

## A framework for performative and assertive updates<sup>1</sup>

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**Abstract.** This article develops a framework for the representation of performative speech acts, in particular declarations (including explicit performatives) and assertions. It is a dynamic framework that treats these speech acts as updates of a common ground, modelled as a context set. It distinguishes between two kinds of updates: Informative updates restrict the indices of the context set by adding information, whereas performative updates change the indices, thus creating new facts. The article discusses the notion of index change in detail and presents an analysis of declarations as performative updates with a proposition concerning social facts. Assertions are specialized performative updates with a truth commitment by the speaker with implicated intention to bring about a corresponding informative update. It also discusses the various tense and aspect forms that are used to express declarations. Finally, it argues that locutionary acts can be modelled as performative updates as well and proposes a treatment of the performative marker *hereby*.

**Keywords:** speech acts, performatives, assertions, declarations, context change

### 1. Introduction

In 1930, the slavistic Erwin Koschmieder discovered that there are declarative sentences which are not used to *describe* an action but rather to *act*. Observing that in such sentences the words coincide with the action, he termed this “Koinzidenzfall”. This predates the distinction between constative and performative speech acts made by the philosopher of language John Austin in the 1950’s that resulted in his famous essay “How to do things with words” (1962).<sup>2</sup>

Constative and performative use of language was difficult to tease apart because many sentences can be used for either purpose, cf. (1). Furthermore, whenever a declarative clause in its performative use was felicitously uttered, the assertive clause can be uttered felicitously as well because its proposition became true by the performative utterance.

- (1) A: *The meeting is adjourned.*  
a. Constative (assertive, reportative): A reports that the meeting is adjourned.  
b. Performative: A adjourns the meeting.

But there are well-known differences that help to distinguish between these sentences. Koschmieder observed that performative sentences cannot answer questions. If B asks, *What happened?* (1) only has a constative reading. Koschmieder and Austin pointed out that in action sentences, the self-referential adverbs *hiermit* / *hereby* identify the performative use as in (2a,b). Koschmieder also noticed that the adverb *soeben* ‘right now’ disallows the performative use, even though it also expresses a temporal coincidence between the utterance and the

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<sup>2</sup> Cf. Keck & Stubbs (1984) for discussing Koschmieder’s contribution relative to Austin’s.

described event. Correspondingly, Austin noticed that progressive tense disfavors the performative interpretation; this effect seems even stronger with the adverb *right now*:

- (2) a. A: *I hereby adjourn the meeting.* c. *I am adjourning the meeting (right now).*  
 b. A: *Ich vertage hiermit die Versammlung.* d. *Ich vertage soeben die Versammlung.*

Another observation by Koschmieder and Austin is that performatives tend to have first person subjects. This applies to action sentences like (2), where replacement by second and third person subjects blocks a performative interpretation, cf. (3a). However, action performatives can occur in passive sentences like (3b), and in statives like (1) and (3c).

- (3) a. A: *She (#hereby) adjournes the meeting.*  
 b. A: *Die Versammlung wird (hiermit) vertagt.*  
 c. A: *Die Versammlung ist (hiermit) vertagt.*

Stative expressions were not mentioned prominently in early work on performative utterances, where the discussion centered on examples like (2) or *I promise to come to your party* that contain a verb, like *adjourn* or *promise*, that denotes the very act that is performed; hence the term “explicit performatives”. Searle (1976) introduced the distinction between “representatives” (assertions) and “declarations” (performatives). Declarations, if performed felicitously, adapt the world to the words and thus guarantee that the words also correspond to the world. Recanati (1987) and Searle (1989) argued that explicit performatives are a subclass of the larger class of declarations, a view that I will follow here.

Furthermore, Austin (1961) remarks that performative utterances cannot be true or false. He also observes that performative declaratives do not contain modal verbs like *could* or *might* – in fact, they do not allow for epistemic or evidential modification in general, and their strength cannot be modified. Hence, (4a,b) only have a constative reading.

- (4) a. A: *The meeting is probably / presumably / certainly adjourned.*  
 b. A: *The meeting is really / indeed adjourned.*

As performatives cannot be true or false, one cannot lie with them (Marsili 2021). For an utterance to be a lie requires that the speaker commits to, or vouches for, the truth of a proposition, which is the defining feature of assertions (cf. Shapiro 2020). Austin observed that performatives can be uttered in mischievous or deceiving ways, but this is different from lying:

- (5) Impostor to A: *You are arrested.*  
 A to impostor: *#You are a liar. / You aren't even a police agent!*

Performatives are put in force whenever they are correctly produced. For example, if a police officer in regular circumstances tells A, *You are arrested*, then A is in the legal status of being arrested. Even if the police officer later finds out that A was the wrong person and revokes this act, in the time in-between it holds that A is arrested.

