

When Russians learn English: How the semantics of causation may change*

PHILLIP WOLFF
Emory University
TATYANA VENTURA
University of Memphis

We examined how the semantics of causal expressions in Russian and English might differ and how these differences might lead to changes in the way second language learners understand causal expressions in their first language. According to the dynamics model of causation (Wolff, 2007), expressions of causation based on CAUSE verbs (make, force) differ from expressions based on ENABLE verbs (let, help, allow) primarily in terms of the causee's inherent tendency toward an endstate, that is, the causee's physical or intentional inclination for a particular state of affairs. In Russian, the tendency appears to be based on internally derived forces, whereas in English, the tendency may be based on either internally or externally derived forces. In two experiments, English and Russian monolinguals and bilinguals described animations in which the causee's tendency was systematically varied. When the causee's tendency was ambiguous, English and Russian monolinguals' descriptions differed, suggesting that the causal expressions differ in meaning across languages. Of primary interest, Russian–English and English–Russian bilinguals' causal descriptions differed from those of monolingual speakers of their first language, and in the direction of the second language, even though they performed the task in the first language. This L2 → L1 transfer is explained in terms of the memory phenomenon of retrieval-induced reconsolidation.

When Russians learn English: how the semantics of causation may change

When people learn a second language, the semantic systems of their two languages can interact. One way they can interact is in the “forward” direction, as when learners assign L1 meanings to L2 words. These effects are predicted in models of bilingual memory which hold that words in the L2 are understood via translation into words in the L1 (Kroll and Stewart, 1994; Kroll and Tokowicz, 2005; Francis, 2005, *inter alia*). Less well-known – and more puzzling – are interactions in the reverse direction. Sometimes learning a second language can lead to changes in the semantic system of the first language, even when the learner continues to use his/her first language on a regular basis (Seliger and Vago, 1991; Laufer, 2003; Tsimpli, Sorace, Heycock and Filiaci, 2004; Köpke, 2007; Schmid, 2007).

There have been many reports of how learning a second language can lead to changes in the L1 at the level of individual words (Otheguy and Garcia, 1988; Athanasopoulos, 2001; Pavlenko, 2002, 2003, 2004; Ben-Rafael, 2004; Hutz, 2004; Laufer, 2003; Marian and

Kaushanskaya, 2007, *inter alia*). For example, Otheguy and Garcia (1988) describe how Cuban immigrants to the US extend the meaning of the verb *correr* “to run” to include the metaphorical meaning of running for office. Hutz (2004) describes a case study in which his informant overextended the verb *gehen* “to walk” by analogy to the verb English verb *go*, to a situation involving flying. Pavlenko (2004) reports how Russian L2 users of English used the Russian adjective for *unhappy*, *neschastlivaia*, in a situation where the unhappiness was temporary, which is acceptable in English, but not in Russian. Such studies demonstrate how learning a second language can lead to relatively local changes in the L1 lexicon.

Interestingly, however, several recent findings indicate that the effects of learning a second language may extend beyond individual words to entire classes of words. This possibility is suggested by recent studies showing that learning a second language can lead to changes in the syntax–semantic interface, that is, to the semantics that coordinates syntactic knowledge with knowledge from other domains (Gürel, 2004; Montrul, 2004; Tsimpli et al., 2004; Sorace, 2005). To the extent that the syntax–semantic interface can be changed, there can be broad-range consequences for how events in the world are described since meaning at the phrasal level involves an interaction between the meaning of the lexical terms and the semantics of the syntax (Jackendoff, 2002; Levin and Rappaport Hovav, 2005; Goldberg, 2006).

In this paper, we examine the hypothesis that changes in the syntax–semantic interface might lead to changes

* This research was supported in part by an award from the University Research Committee of Emory University, as well as by grants awarded to the first author by The University of Memphis Faculty Research Fund and ONR (N00014-01-1-0917). The conclusions of this research do not necessarily reflect those held by these funding sources. We give special thanks to Bianca Klettke and Derek Wong for their help in the research.

Address for correspondence:

Phillip Wolff, Department of Psychology, Emory University, 532 N. Kilgo Circle, Atlanta, GA 30322, USA
pwolff@emory.edu

in the way that speakers of Russian and English describe causal events. We begin by offering an account of the general notions of CAUSE and ENABLE in terms of a new theory of causation, the DYNAMICS MODEL (Wolff, 2007). We then provide an overview of how the notions of CAUSE and ENABLE are expressed in Russian and English and identify ways in which the semantics of these two languages differ; specifically, we note that Russian is more selective in the range of entities that can serve as syntactic subjects. We then propose the THE TENDENCY HYPOTHESIS, which offers an explanation of how this difference at the syntax–semantics interface interacts with the meaning of causal verbs to produce a difference in the range of situations these verbs can be used to describe; specifically, we explain how different constraints on subjects can affect whether an interaction is described with a CAUSE- or ENABLE-type verb. We then examine the potential consequences of these differences for the semantic systems of bilinguals; in particular, we investigate the possibility that differences in the syntax–semantic interface might lead to “backwards influence”. We offer an account of why such differences should lead to backwards influence by adapting recent work on the memory phenomenon of RETRIEVAL-INDUCED RECONSOLIDATION (Nader, Schafe and Le Doux, 2000; Walker, Brakefield, Hobson and Stickgold, 2003; Alberini, 2005; Forcato, Burgos, Argibay, Molina, Pedreira and Maldonado, 2007). To the extent that learning a second language can lead to changes in the syntax–semantic interface, learning a second language can lead to changes in the types of words chosen to describe causal events. These predictions are tested in two experiments involving English and Russian monolinguals and bilinguals.

The dynamics model of causal representation

The concept of CAUSE has been frequently treated as a semantic primitive in both the linguistic literature (Dowty, 1979; Pinker, 1989; Jackendoff, 1990; Pustejovsky, 1991; Levin and Rappaport Hovav, 1995) and the psychological literature (e.g., Schank, 1972; Gentner, 1975; Norman, Rumelhart and the LNR Research Group, 1975; Miller and Johnson-Laird, 1976). However, recent work in psychology, linguistics, philosophy, and artificial intelligence suggests that the concept of CAUSE is a composite (for a review, see Wolff, 2007). The dynamics model, which is based on Talmy’s (1988) theory of force dynamics, provides a new account of how the concept of CAUSE might be decomposed.

Everyday language suggests that we think about causal relations in terms of force. We say, for example, *The force of his argument changed my mind*, or *Peer pressure led my son to skip class*. The DYNAMICS MODEL is an account of how people might interpret and represent

Table 1. *Representations of CAUSE, ENABLE and PREVENT in the dynamics model (Wolff, 2007).*

	Patient tendency for endstate	Affector– patient concordance	Result: endstate approached
CAUSE	N	N	Y
ENABLE	Y	Y	Y
PREVENT	Y	N	N

Y = Yes, N = No

causal relationships (Wolff, 2003, 2007; Wolff, Song and Driscoll, 2002; Wolff and Song, 2003; Wolff, Klettke, Ventura and Song, 2005). It assumes that people represent causal relations in a manner that partially copies, or reproduces, the way in which causal relationships are instantiated in the world. Specifically, the dynamics model holds that people represent causal relationships in terms of configurations of forces.

The sentences in 1, which describe static situations, provide further intuitive support for this view. In each situation described in sentences (1a–d), nothing happens. Because nothing happens, there is no regular sequence of events or transfer or exchange of energy, at least at the macro-level. Rather, what is present in each of these situations is a configuration of forces. According to the dynamics model, it is this configuration of forces that makes these situations causal.

- (1) a. Inertia causes the weighted pen to remain motionless.
- b. Air pockets cause the cork to remain on top of the water.
- c. Dirt caused the valve to remain open.
- d. Natural conforming tendencies in the putty cause it to stay in place.

From a force dynamic perspective, the concept of CAUSE is one member of a family of concepts that also includes the concepts of ENABLE and PREVENT, among others. Each of these concepts represents an interaction between an AFFECTOR and a PATIENT (the entity acted on by the affector). As outlined in Wolff and Song (2003), different causal concepts can be distinguished with respect to three main dimensions. Specifically, as summarized in Table 1, the concepts of CAUSE, ENABLE, and PREVENT can be captured in terms of (i) the TENDENCY of the patient for a result, (ii) the presence or absence of CONCORDANCE between the affector and the patient, and (iii) PROGRESS TOWARD A RESULT. A patient’s tendency toward the endstate is loosely defined as a physical or

intentional inclination for a particular result. For example, objects tend to fall when they are knocked off shelves and people tend to drink when they are thirsty. Affector–patient concordance is defined as present when the actions of the affector facilitate, or at least do not oppose, the tendency of the patient. Finally, a patient will progress towards a result when the resultant force that is produced by the interaction of the patient and affector pushes the patient towards a particular result.

The semantics of these three dimensions is illustrated by the sentences in (2) below. Consider the example of causation in (2a). In this sentence, the patient (the tree) does not have a tendency for the endstate (falling down). The affector (high wind) is not in concordance with the patient and the result occurs. In enabling situations, as in (2b), the tendency of the patient (the bridge) is for the result (to hold weight). The affector (steel reinforcements) does not oppose the patient but rather facilitates the patient, and the result occurs. In preventing situations, as in (2c), the patient (the containers) has a tendency for the result (falling off the truck). The affector (the chains) opposes the tendency of the patient and the result does not occur.

- (2) a. High winds caused the tree to fall down.
 b. Steel reinforcements enabled bridge to hold more weight.
 c. Chains prevented the containers from falling off the truck.

The dynamics model makes a number of predictions. For example, it predicts that the concepts of CAUSE, ENABLE and PREVENT should be similar to each other in meaning since each concept shares one feature in common with each other concept: CAUSE and ENABLE both specify progress towards the endstate; ENABLE and PREVENT both specify patients with a tendency for the endstate; CAUSE and PREVENT both specify a lack of concordance. Wolff and Song (2003) tested the equal-similarity prediction by asking participants to sort twenty-three verbs expressing various kinds of causation into piles according to their similarity to one another. Multidimensional scaling indicated that these verbs fell into the three major categories: a CAUSE category (e.g., *cause, force, get*), an ENABLE category (e.g., *allow, enable, help*), and a PREVENT category (e.g., *block, prevent, stop*). Importantly, the verb clusters associated with each of these concepts were roughly equidistant from one another, just as predicted by the theory. The dynamics theory has also been tested and supported in a series of experiments in which people described animations generated from a physics simulator that instantiated the patterns of physical forces hypothesized for each causal concept (see Wolff and Zettergren, 2002; Wolff, 2007).

Expressions of causation in Russian and English

The dynamics model provides a set of distinctions for understanding the meanings of various causal expressions. Here we focus on the semantics of a particular kind of causal expression, PERIPHRASTIC CAUSATIVE CONSTRUCTIONS (Baron 1977; Cole 1983; Radford 1988; Kozinsky and Polinsky 1993; Helms-Park, 2001; Wolff, 2003; Song and Wolff, 2005). Periphrastic causative constructions are two-clause expressions that encode the notions of CAUSE and RESULT in different clauses. For example, in the periphrastic causative construction in (3), the main (matrix) verb (i.e. *caused*) expresses the notion of CAUSE while the embedded verb (i.e. *open*) expresses the particular RESULT.¹

- (3) Alison caused the door to open.

Periphrastic causative constructions name two participants: the affector and the patient. In (3), the affector would be Alison and the patient, the door. In the literature on causative expressions, the affector is often referred to as the CAUSE and the patient as the CAUSEE. We will use these two sets of terms interchangeably.

In English, there are approximately 50 verbs that can appear as the matrix verb in a periphrastic causative construction (Wolff and Song, 2003). Several studies have shown that these matrix verbs fall into the three basic categories of causation posited by the force dynamic model: CAUSE-type verbs (see (4a)), PREVENT-type verbs, (4b), and ENABLE-type verbs, (4c) (Wolff et al., 2002; Wolff and Song, 2003).

