives woman bag	man giving a donut to another man
DO	No	de jongen toont de vrouw de tas	boy shows woman bag	
PO	Yes	de jongen geeft de tas aan de vrouw	boy gives bag to woman	
PO	No	de jongen toont de tas aan de vrouw	boy shows bag to woman	
DO	Yes	het meisje geeft de jongen de sokken	girl gives boy socks	man giving a hotdog to a girl
DO	No	het meisje toont de jongen de sokken	girl shows boy socks	
PO	Yes	het meisje geeft de sokken aan de jongen	girl gives socks to boy	
PO	No	het meisje toont de sokken aan de jongen	girl shows socks to boy	
DO	Yes	de vrouw geeft de man de broek	woman gives man trousers	man giving a pan to a woman
DO	No	de vrouw toont de man de broek	woman shows man trousers	
PO	Yes	de vrouw geeft de broek aan de man	woman gives trousers to man	
PO	No	de vrouw toont de broek aan de man	woman shows trousers to man	
DO	Yes	de jongen geeft het meisje de rok	boy gives girl skirt	man giving a teapot to a boy
DO	No	de jongen toont het meisje de rok	boy shows girl skirt	
PO	Yes	de jongen geeft de rok aan het meisje	boy gives skirt to girl	
PO	No	de jongen toont de rok aan het meisje	boy shows skirt to girl	
DO	Yes	het meisje geeft de vrouw de jurk	girl gives woman dress	man giving a bear to a girl
DO	No	het meisje toont de vrouw de jurk	girl shows woman dress	
PO	Yes	het meisje geeft de jurk aan de vrouw	girl gives dress to woman	
PO	No	het meisje toont de jurk aan de vrouw	girl shows dress to woman	
DO	Yes	de vrouw geeft de jongen de bril	woman gives boy glasses	man giving a belt to another man
DO	No	de vrouw toont de jongen de bril	woman shows boy glasses	
PO	Yes	de vrouw geeft de bril aan de jongen	woman gives glasses to boy	
PO	No	de vrouw toont de bril aan de jongen	woman shows glasses to boy	

PRIME	TRANS EQUIV?	AUDITORY PRIME SENTENCE	TRANSLATION	TARGET MOVIE CLIP
DO	Yes	de jongen geeft het meisje de ring	boy gives girl ring	man giving a pair of boots to a woman
DO	No	de jongen toont het meisje de ring	boy shows girl ring	
PO	Yes	de jongen geeft de ring aan het meisje	boy gives ring to girl	
PO	No	de jongen toont de ring aan het meisje	boy shows ring to girl	
DO	Yes	het meisje geeft de jongen de lepel	girl gives boy spoon	man giving a flask to a woman
DO	No	het meisje toont de jongen de lepel	girl shows boy spoon	
PO	Yes	het meisje geeft de lepel aan de jongen	girl gives spoon to boy	
PO	No	het meisje toont de lepel aan de jongen	girl shows spoon to boy	
DO	Yes	de vrouw geeft de man de vork	woman gives man fork	man giving an ice-cream to a boy
DO	No	de vrouw toont de man de vork	woman shows man fork	
PO	Yes	de vrouw geeft de vork aan de man	woman gives fork to man	
PO	No	de vrouw toont de vork aan de man	woman shows fork to man	
DO	Yes	de jongen geeft de vrouw de gitaar	boy gives woman guitar	man giving a milk-shake to another man
DO	No	de jongen toont de vrouw de gitaar	boy shows woman guitar	
PO	Yes	de jongen geeft de gitaar aan de vrouw	boy gives guitar to woman	
PO	No	de jongen toont de gitaar aan de vrouw	boy shows guitar to woman	
DO	Yes	het meisje geeft de vrouw de trompet	girl gives woman trumpet	man giving a pop-sicle to a boy
DO	No	het meisje toont de vrouw de trompet	girl shows woman trumpet	
PO	Yes	het meisje geeft de trompet aan de vrouw	girl gives trumpet to woman	
PO	No	het meisje toont de trompet aan de vrouw	girl shows trumpet to woman	
DO	Yes	de vrouw geeft de jongen de plant	woman gives boy plant	man giving a pair of shoes to a girl
DO	No	de vrouw toont de jongen de plant	woman shows boy plant	
PO	Yes	de vrouw geeft de plant aan de jongen	woman gives plant to boy	
PO	No	de vrouw toont de plant aan de jongen	woman shows plant to boy	
DO	Yes	de jongen toont de vrouw de bloem	boy shows woman flower	man showing a bag to a girl
DO	No	de jongen geeft de vrouw de bloem	boy gives woman flower	
PO	Yes	de jongen toont de bloem aan de vrouw	boy shows flower to woman	
PO	No	de jongen geeft de bloem aan de vrouw	boy gives flower to woman	
DO	Yes	het meisje toont de man de krant	girl shows man newspaper	man showing a bear to a boy
DO	No	het meisje geeft de man de krant	girl gives man newspaper	
PO	Yes	het meisje toont de krant aan de man	girl shows newspaper to man	
PO	No	het meisje geeft de krant aan de man	girl gives newspaper to man	
DO	Yes	de vrouw toont de jongen de bal	woman shows boy ball	man showing a cake to another man
DO	No	de vrouw geeft de jongen de bal	woman gives boy ball	
PO	Yes	de vrouw toont de bal aan de jongen	woman shows ball to boy	
PO	No	de vrouw geeft de bal aan de jongen	woman gives ball to boy	
DO	Yes	de jongen toont het meisje de jas	boy shows girl coat	man showing cornflakes to a woman
DO	No	de jongen geeft het meisje de jas	boy gives girl coat	
PO	Yes	de jongen toont de jas aan het meisje	boy shows coat to girl	
PO	No	de jongen geeft de jas aan het meisje	boy gives coat to girl	
DO	Yes	het meisje toont de man de hamer	girl shows man hammer	man showing cookies to a woman
DO	No	het meisje geeft de man de hamer	girl gives man hammer	
PO	Yes	het meisje toont de hamer aan de man	girl shows hammer to man	
PO	No	het meisje geeft de hamer aan de man	girl gives hammer to man	
DO	Yes	de vrouw toont de jongen de zaag	woman shows boy saw	man showing a hat to a girl
DO	No	de vrouw geeft de jongen de zaag	woman gives boy saw	
PO	Yes	de vrouw toont de zaag aan de jongen	woman shows saw to boy	
PO	No	de vrouw geeft de zaag aan de jongen	woman gives saw to boy	
DO	Yes	de jongen toont het meisje de sleutel	boy shows girl key	man showing a saucer to a boy
DO	No	de jongen geeft het meisje de sleutel	boy gives girl key	
PO	Yes	de jongen toont de sleutel aan het meisje	boy shows key to girl	
PO	No	de jongen geeft de sleutel aan het meisje	boy gives key to girl	