- (4) a. bribe (n/a), cause (vyzyvat'), compel (prinuzhdat'), convince (ubezhdat'), drive (n/a), have (n/a), impel (pobuzhdat'), incite (podstrekat'), induce (pobuzhdat'), influence (vliiat'), inspire (vdokhnovliat'), lead (pobuzhdat'), move (pobuzhdat'), persuade (ugovarivat'), prompt (vyzyvat'), push

¹ Periphrastic causatives are often contrasted with lexical causatives, that is, expressions of causation in which the notions of CAUSE and RESULT are encoded within a single clause (e.g., *Alison opened the door*). It is well known that lexical and periphrastic causatives differ in meaning (for a review, see Wolff, 2003). Whereas periphrastic causatives can be applied to causation that is either direct or indirect, lexical causatives are restricted to direct causation (e.g., Shibatani, 1976; Dowty, 1979; Comrie, 1985; Wierzbicka, 1988; Pinker, 1989; Levin and Rappaport Hovav, 1994; Helms-Park, 2001; Wolff, 2003, among others). For example, the meaning of the periphrastic causative in (3) is compatible with a situation where Alison opened a window, allowing a breeze to enter a room which then pushed the door open. The meaning of the associated lexical causative, *Alison opened the door*, is not compatible with this scenario. While the distinction between direct and indirect causation is fascinating and not yet fully understood, it will not be the focus of this paper.

- (podtalkivat'), force (vynuzhdat'), get (n/a), make (zastavliat'), rouse (podnimat'), send (otpravliat'), set (n/a), spur (pobuzhdat'), start (n/a), stimulate (stimulirovat')
- b. bar (pregrazhdat'), block (pregrazhdat'), constrain (stesniat'), deter (sderzhivat'), discourage (otgovarivat'), dissuade (otgovarivat'), hamper (zatrudniat'), hinder (meshat'), hold (zaderzhivat'), impede (prepiatstvovat'), keep (n/a), prevent (predotvrashchat'), protect (predokhraniat'), restrain (sderzhivat'), restrict (ogranichivat'), save (spasat'), stop (uderzhivat')
- c. aid (pomogat'), allow (pozvoliat'), enable (davati vozmozhnost'), help (pomogat'), leave (ostavliat'), let (pozvoliat'), permit (razreshat')

Periphrastic causative constructions are also available in Russian. Rough translations of many of the verbs are provided in (4). Here, we focus on the rough translations of CAUSE and ENABLE verbs. In the case of CAUSE verbs, the closest translation of the verb *make* is *zastavit'*, and the closest translation of the verb *force* is *vynudit'*, though the verb *force* can also be translated with the verb *zastavit'* (Katzner, 1994; Wheeler, Falla and Unbegaun, 1995). Example sentences using these two verbs are shown in (5).

- (5) a. Petr zastavil Shilu rassmeiat'sia.
Peter.NOM made Sheila.ACC laugh
"Peter made Sheila laugh."
- b. Nachal'nik vynudil sekretarshu porezat'
boss.NOM forced secretary.ACC shred
dokumenty.
documents
"The boss forced the secretary to shred the documents."

The closest translation for the verb *cause* is, perhaps, *vyzvat'*. However, unlike the other CAUSE verbs, *vyzvat'* cannot be used as the matrix verb in a periphrastic causative expression, but rather is restricted to mono-clausal situations, as in (6).

- (6) a. Rech' vyzvala burnuiu diskussiu.
speech.NOM caused vivid discussion.ACC
"The speech caused a vivid discussion."
- b. Zemletresenie vyzvalo bol'shye kolichestvo
earthquake.NOM caused big amount.ACC
razruhenii.
of.destructions
"The earthquake caused widespread destruction."

Russian also has rough translations of several English ENABLE verbs. The verbs *allow* and *let* are most closely translated by the verb *pozvolit'*. The closest translation

of the verb *enable* is the verb phrase *dat' vozmozhnost'*, which means "to give an opportunity". The closest translations of the verbs *help* and *permit* are *pomoch'* and *razreshit'*, respectively (Katzner, 1994; Wheeler et al., 1995).² Periphrastic causative constructions using ENABLE verbs are shown in (7).

- (7) a. Andrei dal vozmozhnost' Stepanu
Andrei.NOM enabled Stephen.DAT
prodat' mashynu.
sell car
"Andrei enabled Stephen to sell the car."
- b. Ego zhenia pozvolila Petru bistro
his wife.NOM allowed Peter.DAT quickly
podniat'sia po posluzhnoi lestnitse.
rise up work ladder
"His wife allowed Peter to rise quickly through the ranks."
- c. Ivan pomog Tane vovremia
Ivan.NOM helped Tanya.DAT on.time
zakonchit' ee domashniuu rabotu.
finish her home work
"Ivan helped Tanya to finish her homework on time."

Syntactic subjects in Russian and English

As shown above, many of the English periphrastic causative verbs have rough translations in Russian. In both languages, according to the dynamics model, the key difference between ENABLE and CAUSE constructions concerns whether or not the patient (or causee) has a tendency for the result. However, a careful examination of these causal constructions in the two languages reveals that the translations do not always refer to the same range of situations, as will be shown below. We suggest that this difference in semantics might be traced to a broader cross-linguistic difference in the types of entities that can appear in subject position.

According to Guilfoyle (2000), there may be at least two kinds of languages with respect to permissible subjects (but see Alexiadou and Schäfer, 2006). Type A languages (like Dutch and Irish) restrict the subject position to entities that can initiate events. Practically

² It should be noted that the meanings of the verb *pozvolit'* "allow"/"let" and the verb phrase *dat' vozmozhnost'* "enable" on the one hand differ significantly from the meaning of the verb *pomoch'* "help" on the other. The first two imply that the result would not occur without the intervention of the affector while the third implies that the outcome could occur without the intervention of the affector. Nevertheless, in all of these ENABLE cases, the patient has a tendency for the result and the outcome occurs, so with respect to their force dynamics patterns, these verbs belong to the same category (see Wolff, 2007).

speaking, subjects in Type A languages tend to be sentient, or at least “self-energetic”. Type B languages (like English) allow for a greater range of entities, including entities that not only initiate events but also merely participate in them. For example, one of the hallmarks of Type B languages is that they allow for so-called INSTRUMENT SUBJECTS (e.g., *the knife* in *The knife cut the bread*) while Type A languages do not. On the basis of this diagnostic, we suggest that Russian is a Type A language. As noted by Comrie (1981, p. 72–73), Russian is more restricted in its use of non-agentive subjects than is English. In support of this hypothesis, none of the sentences in (8), all of which include instrument subjects and are acceptable in English, can be directly translated into Russian.

- (8) a. The knife cut the bread.
 *Nozh razrezal hleb.
 knife.NOM cut bread.ACC
- b. The key locked the door.
 *Kliuch zakryl dver'.
 key.NOM locked door.ACC
- c. The corkscrew opened the bottle.
 *Shtopor otkryl butylku.
 corkscrew.NOM opened bottle.ACC
- d. The bullet killed the president.
 *Pulia ubila prezidenta.
 bullet.NOM killed president.ACC

Non-agentive subjects are sometimes acceptable in Russian, but they generally need to be natural forces that do, in fact, generate their own energy, as exemplified in (9).

- (9) a. The forest fire destroyed the village.
 Lesnoi pozhar razrushyl derevniu.
 forest fire.NOM destroyed village.ACC
- b. The hurricane knocked down the trees.
 Uragan perevernul derev'ia
 hurricane.NOM knocked.down trees.ACC

This restriction on subjects should, in principle, extend to the main and embedded subjects of periphrastic causatives. Consistent with this prediction, when the causer in a periphrastic causative construction is non-sentient, the construction cannot be directly translated into Russian even though it is fully acceptable in English, as in (10).

- (10) The siren forced Jerry to leave the room.
 *Sirena vynudila Dzherri pokinut' komnatu.
 siren.NOM forced Jerry.ACC leave room

Similarly, when the causee in a periphrastic causative construction is non-sentient, the construction cannot be

translated into Russian either, even though it is fully acceptable in English, as in (11).³

- (11) a. peter made the car move by pressing the accelerator.
 *Petr zastavil mashinu sdvinut'sia
 Peter.NOM made car.ACC move
 s mesta nazhav pedal' gaza.
 from place having.pressed pedal gas
- b. Kathy caused the rock to fall.
 *Katia zastavila kamen' upast'.
 Kathy.NOM made rock.ACC fall

Occasionally, causers in a Russian periphrastic causative construction can be inanimate, but again, such exceptions appear to be limited to natural forces which are, by definition, capable of self-initiation, as in (12) and (13), respectively.

- (12) The forest fire forced the people to leave their homes.
 Lesnoi pozhar vynudil liudei pokinut'
 forest fire.NOM forced people.ACC leave
 ih doma.
 their homes
- (13) The storm made people stay in the building.
 Shtorm zastavil liudei ostavat'sia v
 storm.NOM made people.ACC stay in
 pomeshchenii.
 building

³ Acceptable Russian translations of the sentences in (10) and (11) would most likely include a causal conjunctive or preposition (e.g., *because, because of*; see Comrie, 1981, pp. 72–73), as in the following:

- (i) Jerry left the room because of the siren.
 Dzherri pokinul komnat-u iz-za zvuk-a siren-y.
 Jerry.NOM left.PAST room.ACC because.of sound.GEN siren.GEN
- (ii) The car moved because Peter pressed the accelerator.
 Mashyna sdvinulas' s mest-a potomy chto Petr
 car.NOM moved.PAST from place.GEN because what Peter.NOM
 nazhal pedal' gaza.
 pressed.PAST pedal.ACC gas.GEN

In English, several periphrastic causative CAUSE verbs are restricted to interactions between two people as well, such as *incite* or *persuade*. The Russian verbs *vynudit'* and *zastavit'*, however, do not have the same meaning as *incite* or *persuade*. For example, if I “persuaded” someone to leave the room, it is not necessarily the case that they did so; rather, the verb implies only that, because of something I said or did, the person now intended to leave the room. A change in intention can occur without the intended event actually occurring. In contrast, the Russian verbs *vynudit'* and *zastavit'* imply that the event actually occurs, but not that the person’s intention was changed. So, for example, if we said *Ja zastavil Petra vyiti iz komnaty* “I made Peter leave the room”, the implication would be that Peter left the room, probably against his will.

The Russian restriction on subjects applies to ENABLE constructions as well. As illustrated in (14), non-sentient causees in ENABLE constructions are acceptable in English but not in Russian.⁴

- (14) a. Hillary allowed the boat to turn into the wind.
 *Hillary pozvolila lodke povernut'sia
 Hillary.NOM allowed boat.DAT turn
 po vetru.
 into wind
- b. Nathaniel allowed the fire to char the wood.
 *Nataniel pozvolil ognju obuglit'
 Nathaniel.NOM let fire.DAT char
 drevesinu.
 wood
- c. Roger enabled the grass to grow (by adding fertilizer).
 *Rodzher dal vozmozhnost' trave
 Roger.NOM enabled grass.DAT
 rasti (dobaviv udobrenie).
 grow having.added fertilizer

The tendency hypothesis: how English and Russian causal expressions differ in meaning

According to what we will call the tendency hypothesis, semantic constraints regulating the distribution of subjects affect how causal situations are described and understood. In Russian, subjects appear to be restricted to entities that are sentient or self-energetic. This restriction may lead Russian speakers to focus on forces that are generated from within the cause or causee, such as the force generated by a car engine or the force initiated by a person's intention. In English, speakers may look for, and take into account, not only forces internal to the cause or causee but also other, external forces that may be present, for example, gravity, friction, or natural forces such as the wind. Since a periphrastic causative construction includes two subjects, restrictions on the subject can have consequences for both the cause and causee in such constructions. In Russian, the periphrastic causative construction may be limited to situations in which the actions of the causee are driven by forces that are internal to the causee, while in English the periphrastic construction may be used to describe situations in which the actions of the causee are driven by forces that are

either internal or external to the causee. For example, in the sentence *John caused Mary to break the window*, the actions of the causee are those of Mary. According to the tendency hypothesis, a Russian translation of this sentence would imply that the act of breaking the window was generated by Mary. In English, this sentence might have this reading, but it could also mean that Mary's actions were due to an external force, such as John's pushing her into the window. We do not mean to imply that Russian speakers are insensitive to external forces; rather, that such forces are not considered when evaluating the forces associated with the cause and causee in a periphrastic causative construction, and by extension, the tendency of the causee.

The difference in meaning between internal and external causation is roughly captured by the difference in the meanings of the verb *cause* on the one hand and the verbs *make* and *force* on the other. In English, these verbs seem to differ somewhat in the extent to which external forces are considered when determining patient tendency. More specifically, we suggest that *make* and *force* are used to describe situations in which internal forces are given more weight; *cause* seems more appropriate for situations in which external forces also come into play. To illustrate, imagine a man suspended over a pool of water, a woman cuts a rope, and the man falls into the pool. We could say *The woman caused the man to fall into the pool*, but it sounds somewhat odd to say *The woman made the man fall into the pool* or *The woman forced the man to fall into the pool*. We suggest that *cause* is more appropriate in this case because the man's tendency to fall into the pool is completely due to the external force of gravity.

In Russian, it would be very odd to say *The woman made the man fall into the pool* (*Zhenshchina zastavila muzhchinu upast' v bassein*) or *The woman forced the man to fall into the pool* (*Zhenshchina vynudila muzhchinu upast' v bassein*). Moreover, the equivalent of *The woman caused the man to fall into the pool* is not available in Russian. As noted above, the verb for *cause* in Russian, *vyzvat'*, cannot be used as the matrix verb in a periphrastic causative expression. According to the tendency hypothesis, this is because the tendency of the patient in a periphrastic causative construction in Russian is based on internal forces only, and as just noted above, the verb *cause* is used when external forces are seen to be involved. Probably the nearest translation of a periphrastic causative construction containing the verb *cause* would be a bi-clausal sentence with a causal conjunctive such as *because* as in *The man fell into the pool because the woman cut the rope* (*Muzhchina upal v bassein potomy chto zhenshchina pererezala verevku*).⁵

⁴ In certain cases, periphrastic causative constructions with non-sentient causees can be translated directly into Russian (e.g., *Mary allowed the paint to dry*; *Nathaniel let the ice melt*). These sentences do not necessarily represent exceptions to the Russian restriction on subjects because the embedded clauses contain unaccusative verbs. According to Perlmutter's Unaccusative Hypothesis, the surface subject of an unaccusative verb is an underlying object (Perlmutter, 1978), and objects are not expected to be restricted in the same way as subjects.

⁵ Causal conjunctives like *because* do not specify the tendency of the patient (Wolff et al., 2005) and so can be used to describe both CAUSE and ENBLE relations. For example, if we say *There is a hole in the*

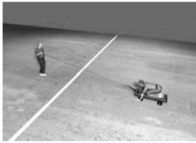

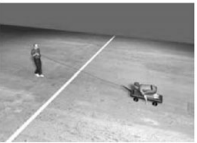
	CAUSE	INTERMEDIATE	ENABLE
	Patient opposes affector	Patient does nothing	Patient pushes along with affector
			
Tendency	No	?	Yes
Opposition	Yes	?	No
Result	Yes	Yes	Yes

Figure 1. Properties that distinguish different kinds of causal interactions associated with the stimulus materials used in Experiment 1.

An interesting consequence of the tendency hypothesis is that Russian and English speakers may differ in the range of situations they describe as causal as opposed to enabling. Importantly, we propose that this difference is not due to differences in the meaning of CAUSE and ENABLE verbs in the two languages, but rather to the way the meanings of these verbs interact with the semantics of subjects in the two languages. To sum up, we propose that the types of subjects that are permissible in subject position may lead speakers to take into account different aspects of experience – internal or external forces – when determining how causal events are described.

Testing for differences in causal description

The tendency hypothesis makes predictions for how speakers of English and Russian will describe causal interactions. Consider the series of situations depicted in Figure 1. In each panel, a man holds a rope and pulls another man on a dolly across a line. In the panel on the far left, the man on the dolly resists by pushing the dolly backwards. According to the dynamics model, speakers of English should describe this interaction with a construction containing a CAUSE verb because the man on the dolly does not have a tendency for the result, the man pulling the rope opposes that tendency, and the result (crossing the line) occurs. Russian speakers should describe the situation in the same way: they should also view the patient as not having a tendency for the result because the force he is generating is directed away from the line.

In the panel on the far right, the man on the dolly pushes himself toward the line. The dynamics model predicts that English speakers should describe this interaction with a construction containing an ENABLE verb because, unlike in the first panel, the man on the dolly has a tendency for

the result. Russian speakers are also expected to describe the scenario with an ENABLE verb because the tendency of the patient can be seen to be internally generated.

In the middle panel, the man on the dolly simply sits there. From an English speaker’s perspective, the tendency of the man is potentially ambiguous. On the one hand, it might appear that he intends to cross the line since he is facing in the direction of the line. On the other hand, the dolly is physically difficult to pull and the man is only adding more weight to it, so there is no physical tendency to cross the line. According to the tendency hypothesis, English speakers viewing this scene could consider either the internal, or psychological, forces (i.e., the man’s intentions) or the external, or physical, forces (i.e., friction). Depending on their focus, they could use either CAUSE or ENABLE to describe this situation. Russian speakers, in contrast, should focus on the forces internal to the man and, given the direction he is facing, should prefer to describe this situation with an ENABLE construction.

Consequences for the second language learner

Cross-linguistic differences in the semantics of subjects could lead to changes in the way second language learners describe causal events in their first language. Before describing how such effects might be manifested in the responses to the scenes in Figure 1, we will offer an account of why such influences might be expected to occur.

As described above, it is predicted that English and Russian monolingual speakers will differ in how they describe causal events and that this difference can be traced to a difference in the syntax–semantic interface of the two languages. The possibility that learning a second language might lead to changes in how a speaker describes causal events is supported by recent work showing that semantic criteria at the syntax–semantics interface can undergo change in the course of learning a second language. Such changes are exemplified by losses in the pragmatic principles licensing null subjects

screen because the boy tripped over the cat, the implication is that the boy caused the hole. In contrast, if we say, *The man made it to the meeting on time because the lights turned on time*, the implication is that the lights enabled the man to make it to the meeting on time.

in Greek and Italian (Tsimpli et al., 2004), changes in the morpho-semantic knowledge that guides the encoding of grammatical aspect in Spanish (Montrul, 2004), and changes in the grammatical knowledge that governs pronominal binding in Turkish (Gürel, 2004).

From a psychological perspective, this phenomenon of L2→L1 influence is supported by recent work on memory with respect to the phenomenon of RETRIEVAL-INDUCED RECONSOLIDATION (Nader, Schafe and Le Doux, 2000; Walker et al., 2003; Alberini, 2005; Forcato et al., 2007).⁶ The basic idea in retrieval-induced reconsolidation is that reactivation of a consolidated memory can result in memory traces becoming temporarily labile and susceptible to editing and modification. The phenomenon was elegantly demonstrated in a study by Walker et al. (2003). Their study took place over three days. On day 1, participants in one condition learned a repeating five-element sequence that they typed out on a keyboard. On day 2, the same participants learned a different five-element sequence. On day 3, their memory for the first sequence was tested. The results showed that participants' memory for the first sequence on day 3 suffered no interference from the second sequence (and actually improved). A very different pattern was observed in the second condition. On days 1 and 2, participants in this condition also learned two five-element sequences. The key difference was that on day 2, the participants briefly practiced the sequence from day 1 before learning the second sequence. On day 3, their performance on sequence 1 fell dramatically. The brief practice on day 2 apparently reactivated the memory for sequence 1 and rendered it susceptible to interference from the second sequence. A similar set of findings was observed in Forcato et al. (2007) with respect to items in declarative (as opposed to procedural) memory.

In the context of second language learning, the implication of retrieval-induced reconsolidation is that the first language may be susceptible to change when elements in the L2 reactivate their analogs in the L1. It is interesting to note that retrieval-induced reconsolidation may be limited to direct (as opposed to indirect) reactivations of a memory trace. Memories that are merely associated with the memories being reactivated do not appear to become vulnerable to disruption or change (Debiec, Doyère, Nader and LeDoux, 2006). Extending this finding to second language learning, it may be that the phenomenon of retrieval-induced reconsolidation is restricted to highly similar elements in the L1 and L2. Indeed, as noted by several researchers, similarity between L1 and L2 structures may be a necessary condition for the first language to have an effect on the second (Altenberg, 1991; Isurin, 2000; Köpke, 2004, 2007).

⁶ The term, retrieval-induced reconsolidation, is our label for a phenomenon described in a number of recent papers.

As discussed above, Russian appears to be more selective than English in the range of entities that can serve as syntactic subjects. In particular, in Russian, subjects may be restricted to entities that can generate internal forces while in English, the forces may be either internal or external. A native speaker of Russian learning English will, of course, produce and comprehend an innumerable number of expressions containing subjects. The grammatical role of subject in Russian is likely to be (implicitly) perceived as highly similar to the grammatical role of subject in English. In learning English, then, speakers of Russian may reactivate the semantic criteria associated with subjects in Russian. According to the mechanism of retrieval-induced reconsolidation, reactivation of these criteria will make them susceptible to modification. Over time, these criteria might change in a manner that makes them more like those in English; specifically, over time, the semantic conditions regulating subjects in Russian might be extended to include entities that act on other entities by virtue of external forces. Once the criteria for subjects change, the way Russian bilinguals describe causal situations will likely change as well. In particular, Russian bilinguals should be more likely than Russian monolinguals to describe ambiguous situations (like the one depicted in the middle panel of Figure 1) with a CAUSE construction. This prediction, along with the predictions derived for English and Russian monolinguals, was tested in the experiment described in the following section.

Experiment 1

Russian monolinguals, English monolinguals, and Russian–English (L1 = Russian) bilinguals viewed and described the 3D animations depicted in Figure 1. We predicted that all groups would describe the animations at the far left and far right with a CAUSE verb (*make/zastavit'*) and an ENABLE verb (*let/pozvolit'*), respectively. For the intermediate animation, we predicted that English monolinguals would prefer *make/zastavit'* while Russian monolinguals would prefer *let/pozvolit'*. Finally, we predicted that Russian bilinguals would differ from the Russian monolinguals in the direction of the English monolinguals, even when describing the animations in Russian.

Methods

Participants

The participants were 16 English monolinguals attending the University of Memphis, 16 Russian monolinguals (11 living in Moscow and 5 living in Memphis), and 16 Russian–English bilinguals (L1 = Russian; 14 living in San Francisco and 2 living in Memphis). Russian monolinguals and Russian–English bilinguals

Table 2. Characteristics of the Russian monolinguals that participated in Experiment 1.

Participant	Gender	Russian reading	Russian speaking	English reading	English speaking	Age	English learning age	Years in the US
A.B.	F	9	10	1	1	64	0	0.33
A.S.	M	8	0	0	0	45	10	0
A.Z.	M	9	9	1	1	32	10	0.75
E.I.	F	9	10	0	1	31	9	0
G.A.	F	8	10	0	0	65	10	0
G.B.	M	9	10	1	1	65	10	0.33
G.P.	F	9	10	1	1	58	10	0
I.K.	M	9	10	1	0	46	9	0
I.P.	M	10	10	1	1	60	9	0
K.U.	M	9	10	0	0	51	10	0
M.T.	F	9	10	1	1	30	9	0
N.G.	M	8	9	1	1	33	10	0.58
N.K.	F	8	9	1	1	30	10	0.50
S.S.	F	8	0	0	0	68	10	0
T.P.	F	9	10	0	0	64	9	0
V.B.	M	10	10	1	0	62	9	0

rated themselves on their ability to read English, speak English, read Russian and speak Russian on a 0–10 point scale. On this scale, 0 designated extremely low and 10, extremely high. Participants also indicated their gender, current age, the age at which they began to learn English in school, the number of years they had been in the United States and their highest degree obtained.

Table 2 lists the information provided by the Russian monolinguals. Fifty percent of the participants were male. The mean age was 50.25. All of the participants had at least a Bachelor's degree and had lived their entire life in Russia, except for five individuals who had just moved to Memphis (see below). The participants' exposure to English was very limited. It is a common requirement in Russia that schoolchildren study a foreign language for at least four years, usually English. Instruction begins in the fourth grade and involves language courses that meet twice a week for 45 minutes. The instruction is geared towards reading comprehension rather than verbal or written communication. There is no foreign language requirement in college, unless it is the person's major, or the student is in the Arts and Sciences and is working towards his/her Ph.D. Given that the average age was 50, the average number of years after receiving limited exposure to English was 37 years. As shown in Table 2, all of the Russian monolinguals described their ability to read and speak in English as extremely low. The monolingual Russians were friends and relatives of the second author's grandparents.

Five of the Russian monolinguals had recently moved to Memphis. These participants had a mean age of

44.8 years and had been in the United States for between four and nine months. None of the participants had used English since 13 years of age. The participants did not have sufficient English skills to be employed in the US. Three of the participants were stay-at-home wives or mothers. The remaining participants, both men who were 64 and 65 years of age, moved to the US to help their children. Their exposure to English was quite limited: at home they spoke in Russian, watched Russian news channels on TV, and bought groceries at the local ethnic food store. All five participants rated their English skills as extremely low. It is for these reasons that these participants were classified as monolinguals.