PRIME	TRANS EQUIV?	AUDITORY PRIME SENTENCE	TRANSLATION	TARGET MOVIE CLIP
DO	Yes	het meisje toont de vrouw het geld	girl shows woman money	man showing a bottle of wine to another man
DO	No	het meisje geeft de vrouw het geld	girl gives woman money	
PO	Yes	het meisje toont het geld aan de vrouw	girl shows money to woman	
PO	No	het meisje geeft het geld aan de vrouw	girl gives money to woman	
DO	Yes	de vrouw toont de man de fles	woman shows man bottle	man showing a bike to a girl
DO	No	de vrouw geeft de man de fles	woman gives man bottle	
PO	Yes	de vrouw toont de fles aan de man	woman shows bottle to man	
PO	No	de vrouw geeft de fles aan de man	woman gives bottle to man	
DO	Yes	de jongen toont het meisje de appel	boy shows girl apple	man showing a book to another man
DO	No	de jongen geeft het meisje de appel	boy gives girl apple	
PO	Yes	de jongen toont de appel aan het meisje	boy shows apple to girl	
PO	No	de jongen geeft de appel aan het meisje	boy gives apple to girl	
DO	Yes	het meisje toont de vrouw de banaan	girl shows woman banana	man showing a box to a boy
DO	No	het meisje geeft de vrouw de banaan	girl gives woman banana	
PO	Yes	het meisje toont de banaan aan de vrouw	girl shows banana to woman	
PO	No	het meisje geeft de banaan aan de vrouw	girl gives banana to woman	
DO	Yes	de vrouw toont de jongen de meloen	woman shows boy melon	man showing a cake to a woman
DO	No	de vrouw geeft de jongen de meloen	woman gives boy melon	
PO	Yes	de vrouw toont de meloen aan de jongen	woman shows melon to boy	
PO	No	de vrouw geeft de meloen aan de jongen	woman gives melon to boy	
DO	Yes	de jongen toont de man de kokosnoot	boy shows man coconut	man showing a jacket to a boy
DO	No	de jongen geeft de man de kokosnoot	boy gives man coconut	
PO	Yes	de jongen toont de kokosnoot aan de man	boy shows coconut to man	
PO	No	de jongen geeft de kokosnoot aan de man	boy gives coconut to man	
DO	Yes	het meisje toont de jongen het mes	girl shows boy knife	man showing a purse to a girl
DO	No	het meisje geeft de jongen het mes	girl gives boy knife	
PO	Yes	het meisje toont het mes aan de jongen	girl shows knife to boy	
PO	No	het meisje geeft het mes aan de jongen	girl gives knife to boy	
DO	Yes	de vrouw toont het meisje de fluit	woman shows girl whistle	man showing a tea-pot to a woman
DO	No	de vrouw geeft het meisje de fluit	woman gives girl whistle	
PO	Yes	de vrouw toont de fluit aan het meisje	woman shows whistle to girl	
PO	No	de vrouw geeft de fluit aan het meisje	woman gives whistle to girl	
DO	Yes	de jongen toont de vrouw de pan	boy shows woman pan	man showing a vase to a man
DO	No	de jongen geeft de vrouw de pan	boy gives woman pan	
PO	Yes	de jongen toont de pan aan de vrouw	boy shows pan to woman	
PO	No	de jongen geeft de pan aan de vrouw	boy gives pan to woman	

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