The average age of the Russian bilinguals was 38.56 years old. Fifty-six percent were male. The majority of the bilinguals lived in a Russian-speaking community where they spoke Russian everyday but also had jobs (mostly programming) where they used English. None of the bilinguals began learning English before the age of 8 years. Their average number of years in the US was 6.89. Their average self-rated English reading and speaking ability was 7.5, and their average self-rated Russian reading and speaking ability was 9.2. Table 3 lists the information provided by the Russian bilinguals. The bilinguals' self-ratings suggest that they were fluent or near-fluent in both English and Russian.

Materials

The materials were the three animations depicted in Figure 1. The animations were approximately 300 frames in length and ran at 30 frames/second (approximately

Table 3. Characteristics of the Russian–English bilinguals that participated in Experiment 1.

Participant	Gender	Russian reading	Russian speaking	English reading	English speaking	Age	English learning age	Years in the US
D.A.	M	9	10	7	9	33	9	6
E.K.	F	10	10	8	8	52	10	7
G.K.	M	8	10	7	7	35	9	6
I.P.	F	9	10	7	7	37	10	10
M.K.	M	8	9	7	7	36	10	6
M.P.	M	9	10	7	8	40	8	10
M.V.	F	9	10	7	8	37	10	6
N.C.	F	8	9	7	7	37	10	6
N.G.	M	9	10	7	8	36	10	7
N.K.	F	10	10	7	8	49	10	6
N.M.	M	9	10	7	8	32	9	5
N.U.	M	8	9	7	6	54	10	7
P.S.	M	9	10	8	9	35	8	7
R.A.	F	8	10	8	9	32	9	8
T.I.	F	8	10	7	8	36	10	6
V.G.	M	8	10	8	8	36	9	7

10 seconds long). The animations were made with an animation package called Discreet 3D Studio Max version 4. The sentences in English used the CAUSE verb *make* and the ENABLE verb *let*. The Russian sentences used rough translations of these two verbs: *zastavit* ‘make’ and *pozvolit* ‘let/allow’.

Procedure

The animations were presented in random order on Windows-based computers. After each animation, participants chose which one of two sentences best described the animation. Specifically, English speakers chose from the sentences *The man in red made the man in green cross the line* and *The man in red let the man in green cross the line* while Russians (monolinguals and bilinguals) chose from the rough translations of these sentences, *Мужчина в красной рубашке заставил мужчину в зеленой рубашке пересечь линию* and *Мужчина в красной рубашке позволил мужчине в зеленой рубашке пересечь линию*. If participants felt that neither sentence described the scene, they could choose the option ‘none of the above’ (=‘Ни одно из выше указанных’). Participants indicated their answers by clicking a radio button next to their choice.

The English monolinguals were tested in a lab setting at the University of Memphis. In contrast, the Russian monolinguals and bilinguals were tested in a home setting by the second author. In the case of the Russian bilinguals in particular, the entire experiment was conducted in Russian and began with an extended conversation in

Table 4. Proportion of times the CAUSE and ENABLE sentences were chosen for the two ends of the CAUSE–ENABLE series in Experiment 1 along with associated standard errors of the mean.

		CAUSE	ENABLE
Verb type		Patient opposes affector	Efforts of patient and affector are concordant
English monolinguals	CAUSE	.94 (.062)	.13 (.062)
	ENABLE	.06 (.085)	.56 (.128)
Russian monolinguals	CAUSE	.75 (.112)	.06 (.062)
	ENABLE	.25 (.112)	.81 (.101)
Russian bilinguals	CAUSE	.69 (.120)	.13 (.085)
	ENABLE	.06 (.062)	.56 (.128)

Russian to assure that the bilingual was in a Russian ‘mode’ (Grosjean, 2001).

Results and discussion

The results were consistent with the predictions. As shown in Table 4, when the patient clearly did not have a tendency for the result, English and Russian mono- and bilinguals used the CAUSE verb. When the patient clearly did have a tendency for the result, all participants used the ENABLE verb. Thus, the situations that were predicted to

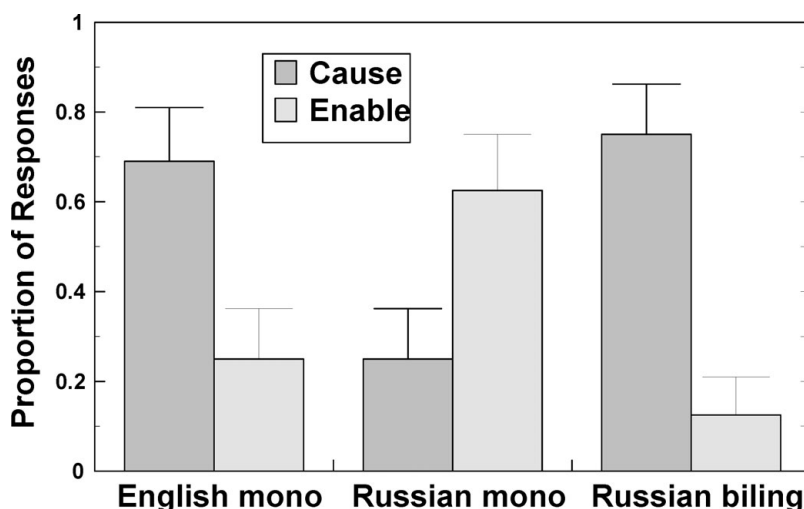


Figure 2. Proportion of times the CAUSE and ENABLE sentences were chosen for the intermediate animation with associated standard errors of the mean in Experiment 1.

elicit similar descriptions from the speakers of all three language groups did just that.

Of primary interest was how the speakers of each group would describe the intermediate situations, in which the tendency of the patient was unclear and the patient showed no sign of being able to accomplish the event on his own (see Figure 2). For these scenes, monolingual English speakers used a CAUSE verb while monolingual Russian speakers used an ENABLE verb. Most interestingly, the Russian–English bilinguals patterned like monolingual English speakers despite the fact that they performed the task in Russian. Specifically, Russian–English bilinguals described the intermediate scene with an ENABLE verb, consistent with the hypothesis that learning a second language can lead to changes in the syntax–semantic interface in the first language.

The conclusions described above were supported by analysis of variance. Participants were more likely to use a CAUSE verb (*make/zastavit'*) for the animation in which the patient pushed away from the endstate ($M = .79$, $SD = .410$) than for the animation in which the patient pushed toward the endstate ($M = .15$, $SD = .357$), $F(1,45) = 44.63$, $p < .005$. Focusing still on participants' CAUSE descriptions, there was an unpredicted overall effect of language group, $F(2,45) = 3.316$, $p < .045$; however, Bonferroni post-hoc tests failed to show any significant differences between any two language groups. The interaction between language group and scene type (CAUSE vs. ENABLE) was also non-significant, $F(2,45) = .882$, $p = .421$. A similar pattern of results was obtained when considering participants' use of the ENABLE verb, *let/pozvolit'*. Participants were more likely to use an ENABLE verb for the animation in which the patient pushed toward the endstate ($M = .64$, $SD = .483$) than for the animation in which the patient pushed away

from the endstate ($M = .13$, $SD = .334$), $F(1,45) = 42.04$, $p < .005$. No other effects were significant for the animations at the ends of the CAUSE–ENABLE series.

While the three language groups responded similarly to situations where the patient pushed away from or towards the endstate, differences emerged with respect to the intermediate situation, in which the patient simply sat on the dolly. Figure 2 shows the proportion of times that English and Russian monolinguals and Russian–English bilinguals chose the CAUSE and ENABLE sentences for this animation.

Participants' use of CAUSE descriptions differed across the language groups, $F(2,45) = 72.42$, $p < .005$. Planned comparisons revealed that English monolinguals ($M = .69$, $SD = .479$) were more likely than Russian monolinguals ($M = .25$, $SD = .447$) to describe the intermediate situation with a CAUSE description, $p = .01$. This difference supports the hypothesis that the verbs *make* and *zastavit'* differ in the range of situations they can describe. Similarly, participants' use of ENABLE descriptions differed across the language groups, $F(2,45) = 28.23$, $p < .01$. Planned comparisons revealed that Russian monolinguals ($M = .63$, $SD = .500$) were more likely than English monolinguals ($M = .25$, $SD = .447$) to describe the intermediate situation with an ENABLE description, $p = .019$. This difference supports the hypothesis that the verbs *let* and *pozvolit'* also differ in the range of situations that they can describe.

Having established that speakers of Russian and English differ in their descriptions of causal situations, we turn to the question of whether learning a second language affected the bilinguals' descriptions of causation in their first language. Indeed, as predicted, planned comparisons indicated that the Russian bilinguals ($M = .75$, $SD = .447$) were more likely than Russian monolinguals to describe

the intermediate animation with the CAUSE sentence, $p = .003$. Planned comparisons also indicated that Russian bilinguals ($M = .12$, $SD = .342$) were less likely than Russian monolinguals to describe the intermediate animation with the ENABLE sentence, $p = .002$. In sum, the difference between these two groups suggests that learning English may have led to an extension of the meaning of the Russian construction containing the CAUSE verb *zastavit'*. The change can be explained in terms of retrieval-induced reconsolidation. When Russians learn English, the semantic constraints on possible subjects in their L1 may loosen due to their reactivation while learning English such that the semantics of subjects in their L1 more closely resembles the semantics of subjects in their L1, English. As a consequence, Russian bilinguals' choice of CAUSE and ENABLE verbs will change in the direction of English.

The results suggest that the semantic system of the Russian bilinguals changed. However, it is possible that the results of this experiment might be limited to the particular verbs that were considered, *make/zastavit'* and *let/pozvolit'*. To the extent that the results reported above are due to a change in the syntactic–semantic interface, the pattern should generalize to other verbs and to a wider range of scenarios. In addition, to the extent that the change in the Russian bilinguals' first language was due to retrieval-induced reconsolidation, it should be possible to change the semantics of subjects in the other direction. When a native English speaker learns CAUSE and ENABLE verbs in Russian, they might retract the range of situations described by CAUSE verbs and expand the range of situations described by ENABLE verbs in English. This follows because, without further assumptions, retrieval-induced reconsolidation allows for both broadening and narrowing of semantic criteria.⁷ These various possibilities and predictions were addressed in the second experiment, described in the following section.

Experiment 2

In Experiment 2, the materials and procedures were the same as in Experiment 1, except that there were four language groups (English and Russian monolinguals, and Russian–English and English–Russian bilinguals); four series of animations instead of one;

⁷ This prediction contradicts the view that changes in the L1 will always be in the direction of greater simplicity (see Köpcke and Schmid, 2004, for a critical discussion of this hypothesis), which is potentially problematic since certain kinds of language attrition appear to occur in only one direction. Sorace (2005) notes, for example, that Italian speakers who learn English may use overt subjects more often than monolingual Italian speakers, but English speakers who learn Italian do not tend produce null subjects more often than monolingual English speakers.

and the sentence choices were based on two different CAUSE (*make/zastavit'* and *force/vynudit'*) and ENABLE verbs or verb phrases (*help/pomoch'* and *enable/dat' vozmozhnost'*) each instead of one. Three of the four sets of animations depicted interactions between two sentient entities. However, one set of animations depicted an interaction between two non-sentient entities (i.e., a boat and a fan). As discussed in the introduction, it appears that Russian periphrastic causative constructions are largely restricted to interactions between sentient entities. We anticipated that the sentences for the last set of animations would sound odd in Russian. This set was included nevertheless to see whether the results for this type of interaction would pattern like those in which the two entities were sentient. As in Experiment 1, we predicted that the four language groups would describe the two ends of the CAUSE–ENABLE series in the same way but would differ on the intermediate animations. In particular, we predicted that Russian bilinguals would describe the intermediate animations like English monolinguals, replicating one of the main findings of the previous experiment. In addition, we predicted that the English bilinguals would describe the intermediate animations like Russian monolinguals, thereby providing evidence in support of the view that changes in the L1 are driven by retrieval-induced reconsolidation.

Methods

Participants

The participants were 16 English monolinguals attending the University of Memphis, 16 Russian monolinguals (15 living in Moscow and one living in Memphis), 16 highly proficient Russian–English bilinguals (L1 = Russian) living in San Francisco and 14 moderately proficient English–Russian bilinguals (L1 = English) living in Moscow. As in Experiment 1, participants rated themselves on their ability to read English, speak English, read Russian and speak Russian on a 0–10 point scale in which 0 designated extremely low and 10 designated extremely high. Participants also indicated their gender, current age, the age at which they began to learn English in school, the number of years they had been in the United States and their highest degree obtained. The Russian monolinguals and Russian–English bilinguals were different from those tested in Experiment 1.

Table 5 lists the information provided by the Russian monolinguals, who were recruited by the second author's grandparents. The average age was 48.25 and 56% were females. As in Experiment 1, all of the participants had at least a Bachelor's degree and had lived their entire life in Russia, except for one individual who had moved to Memphis 6 months earlier. Exposure to English was extremely limited for all of the participants and based on English classes taken between 9 and 13

Table 5. *Characteristics of the Russian monolinguals that participated in Experiment 2.*

Participant	Gender	Russian reading	Russian speaking	English reading	English speaking	Age	English learning age	Years in the U.S.
A.B.	M	9	10	0	1	47	10	0
A.G.	F	10	10	1	1	68	10	0
A.L.	F	9	10	1	1	47	8	0
A.L.	F	10	10	1	1	35	10	0
A.N.	F	9	9	0	0	39	10	0
A.S.	M	9	9	0	0	37	10	0
A.V.	F	10	10	0	1	66	10	0
B.G.	M	10	10	1	1	62	9	0
E.B.	F	8	9	1	1	34	10	0.5
G.V.	F	9	10	0	0	46	10	0
O.G.	M	8	9	0	0	38	9	0
S.B.	M	10	10	1	1	49	8	0
S.G.	M	9	10	0	1	60	10	0
S.K.	F	10	10	1	1	52	9	0
U.S.	M	9	9	0	0	43	10	0
V.K.	F	9	10	0	0	65	10	0

Table 6. *Characteristics of the Russian–English bilinguals that participated in Experiment 2.*

Participant	Gender	Russian reading	Russian speaking	English reading	English speaking	Age	English learning age	Years in the U.S.
A.B.	M	8	9	8	9	34	8	10
A.N.	M	10	10	8	8	41	10	4
E.K.	M	7	7	9	9	28	10	9
E.V.	F	10	10	7	7	43	10	5
E.Z.	M	8	9	9	8	27	8	5
I.B.	M	10	10	9	9	30	8	5
I.D.	M	8	9	8	9	41	9	11
K.S.	F	8	8	8	8	37	7	10
M.N.	M	8	9	8	8	31	10	9
N.A.	M	8	8	8	9	38	10	9
N.P.	F	8	9	8	8	36	10	7
O.K.	F	8	8	8	9	28	8	7
O.K.	M	8	9	8	8	32	9	8
T.A.	F	9	9	7	8	30	10	4
T.P.	F	8	8	8	8	35	8	12
V.K.	M	9	9	7	8	36	7	10

years of age. As shown in Table 5, all of the Russian monolinguals described their ability to read and speak in English as extremely low.

Table 6 lists the information provided by the Russian–English bilinguals. These bilinguals were living in a Russian community in San Francisco and had jobs in which they had to use English. The average age of the

participants was 34.19 and 32% were female. Most of the bilinguals were programmers. The average number of years that they had been in the US was 7.8. Their average self-rated English reading and speaking abilities were 8 and 8.3, respectively. Their average self-rated Russian reading and speaking abilities were 8.4 and 8.8, respectively.

Table 7. Characteristics of the English–Russian bilinguals that participated in Experiment 2.

Participant	Gender	Russian reading	Russian speaking	English reading	English speaking	Age	Russian learning age	Years in Russia
A.J.	F	7	8	10	10	21	15	0.83
C.V.	F	7	7	10	10	19	14	0.5
E.T.	F	6	7	10	10	20	15	0.42
G.C.	M	7	7	10	10	22	16	0.5
J.B.	F	8	9	10	10	21	14	0.92
J.H.	M	7	7	10	10	24	15	0.58
K.L.	F	7	7	10	10	23	18	0.5
L.M.	F	7	8	10	10	19	15	0.58
M.A.	M	6	7	10	10	24	18	0.5
M.D.	F	7	8	10	10	23	18	0.5
N.G.	M	7	8	10	10	21	15	0.67
P.M.	F	7	7	10	10	20	14	0.58
S.A.	F	6	7	10	10	20	15	0.42
W.H.	M	9	8	10	10	22	18	0.92

Table 7 lists the information provided by the English–Russian bilinguals. The average age of the participants was 21.36 and 64% were female. These bilinguals were students at Moscow State University. They took classes every day in Russian and lived with families who did not speak English. However, because of the large number of English speakers at the school, the English bilinguals maintained regular use of English. Their average number of years in Russia was 0.6 (7.2 months). Their average self-rated English reading and speaking ability was 10, and their average self-rated Russian reading and speaking ability was 7.24.

Materials

Twelve animations were used to create four CAUSE–ENABLE series. One of the series (Series 1) was the same as in Experiment 1 (see Figure 1 above). The remaining series are shown in Figure 3 along with descriptions and average lengths. For each of the intermediate animations, the patient did not initiate any action and did not move until acted upon.

Procedure

Participants viewed twelve randomly-ordered animations. After each animation, they chose which of two possible sentences (or “none of the above”) best described the occurrence. For CAUSE sentences, the matrix verb was either *make/zastavit’* or *force/vynudit’* while for ENABLE sentences, the matrix verb was either *help/pomoch’* or for the verb *enable*, the verb phrase *dat’ vozmozhnost’* (literally, “to give an opportunity”). Sample Russian and English sentences used in this experiment are listed in

the Appendix. Participants clicked a radio button on the computer screen to indicate their choice.

As in Experiment 1, the English monolinguals were tested in a lab setting at the University of Memphis and the Russian monolinguals and bilinguals were tested in a home setting. The English bilinguals were tested in their school. In the case of the Russian and English bilinguals in particular, the entire experiment was conducted in their first language and was preceded by an extended conversation in their first language in an attempt to establish the relevant language mode.

Results and discussion

The findings replicated the results from the first experiment with a wider range of scenarios and verbs. In particular, the findings provide further evidence that expressions encoding the notions of CAUSE and ENABLE differ across languages and that learning a second language can lead to changes in the meanings of these expressions not only in Russian but also in English.

Table 8 shows the proportion of times that all four language groups chose the CAUSE and ENABLE sentences for animations at opposite ends of the CAUSE–ENABLE series. As can be seen, there was an effect of scene type: participants were more likely to use expressions with CAUSE verbs (*make/zastavit’* or *force/vynudit’*) for the animations in which the patient pushed away from the endstate ($M = .89$, $SD = .154$) than for animations in which the patient pushed towards the endstate ($M = .11$, $SD = .171$), across both participants, $F_p(1,60) = 942$, $p < .005$, and items, $F_i(1,24) = 190$,

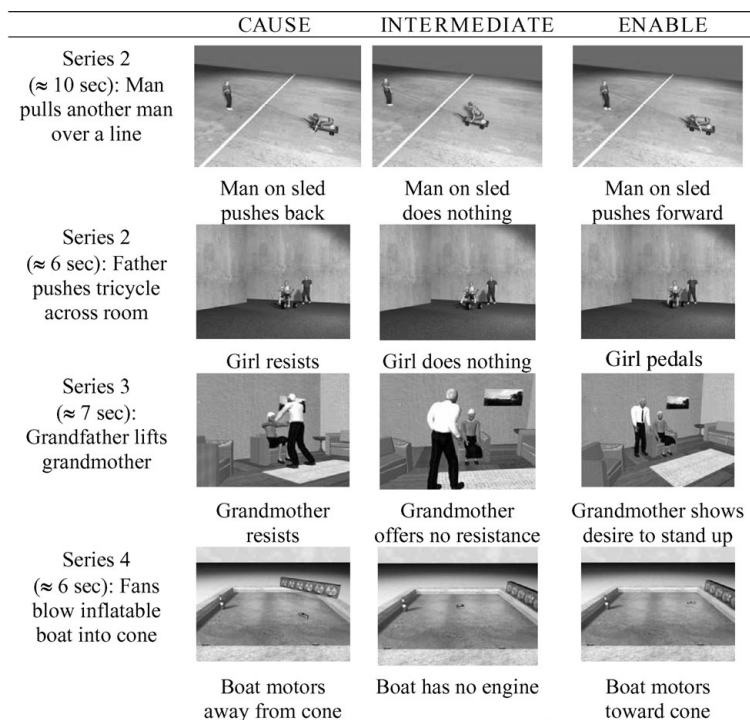


Figure 3. The four series of animations used in Experiment 2 along with average lengths and descriptions of what occurred.

Table 8. Percentage of times the CAUSE and ENABLE sentences were chosen for the two ends of the CAUSE–ENABLE series in Experiment 2 along with associated standard errors of the mean.

		CAUSE	ENABLE
Verb type		Patient clearly resists affector	Efforts of affector and patient are concordant
English monolinguals	CAUSE	.88 (.224)	.14 (.223)
	ENABLE	.13 (.224)	.81 (.233)
Russian monolinguals	CAUSE	.89 (.128)	.05 (.101)
	ENABLE	.11 (.128)	.92 (.151)
English bilinguals	CAUSE	.86 (.128)	.20 (.163)
	ENABLE	.08 (.120)	.78 (.154)
Russian bilinguals	CAUSE	.94 (.112)	.03 (.125)
	ENABLE	.06 (.112)	.88 (.183)

$p < .005$. There was also an interaction between language group and scene type that was significant across participants, $F_p(3,60) = 4.75$, $p < .01$, but not items, $F_i(3,24) = .695$, $p = .564$. This interaction reflects the relatively uninteresting finding that the size of the effect of scene type differed across languages. Importantly, though, the effect of scene type was present for all four language groups. No other effects were significant.

A similar pattern of results was obtained when considering participants' use of expressions containing ENABLE verbs or verb phrases, *help/pomoch'* or *enable/dat' vozmozhnost'*. Participants were more likely to use expressions containing ENABLE verbs for animations in which the patient had a tendency for the endstate ($M = .85$, $SD = .187$) than for animations in which the patient did not have a tendency for the endstate ($M = .09$, $SD = .151$), across both participants, $F_p(1,60) = 653$, $p < .005$, and items, $F_i(1,24) = 177$, $p < .005$. No other effects or interactions were significant.

In sum, the results indicate that all four groups of speakers strongly preferred CAUSE sentences to describe animations in which the patient pushed away from the endstate (opposing the affector) and ENABLE sentences for animations in which the patient pushed toward the endstate (in concordance with the affector). These results provide further evidence that the notions of CAUSE and ENABLE are clearly distinguished in both English and Russian. The results also indicate that participants in all four groups viewed the animations as reasonably good examples of the categories of CAUSE and ENABLE since the sums of all responses for each animation was close to or at 100 percent, indicating that participants rarely chose "none of the above".

While all of the participants agreed on how to describe the ends of the CAUSE–ENABLE series, differences appeared for the intermediate situations in which the patient had an ambiguous tendency and showed no

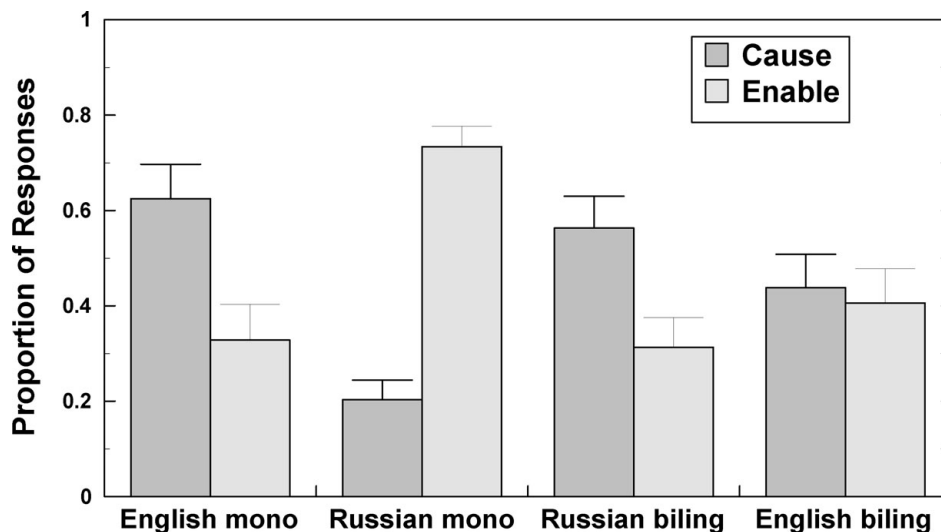


Figure 4. Proportion of times the CAUSE and ENABLE sentences were chosen for the intermediate animations in Experiment 2.

initiative. Figure 4 shows the percentage of times that English and Russian monolinguals and Russian–English and English–Russian bilinguals chose CAUSE and ENABLE sentences for the intermediate animations in the four series.

Focusing on the intermediate animations, participants' use of CAUSE descriptions for the different language groups differed significantly across participants, $F_p(3,60)=8.68$, $p < .005$, while there was only a statistical tendency across items, $F_i(3,12)=3.03$, $p=.071$. Planned comparisons revealed that English monolinguals ($M=.63$, $SD=.289$) were more likely than Russian monolinguals ($M=.20$, $SD=.164$) to describe the intermediate situation with a CAUSE description, across both subjects, $p < .005$, and items, $p < .05$. This difference supports the hypothesis that the meanings of the expressions containing the CAUSE verbs *make/zastavit'* and *force/vynudit'* differ across the languages. Participants' use of ENABLE descriptions for the different language groups mirrored that of CAUSE descriptions. ENABLE descriptions for the different language groups differed significantly across participants, $F_p(3,60)=9.45$, $p < .005$, and items, $F_i(3,12)=4.36$, $p=.027$. Planned comparisons revealed that Russian monolinguals ($M=.734$, $SD=.170$) were more likely than English monolinguals ($M=.328$, $SD=.299$) to describe the intermediate situation with an ENABLE description, across both subjects, $p < .005$, and items, $p < .01$. This difference supports the hypothesis that the meanings of the ENABLE verbs *help/pomoch'* and *enable/dat' vozmozhnost'* differ across the languages.

In addition to showing that the meanings of causal expressions can vary across the languages, the results

show how learning a second language can change the meaning of the causal expressions in one's first language. In particular, planned comparisons indicated that the Russian bilinguals ($M=.563$, $SD=.266$) were more likely than the Russian monolinguals to describe the intermediate animation with a CAUSE sentence, across both subjects, $p < .005$, and items, $p < .05$. Turning to ENABLE descriptions, planned comparisons indicated that Russian bilinguals ($M=.313$, $SD=.250$) were also less likely than Russian monolinguals to describe the intermediate animation with an ENABLE sentence, across both subjects, $p < .005$, and items, $p < .05$. The difference between the Russian bilinguals and monolinguals cannot be explained in terms of language since the Russian bilinguals performed the task in Russian, just like the Russian monolinguals. Rather, the difference between these two groups suggests that learning English changed the semantics of the CAUSE and ENABLE constructions. There was no evidence that Russian bilinguals differed from the English monolinguals in how they described the intermediate situations in terms of the proportion of CAUSE ($p_p=.49$, $p_i=.48$) or ENABLE ($p_p=.75$, $p_i=.86$) sentences chosen.

The influence of learning a second language on one's first language was also demonstrated in the case of the English–Russian bilinguals. Most tellingly, the English bilinguals ($M=.44$, $SD=.281$) chose CAUSE descriptions less frequently than did the English monolinguals, across participants $p < .05$, but not across items, $p=.239$. This result implies that the English bilinguals did not describe the intermediate scenes like English monolinguals, even though they performed the task in English. While the English bilinguals differed

Table 9. Proportion of responses to the intermediate scenarios where people chose the CAUSE responses broken down by language group and item.

	Series 1	Series 2	Series 3	Series 4
	Man pulls another man over a line	Father pushes tricycle across room	Grandfather lifts grandmother	Fans blow inflatable boat into cone
English Mono	.56	.74	.38	.70
Russian Mono	0	0	.13	.69
English Biling.	.50	.21	.5	.75
Russian Biling.	.50	.63	.50	.63

from the English monolinguals, they also differed from the Russian monolinguals. In particular, the English bilinguals described the intermediate scenarios with CAUSE descriptions more often than the Russian monolinguals, across participants, $p < .05$, but not across items, $p = .148$.

Whereas the Russian bilinguals differed from the Russian monolinguals and patterned like the English monolinguals, the English bilinguals did not pattern like either of the monolingual groups. This difference between the English and Russian bilinguals might be explained by the amount of time each group of speakers had spent in their second language setting. Whereas the Russian bilinguals had been living in the US for an average of 7.8 years, the English bilinguals had spent less than a year ($M = 0.6$ years) in Moscow. Thus, the pattern of results for the English–Russian bilinguals might represent a transition from an English to a Russian way of representing the meaning of causal expressions.

While there was consistency in how the speakers of the different language groups described the scenarios, there were also some differences. Table 9 shows the proportion of times participants used CAUSE descriptions to describe the intermediate situations broken down by language group and item. The table reveals that there were pronounced differences between the languages in Series 1–3. However, for Series 4, all language groups preferred to describe the intermediate scenario with a CAUSE description. Interestingly, this was also the only series of animations in which the interaction involved no sentient entities. The results suggest that the cross-linguistic differences in CAUSE and ENABLE expressions might be restricted to situations involving sentient entities, or entities that are capable of initiating and carrying out the result on their own.

Overall, the pattern of results in Experiment 2 closely mirrored the pattern observed in Experiment 1. In Experiment 1, the CAUSE verbs were *make* and *zastavit'* and the ENABLE verbs were *let* and *pozvolit'* while in Experiment 2, the CAUSE verbs were *make/zastavit'* and

force/vynudit' and the ENABLE verbs or verb phrases were *help/pomoch'* and *enable/dat' vozmozhnost'*. The replication of the results from Experiment 1 indicates that the results from both experiments are not specific to the particular verbs used in each experiment. Further analyses of the results from Experiment 2 revealed that the pattern of results was the same for both types of CAUSE and ENABLE expressions. Thus, the results appear to reflect a phenomenon that concerns groups of verbs rather than individual lexical items.

General discussion

The results from this research suggest that the meaning of causal expressions can differ across languages. In both Experiment 1 and Experiment 2, English and Russian monolinguals differed in their use of CAUSE and ENABLE constructions in describing ambiguous events. The results also suggest that such cross-linguistic differences can lead to changes in the bilingual's first language. In both Experiment 1 and Experiment 2, bilinguals' descriptions of causal events in their first language differed from those of monolinguals for the same events and changed in the direction of their second language.

Internal versus external causation

According to the tendency hypothesis, the types of entities that can appear as subjects may lead speakers to focus on different aspects of an event when deciding how the event can be described. Specifically, if the language restricts the subject position to entities that are self-energetic (as in Russian), then the tendency of the patient (or causee) may be evaluated only with respect to forces that are generated within the patient. When entities in the subject position are not so restricted – as in English – speakers may look for, and take into account, not only forces internal to the patient, but also external forces that may be present (e.g., gravity, friction).

It is potentially interesting to contrast the tendency hypothesis with Levin and Rappaport Hovav's (1995) hypothesis about the difference in meaning between unergative and unaccusative intransitive verbs. According to Levin and Rappaport Hovav (1995), unaccusative verbs (e.g., *melt*, *burn*, *break*, *open*) describe happenings that are typically conceptualized as being brought about by external causes.⁸ Unergative verbs (e.g., *laugh*, *run*, *dance*, *sneeze*), in contrast, describe happenings that are conceptualized as being brought about by internal causes. The relationship between Levin and Rappaport Hovav's (1995) hypothesis and the tendency hypothesis concerns different parts of a causal event. As frequently noted, sentences denoting causal relations often imply the occurrence of two events: a causing subevent and a resulting subevent (Dowty, 1979; Levin and Rapoport, 1988; Jackendoff, 1990; Van Valin, 1990; Croft, 1991; Pustejovsky, 1991, among others). Levin and Rappaport Hovav's (1995) distinction between internal and external causation concerns the resulting subevent, that is, whether the change of state is driven by internal or external forces. The tendency hypothesis, on the other hand, concerns the causing subevent described by the embedded clause. For example, in the sentence *John made Mary open the window*, the causing subevent in the embedded clause would be Mary's actions. This sentence is acceptable in Russian because, according to the tendency hypothesis, the patient in a periphrastic causative construction in Russian must be able to initiate its own actions. In contrast, *Kathy caused the rock to fall* is not acceptable in Russian because rocks cannot initiate their own actions.

Where the constraint on subjects might come from

According to Levin and Rappaport Hovav (1995), whether a change of state is internally or externally caused is part of the meaning of the verb. In contrast, constraints on subjects are probably NOT specified in the lexicon. According to Guilfoyle (2000), from the perspective of generative grammar, the difference between Type A and Type B languages is specified in the syntax. Specifically, she suggests that in Type A languages, the external argument raises to the specifier of TP (Tense Phrase), which allows the entity to be checked for time (i.e., whether it is the initiator of the event). In Type B languages (like English), the external argument raises to the specifier

⁸ As noted by Levin and Rappaport Hovav (1995), not all change-of-state verbs are externally caused. For verbs in which there is a change of state without an external cause, e.g., *blush* and *bloom*, they argue that the change of state – also a determiner of unaccusativity – takes precedence over whether the causation is internal or external. As a consequence, such verbs are classified as unaccusative despite that fact that they imply internally caused eventualities.

of AgrS (Subject Agreement), in which case the subject entity is only checked for its being a participant in the event.

An alternative – though not necessarily mutually exclusive – possibility is that the constraints on subjects are not specified directly, but rather arise as an emergent property of various other properties of the language. A proposal of this type is suggested by Hawkins (1985).⁹ Hawkins' main interest was in contrasting English and German, but his insights extend to Russian. Russian, like German, has a rich case system which allows for freedom in word order (Thompson, 1977). English, on the other hand, has only the last vestiges of a case system and, as a consequence, has a more fixed word order than either Russian or German. Fixed word order presents a potential problem for language understanding since principles of pragmatics (e.g., given/new organization) often favor changes in word order. One way a language with fixed word order can satisfy the needs of pragmatics is to allow for a wider range of entities in the subject position. Thus, in languages where word order is relatively fixed, like English, the range of entities that can appear in the subject position will likely be greater than in languages where grammatical relations are marked. It may be for this reason, then, that languages like English, but not Russian, allow for instrumental subjects and causees that are non-sentient.

What changes in the second language learner

A common view in second language acquisition research is that the interaction between the first and second languages shifts over the course of acquisition (see Schmid and Köpke, 2007). Initially, learners may manifest instances of L1 influence in their L2 (forward influence). Such influences fade, however, as the learner develops proficiency in the L2. In more advanced stages of bilingualism, the direction of influence can change and the second language can have an impact on the first language (backward influence). Schmid and Köpke (2007) challenge this account in arguing that the direction of influence is bi-directional, at least in the advanced stages of bilingualism. Schmid and Köpke's (2007) proposal is compatible with the mechanism of change offered in this paper. The process of retrieval-induced reconsolidation can work in either direction: elements in the L2 can reactivate elements in the L1 and lead to change in the L1, or elements in the L1 can reactivate elements in the L2, leading to change in the L2. The direction of this change may depend on the bilingual's "language mode" (Grosjean, 2001). As noted by Schmid (2007), there are a variety of potential language modes a bilingual

⁹ We thank Beth Levin for making us aware of this idea and pointing us to Hawkins' (1985) work.

might engage in. For example, some bilinguals might find themselves in communities consisting of both L1 and L2 speakers in which codeswitching is frequent and the chance of retrieval-induced reconsolidation is raised. In other situations, bilinguals might interact mostly with monolinguals from either their first or second language, which might promote a monolingual mode in which switches and mixing are avoided, and the chance of retrieval-induced reconsolidation is lowered (see also Köpke, 2007). In sum, the likelihood of the occurrence and direction of the language influence will likely depend on the language environment, which will influence the language modes that bilinguals engage in.

Evidence that influence can occur in both directions was obtained in a recent study by Marian and Kaushanskaya (2007). The authors examined lexical borrowing and semantic and syntactic transfer in Russian–English bilinguals. Participants were asked to describe an event from their life in either their first or second language. Overall, bilinguals were more likely to make L1 → L2 transfers (than L2 → L1 transfers) when the concepts were purely semantic. For example, when speaking in English, the bilinguals made statements like *I was very hungry and was happy to see the table*. In Russian such a statement is acceptable since the word for *table*, *stol*, can mean either the actual table or the food on the table. In contrast, their L2 → L1 transfers tended to be syntactic. Many of these syntactic transfers most likely involved accompanying semantic information, so they were probably similar to those observed in the studies reported in this paper. Hence, while transfer might occur in either direction, L2 → L1 influence might be more common for semantics at the syntax–semantics interface than for semantics in the lexicon.

Second language influence versus attrition

When transfer occurs from L2 to L1, it can result in changes that might be construed as instances of LANGUAGE ATTRITION. As noted by Köpke (2004), the notion of language attrition has been defined in many ways, but most definitions imply an L2 influence on the L1 that leads to a negative change, including a decline or loss of language ability or competence. The changes described in our paper could be described as attrition in the sense that the bilinguals' judgments deviated from the standards set by monolinguals. However, such deviations do not seem overly negative, just different. It is for this reason that we have followed researchers such as Cook (2003) and Pavlenko (2003, 2004) by referring to these changes as exemplifying L2 → L1 influence rather than language attrition (see also Hohenstain, Eisenberg and Naigles, 2006; Marian and Kaushanskaya, 2007).

An even more precise characterization of the phenomena observed in this paper can be provided

given Pavlenko's (1999, 2002, 2003, 2004) framework for describing types of language change. According to Pavlenko, transfer from the L2 to the L1 can take the form of "borrowing" of L2 elements that may be lacking in the L1, "restructuring" via the deletion or incorporation of L2 elements into the L1; "convergence" of elements from the L1 and L2 into a single integrated system; "shifting" of the L1 structures or values in the direction of L2 structures or values; and "attrition", whereby L1 elements are permanently lost due to the influence of the L2. In our studies, the apparent changes to the L1 can be viewed as exemplifying either restructuring or shifting. They can be viewed as restructuring because they apparently involved the deletion or incorporation of an L2 element into the L1, specifically, consideration of external forces. The findings can also be viewed as demonstrating shifting in that there was a move away from L1 values and boundaries toward those specified by the L2.

Consequences for the conceptual system

One of the key findings in this research is that Russian bilinguals differed from Russian monolinguals in their descriptions of scenes depicting ambiguous tendency even though both groups described the scenes in Russian. One possible interpretation of these results is that learning English not only changed the syntax–semantic interface in the Russian bilinguals' L1, but maybe also influenced their underlying conceptual system. In effect, the results might be interpreted as providing support for at least one version of the Whorfian hypothesis (Whorf, 1991/1950/1941). While we are sympathetic to this possibility, such a conclusion does not necessarily follow from the data.

If the conceptual and semantic systems are one and the same, the results from our experiments could be taken as supporting a change at the conceptual level. However, as pointed out by several theorists, the semantic and the conceptual do not constitute a single system (Pinker, 1994; Levinson, 1997; Pavlenko, 1999; Jackendoff, 2002). One reason for distinguishing these systems is that word meanings are ambiguous in a way that concepts are not (Pinker, 1994; Levinson, 1997). For example, if we say *The paper is on the desk* we might be referring to a newspaper, an individual sheet of paper, a pile of shredded paper, or an important document. In a given situation, the correct referent may be known without ambiguity, despite the ambiguity of the sentence. Another reason for separating the two systems is that people can have thoughts without having the words to express those thoughts (Pinker, 1994). There are very strong reasons to believe that infants, for example, have many concepts well before they have the words to express them (for a review, see Bowerman, 1996). With respect to causation, in particular, several studies have shown that the first notions

of causation appear relatively early in development (for a review, see Cohen, Amsel, Redford and Casasola, 1998), well before the ability to describe causal relationships (Bowerman, 1982). Because of the difference between semantic and conceptual systems, linguists have taken pains to distinguish the concept of CAUSE from the verb *cause* (Fodor, 1970; Cruse, 1972; Dowty, 1979; Lakoff and Johnson, 1999) since the verb *cause* might include other abstract components of meaning besides CAUSE in its representation or differ from CAUSE in terms of its presuppositions (Dowty, 1979).

With respect to the present results, the chief reason why we cannot confidently assume that they indicate a change in the concept of CAUSE is that the dependent measure we used was linguistic. Because it was linguistic, we cannot tell whether the difference between the Russian monolinguals and bilinguals reflected a change in the conceptual system or only a change in the semantic system, that is, a change in the meaning of the periphrastic causative constructions containing the CAUSE and ENABLE verbs. To investigate a change in the conceptual system, we would need to use a non-linguistic dependent measure, such as memory for an event, reaction time to recognition, or some kind of similarity judgment.

A study of Indonesian–English bilinguals offers more direct evidence for how learning a second language might bring about a change at the conceptual level (Boroditsky, Ham and Ramscar, 2002). Indonesian differs from English in that it lacks tense marking. The authors predicted that this difference would correspond to differences in cognitive preference and performance in two non-linguistic tasks, namely, similarity judgments and memory for pictures. After establishing that English and Indonesian monolinguals differed in a similarity task, Boroditsky et al. (2002) tested Indonesian–English bilinguals on the same task in two different language contexts. That is, one group of bilinguals was tested in Indonesian and the other group was tested in English. In general, the bilinguals' performance corresponded to the language mode: they performed more like Indonesian monolinguals when tested in Indonesian than when tested in English and vice versa for the English testing condition. Likewise, in a matching task, Indonesian–English bilinguals tended to perform according to the language context of their test, exhibiting better memory for the time frame of an action when tested in English than in Indonesian. However, the bilinguals' similarity ratings (task 1) in the Indonesian condition fell somewhat in between that of the Indonesian monolinguals and English speakers. The authors attribute this result to the bilinguals' experience with English. This study is noteworthy because non-linguistic measures were used, allowing the authors to more directly access the conceptual system. With respect to the current study, the logical next step would be to

examine whether any non-linguistic correlates accompany the linguistic shift.

Conclusion

Often, the words and constructions in one language differ in meaning from their rough translations in another language. Here we investigated the potential consequences of these differences in meaning for the semantic system of the bilingual. In two experiments we found evidence that Russian and English speakers have a common system for representing the semantics of causal expressions, as specified in the force dynamics model. However, it appears that speakers of Russian and English emphasize different aspects of experience when computing the components of meaning that differentiate different categories of causation. Our findings also suggest that learning a second language may lead people to focus on different aspects of experience when choosing and understanding causal expressions in their first language.

Appendix. English and Russian sentences used for each animation series in Experiment 2

1.

A

The man	in the red	shirt	made	
Мужчина	в	красной	рубашке	заставил
Muzhchin-a	v	krasnoi	rubashke	zastavil
man-NOM	in	red	shirt	made.PAST

the man	in green	shirt	cross	the line.
мужчину	в	зеленой	рубашке	пересечь
muzhchn-u	v	zelenoi	rubashke	peresech' lini-u.
man.ACC	in	green	shirt	CROSS.PERF line-ACC

B

The man	in the red	shirt	forced	
Мужчина	в	красной	рубашке	вынудил
Muzhchin-a	v	krasnoi	rubashke	vynudil
man-NOM	in	red	shirt	forced.PAST

the man	in the green	shirt	cross	the
мужчину	в	зеленой	рубашке	пересечь
muzhchn-u	v	zelenoi	rubashke	peresech'
man-ACC	in	green	shirt	CROSS.PERF

line.
линию.
lini-u.
line-ACC

C

The man	in the red	shirt	helped	
Мужчина	в	красной	рубашке	помог
Muzhchin-a	v	krasnoi	rubashke	pomog
Man-NOM	in	red	shirt	helped.PAST

the man in the green shirt cross
 мужчине в зеленой рубашке пересечь
 muzhchin-e v zelenoi rubashke peresech'
 man-DAT in green shirt cross.PERF
 the line.
 линию.
 lini-u.
 line-ACC

D
 The man in the red shirt
 Мужчина в красной рубашке
 Muzhchin-a v krasnoi rubashke
 Man-NOM in red shirt
 enabled
 дал возможность
 dal vozmozhnost'
 gave.PAST opportunity

the man in the green shirt to cross
 мужчине в зеленой рубашке пересечь
 muzhchn-e v zelenoi rubashke peresech'
 man-DAT in green shirt cross.PERF
 the line.
 линию.
 lini-u.
 line-ACC

2.
 A.
 The father made the daughter move across
 Отец заставил дочь пересечь
 Otets zastavil doch' peresech'
 father.NOM made.PAST daughter.ACC cross.PERF
 the room.
 комнату.
 komnat-u.
 room-ACC

B.
 The father forced the daughter to move across
 Отец вынудил дочь пересечь
 Otets vynudil doch' peresech'
 father.NOM forced.PAST daughter.ACC cross.PERF
 the room.
 комнату.
 komnat-u.
 room-ACC

C.
 The father helped the daughter to move across
 Отец помог дочери пересечь
 Otets pomog docher-i peresech'
 father.NOM helped.PAST daughter.DAT cross.PERF
 the room.
 комнату.
 komnat-u.
 room-ACC

D.
 The father enabled the daughter
 Отец дал возможность дочери
 Otets dal vozmozhnost' docher-i
 father.NOM gave.PAST opportunity daughter-DAT
 to move across the room.
 пересечь комнату.
 peresech' komnat-u.
 cross.PERF room-ACC.

3.
 A.
 The grandfather made the grandmother
 Дедушка заставил бабушку
 Dedushk-a zastavil babushk-u
 grandfather-NOM made.PAST grandmother-ACC
 get up.
 подняться.
 podniat'sia.
 rise.PERF

B.
 The grandfather forced the grandmother to
 Дедушка вынудил бабушку
 Dedushk-a vynudil babushk-u
 grandfather-NOM forced.PAST grandmother-ACC
 get up.
 подняться.
 podniat'sia.
 rise.PERF

C.
 The grandfather helped the grandmother
 Дедушка помог бабушке
 Dedushk-a pomog babushk-e
 grandfather-NOM helped.PAST grandmother-DAT
 to get up.
 подняться.
 podniat'sia.
 rise.PERF

D.
 The grandfather enabled
 Дедушка дал возможность
 Dedushk-a dal vozmozhnost'
 grandfather-NOM gave.PAST opportunity
 the grandmother to get up.
 бабушке подняться.
 babushk-e podniat'sia.
 grandmother-DAT rise.PERF

4.
 A.
 The fans made the raft hit the
 Вентиляторы заставили плот ударить
 Ventilator-y zastavil-i plot udarit'
 fan.NOM-PL made.PAST-PL raft.ACC hit.PERF
 cone.
 конус.
 konus.
 cone.ACC

B.

The fans forced the raft to hit
 Вентиляторы вынудили плот ударить
 Ventilator-u vynudil-i plot udarit'
 fan.NOM-PL forced.PAST-PL raft.ACC hit.PERF
 the cone.
 конус.
 konus.
 cone.ACC

C.

The fans helped the raft to hit
 Вентиляторы помогли плоту ударить
 Ventilator-u pomogl-i plot-u udarit'
 fan.NOM-PL helped.PAST-PL raft.DAT hit.PERF
 the cone.
 конус.
 konus.
 cone.ACC

D.

The fans enabled the raft
 Вентиляторы дали возможность плоту
 Ventilator-u dal-i vozmozhnost' plot-u
 fan.NOM-PL gave.PAST-PL opportunity raft.DAT
 to hit the cone.
 ударить конус.
 udarit' konus.
 hit.PERF cone.ACC

References

- Alberini, C. M. (2005). Mechanisms of memory stabilization: Are consolidation and reconsolidation similar or distinct processes? *TRENDS in Neuroscience*, 28, 51–56.
- Altenberg, E. P. (1991). Assessing first language vulnerability to attrition. In Seliger & Vago (eds.), pp. 189–206.
- Athanasopoulos, P. (2001). L2 acquisition and bilingual conceptual structure. M.A. thesis, University of Essex.
- Baron, N. S. (1977). *Language acquisition and historical change*. New York: North-Holland.
- Ben-Rafael, M. (2004). Language contact and attrition: The spoken French of Israeli Francophones. In Schmid et al. (eds.), pp. 165–188.
- Boroditsky, L., Ham, W. & Ramscar, M. (2002). What is universal about event perception? Comparing English and Indonesian speakers. In *Proceedings of the 25th Annual Conference of the Cognitive Science Society*, pp. 168–173. Hillsdale, NJ: Lawrence Erlbaum.
- Bowerman, M. (1982). Reorganizational processes in lexical and syntactic development. In E. Wanner & L. Gleitman (eds.), *Language acquisition: The state of the art*, pp. 319–346. New York: Cambridge University Press.
- Bowerman, M. (1996). The origins of children's spatial semantic categories: Cognitive versus linguistic determinants. In J. J. Gumperz & S. C. Levinson (eds.), *Rethinking linguistic relativity*, pp. 145–175. Cambridge: Cambridge University Press.
- Cohen, L. B., Amsel, G., Redford, M. A. & Casasola, M. (1998). The development of infant causal perception. In A. Slater (ed.), *Perceptual development: Visual, auditory, and speech perception in infancy*, pp. 167–209. East Sussex: Psychology Press Ltd.
- Cole, P. (1983). The grammatical role of the causee in Universal Grammar. *International Journal of American Linguistics*, 49, 115–133.
- Comrie, B. (1981). *Language universals and linguistic typology*. Chicago, IL: University of Chicago Press.
- Comrie, B. (1985). Causative verb formation and other verb-deriving morphology. In T. Shopen (ed.), *Language typology and syntactic description* (vol. 3): *Grammatical categories and the lexicon*, pp. 309–348. New York: Cambridge University Press.
- Cook, V. J. (2003). Introduction: The changing L1 in the L2 user's mind. In Cook (ed.), pp. 1–18.
- Cook, V. J. (ed.) (2003a). *Effects of the second language on the first*. Clevedon: Multilingual Matters.
- Croft, W. A. (1991). *Syntactic categories and grammatical relations*. Chicago, IL: University of Chicago Press.
- Cruse, D. A. (1972). A note on English causatives. *Linguistic Inquiry*, 3, 522–528.
- Debiec, J., Doyère, V., Nader, K. & LeDoux, J. E. (2006). *PNAS*, 103, 3428–3433.
- Dowty, D. R. (1979). *Word meaning and Montague grammar*. Dordrecht: Reidel.
- Fodor, J. A. (1970). Three reasons for not deriving “kill” from “cause to die”. *Linguistic Inquiry*, 1, 429–438.
- Forcato, C., Burgos, V. L., Argibay, P. F., Molina, V. A., Pedreira, M. E. & Maldonado, H. (2007). Reconsolidation of declarative memory in humans. *Learning and Memory*, 14, 295–303.
- Francis, W. S. (2005). Bilingual semantic and conceptual representation. In Kroll & De Groot (eds.), pp. 251–267.
- Gentner, D. (1975). Evidence for the psychological reality of semantic components: The verbs of possession. In Norman et al. (eds.), pp. 211–246.
- Goldberg, A. (2006). *Constructions at work: The nature of generalization in language*. Oxford: Oxford University Press.
- Grosjean, F. (2001). The bilingual's language modes. In J. L. Nicol (ed.), *One mind, two languages: Bilingual language processing*, pp. 1–22. Malden, MA: Blackwell.
- Guilfoyle, E. (2000). *Tense and N-features in Modern Irish*. In A. Carnie & E. Guilfoyle (eds.), *The syntax of verb initial languages*, pp. 61–74. Oxford: Oxford University Press.
- Gürel, A. (2004). Attrition in L1 competence: The case of Turkish. In Schmid et al. (eds.), pp. 207–221.
- Hawkins, J. A. (1985). *A comparative typology of English and German: Unifying the contrast*. Austin, TX: University of Texas Press.
- Helms-Park, R. (2001). Evidence of lexical transfer in learning syntax. *Studies in Second Language Acquisition*, 23, 71–102.
- Hohenstain, J., Eisenberg, A. & Naigles, L. (2006). Is he floating across or crossing afloat? Cross-influence of L1 and L2 in Spanish–English bilingual adults. *Bilingualism: Language and Cognition*, 9, 249–261.

- Hutz, M. (2004). Is there a natural process of decay? A longitudinal study of language attrition. In Schmid et al. (eds.), pp. 189–206.
- Isurin, L. (2000). “Deserted island” or a child’s first language loss. *Bilingualism: Language and Cognition*, 3, 151–166.
- Jackendoff, R. (1990). *Semantic structures*. Cambridge, MA: MIT Press.
- Jackendoff, R. (2002). *Foundations of language: Brain, meaning, grammar, evolution*. New York: Oxford University Press.
- Katzner, K. (1994). *English–Russian, Russian–English dictionary*. New York: John Wiley & Sons.
- Köpke, B. (2004). Attrition is not a unitary phenomenon: On different possible outcomes of language contact situations. In A. M. L. Suarez, F. Ramallo & X-P. Rodriguez-Yanez (eds.), *Bilingual socialization and bilingual language acquisition: Proceedings from the Second International Symposium on Bilingualism*, pp. 1331–1347. Vigo: Servizo de Publicacions da Universidade de Vigo.
- Köpke, B. (2007). Language attrition at the crossroads of brain, mind, and society. In Köpke et al. (eds.), pp. 9–37.
- Köpke, B. & Schmid, M. S. (2004). Language attrition: The next phase. In M. S. Schmid, B. Köpke, M. Keijzer & L. Weilemar (eds.), *First language attrition: Interdisciplinary perspective on methodological issues*. pp. 1–43. Amsterdam & Philadelphia: John Benjamins.
- Köpke, B., Schmid, M. S., Keijzer, M. & Dostert, S. (eds.) (2007). *Language attrition: Theoretical perspectives*. Amsterdam: John Benjamins.
- Kozinsky, I. & Polinsky, M. (1993). Causee and patient in the causative of transitive: Coding conflict or doubling of grammatical relations? In B. Comrie & M. Polinsky (eds.), *Causatives and transitivity*, pp. 177–240. Amsterdam & Philadelphia: John Benjamins.
- Kroll, J. F. & A. M. B. De Groot (eds.) (2005). *Handbook of bilingualism: Psycholinguistic approaches*. Oxford: Oxford University Press.
- Kroll, J. F. & Stewart, E. (1994). Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language*, 33, 149–174.
- Kroll, J. F. & Tokowicz, N. (2005). Models of representation and processing. In Kroll & De Groot (eds.), pp. 531–553.
- Lakoff, G. & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to Western thought*. New York: Basic Books.
- Laufer, B. (2003). The influence of L2 on L1 collocational knowledge and on L1 lexical diversity in free written expression. In Cook (ed.), pp. 19–31.
- Levin, B. & Rapoport, T. R. (1988). Lexical subordination. *Proceedings of the 24th Annual Meeting of the Chicago Linguistics Society*, pp. 275–289. Chicago, IL: Chicago Linguistics Society.
- Levin, B. & Rappaport Hovav, M. (1994). A preliminary analysis of causative verbs in English. *Lingua*, 92, 35–77.
- Levin, B. & Rappaport Hovav, M. (1995). *Unaccusativity: At the syntax–lexical semantics interface*. Cambridge, MA: MIT Press.
- Levin, B. & Rappaport Hovav, M. (2005) *Argument realization* (Research Surveys in Linguistics). Cambridge: Cambridge University Press.
- Levinson, S. C. (1997). From outer to inner space: Linguistic categories and non-linguistic thinking. In E. Pederson & J. Nuyts (eds.), *With language in mind: The relationship between linguistic and conceptual representation*, pp. 13–45. Cambridge: Cambridge University Press.
- Marian, V. & Kaushanskaya, M. (2007). Cross-linguistic transfer and borrowing in bilinguals. *Applied Psycholinguistics*, 28, 369–390.
- Miller, G. A. & Johnson-Laird, P. N. (1976). *Language and perception*. Cambridge, MA: Harvard University Press.
- Montrul, S. (2004). Subject and object expression in Spanish heritage speakers: A case of morpho-syntactic convergence. *Bilingualism: Language and Cognition*, 7, 125–142.
- Nader, K., Schafe, G. E. & LeDoux, J. E. (2000). The labile nature of consolidation theory. *Nature Reviews*, 1, 216–219.
- Norman, D. A., Rumelhart, D. E. & the LNR Research Group (eds.) (1975). *Explorations in cognition*. San Francisco, CA: W. H. Freeman.
- Otheguy, R. & Garcia, O. (1988). Diffusion of lexical innovations in the Spanish of Cuban Americans. In J. L. Ornstein-Galicia, G. K. Green & D. Bixler-Marquez (eds.), *Research issues and problems in U.S. Spanish: Latin American and Southwestern varieties*, pp. 203–243. Brownsville, TX: University of Texas.
- Pavlenko, A. (1999). New approaches to concepts in bilingual memory. *Bilingualism: Language and Cognition*, 2, 209–230.
- Pavlenko, A. (2002). Bilingualism and emotions. *Multilingua*, 21, 45–78.
- Pavlenko, A. (2003). “I feel clumsy speaking Russian”: L2 influence on L1 in narratives of Russian L2 users of English. In Cook (ed.), pp. 32–61.
- Pavlenko, A. (2004). L2 influence and L1 attrition in adult bilingualism. In Schmid et al. (eds.), pp. 47–60.
- Pinker, S. (1989). *Learnability and cognition: The acquisition of argument structure*. Cambridge, MA: MIT Press.
- Pinker, S. (1994). *The language instinct*. New York: William Morrow & Co.
- Pustejovsky, J. (1991). The syntax of event structure. *Cognition*, 41, 47–81.
- Radford, A. (1988). *Transformational grammar: A first course*. Cambridge: Cambridge University Press.
- Schank, R. C. (1972). Conceptual dependency: A theory of natural language understanding. *Cognitive Psychology*, 3, 532–631.
- Schmid, M. S. (2007). The role of L1 use for L1 attrition. In Köpke et al. (eds.), pp. 135–153.
- Schmid, M. S. & Köpke, B. (2007). Bilingualism and attrition. In Köpke et al. (eds.), pp. 1–7.
- Schmid, M. S., Köpke, B., Keijzer, M. & Weilemar, L. (eds.) (2004). *First language attrition: Interdisciplinary perspectives on methodological issues*. Amsterdam: John Benjamins.
- Seliger, H. W. & Vago, R. M. (eds.) (1991). *First language attrition*. Cambridge: Cambridge University Press.

- Shibatani, M. (1976). The grammar of causative constructions: A conspectus. In M. Shibatani (ed.), *The grammar of causative constructions* (Syntax and Semantics 6), pp. 1–40. New York: Academic Press.
- Smith, R. E. & Hunt, R. R. (2000). The influence of distinctive processing on retrieval-induced forgetting. *Memory & Cognition*, 28, 503–508.
- Song, G. & Wolff, P. (2005). Linking perceptual properties to the linguistic expression of causation. In M. Achard & S. Kemmer (eds.), *Language, culture, and mind*, pp. 237–250. Stanford, CA: CSLI Publications.
- Sorace, A. (2005). Selective optionality in language development. In L. Cornips & K. P. Corrigan (eds.), *Syntax and variation: Reconciling the biological and the social*, pp. 55–80. Amsterdam: John Benjamins.
- Talmy, L. (1988). Force dynamics in language and cognition. *Cognitive Science*, 12, 49–100.
- Thompson, I. (1977). Russian word order: A comparative study. *The Slavic and East European Journal*, 21, 88–103.
- Tsimpli, I., Sorace, A., Heycock, C. & Filiaci, F. (2004). First language attrition and syntactic subjects: A study of Greek and Italian near-native speakers of English. *International Journal of Bilingualism*, 3, 257–278.
- Van Valin, R. (1990). Semantic parameters on split intransitivity. *Language*, 66, 221–260.
- Walker, M. P., Brakefield, T., Hobson, J. A. & Stickgold, R. (2003). Dissociable stages of human memory consolidation and reconsolidation. *Nature*, 425, 616–620.
- Wheeler, M., Falla, P. S. & Unbegaun, B. (eds.). (1995). *Oxford Russian dictionary*. Oxford: Oxford University Press.
- Whorf, B. (1991/1950/1941). An American Indian model of the universe. In J. Carroll (ed.), *Language, thought and reality: Selected writings of Benjamin Lee Whorf*, pp. 57–64. Cambridge, MA: MIT Press.
- Wierzbicka, A. (1988). *The semantics of grammar*. Amsterdam: John Benjamins.
- Wolff, P. (2003). Direct causation in the linguistic coding and individuation of causal events. *Cognition*, 88, 1–48.
- Wolff, P. (2007). Representing causation. *Journal of Experimental Psychology: General*, 136, 82–111.
- Wolff, P. & Song, G. (2003). Models of causation and the semantics of causal verbs. *Cognitive Psychology*, 47, 376–332.
- Wolff, P., Song, G. & Driscoll, D. (2002). Models of causation and causal verbs. In *Papers from the 37th Meeting of the Chicago Linguistics Society, Main Session* (vol. 1), pp. 607–622. Chicago, IL: Chicago Linguistics Society.
- Wolff, P., Klettke, B., Ventura, T. & Song, G. (2005). Categories of causation across cultures. In W. Ahn, R. L., Goldstone, B. C., Love, A. B., Markman & P. Wolff (eds.), *Categorization inside and outside of the lab: Festschrift in honor of Douglas L. Medin*, pp. 29–48. Washington, DC: American Psychological Association.
- Wolff, P. & Zettergren, M. (2002). A vector model of causal meaning. In *Proceedings of the Twenty-fourth Annual Conference of the Cognitive Science Society*, pp. 976–981. Hillsdale, NJ: Lawrence Erlbaum.

Received: August 29, 2006

Final revision received: January 18, 2008

Accepted: January 28, 2008