The distinction between descriptive and performative use of language is of great importance in philosophy of language but it is treated rather marginally in linguistic semantics. The beginning

of a semantic account that takes performatives seriously is Szabolcsi (1982). I engaged with this article in Krifka (2014), and in the current article I will offer several refinements.

In Section 2, I will characterize Szabolcsi’s approach and her notion of functional index change. In Section 3 I will argue for a relational form of this notion. In section 4 I will integrate relational index change into a simple form of dynamic semantics for which we can define both the well-known “informative” update and the novel “performative” update. Section 5 will present an interpretation of assertions and declarations which assumes that this distinction is reflected in the syntax, and it will also point out that assertions have a performative component. Section 6 will discuss the temporal, modal and aspectual forms of performatives in a range of languages. In the Section 7, I will argue that the utterance of expressions themselves, and hence their locutionary aspect, can be addressed in the framework developed here as well. The final Section 8 deals with the performative marker *hereby*.

## 2. The proposal of Szabolcsi (1982)

Szabolcsi’s short paper was developed in the framework of Montague (1973), who proposes that declarative clauses denote propositions  $\phi$ , functions from world-time indices into truth values, type  $\langle s, t \rangle$ . This captures the use of language as describing how the world is like. Performative speech acts do not describe the world but change it, and Szabolcsi interprets them as “transition from one state of affairs to another”, hence of type  $\langle s, s \rangle$  (cf. also Sbisà 2002 for speech acts as context changers). She proposes that performative meanings based on a proposition  $\phi$  are functions that change an index  $i$  to  $i'$  with  $i \leq i'$  (that is,  $i'$  is equal or later than  $i$ ), where  $i'$  is identical to  $i$  with the (possible) difference that  $\phi$  is true at  $i'$ . While Szabolcsi writes  $i[\phi]$  for this index  $i'$ , we will use the notation  $i+\phi$ , and call it “functional index change”:<sup>3</sup>

(6) Functional index change (Szabolcsi):

$$i+\phi = i'[i \leq i' \wedge i' \text{ is identical to } i \text{ with the possible exception that } \phi(i')]$$

Now, given some index  $i$ , some expressions that involve a proposition  $\phi$  are interpreted descriptively, as  $\phi(i)$ , whereas others are interpreted performatively, as  $i+\phi$ . But what determines the type of interpretation? Why is *I congratulated you* interpreted descriptively, and *I congratulate you* rather performatively? Szabolcsi proposes that this is regulated by the system of syntactic categories<sup>4</sup>: descriptive sentences are of category  $t$  and interpreted by functions from indices to truth values, type  $\langle s, t \rangle$ , whereas performative sentences are of a different syntactic category  $\bar{t}$  and interpreted as functions from indices to indices, type  $\langle s, s \rangle$ . As sentences are projected from verbal predicates, this leads to a doubling of syntactic categories. For example, the verbal predicate *congratulate* has two distinct syntactic categories,  $(t/e)/T$  for the informative use, and  $(\bar{t}/e)/T$  for the performative use. Szabolcsi considers  $\bar{t}$  as a subcategory of  $t$ , hence every

<sup>3</sup> Lascarides & Asher (2003) define an action that makes a proposition true as a function from worlds to worlds; however, they do not give any restriction except that the proposition should hold at the output world. A similar index change is proposed in Hunter et al. (2018), rule 21.

<sup>4</sup> Montague (1973) uses  $t$  for both the syntactic category of sentences and the semantic type of truth values. In order to avoid confusion, I use italics for syntactic types here. Note, also, that Szabolcsi names indices as world-time pairs  $\langle i, j \rangle$ , whereas in the current text, letters  $i, i'$  etc. stand for indices encompassing possible worlds and times.

syntactic rule involving  $t$  also applies to  $\bar{t}$ . For interpretation, she proposes a meaning postulate scheme that states that whenever  $\alpha$  is a meaningful expression with a meaning of type  $\langle s, t \rangle$ , then  $\alpha$  is also a meaningful expression of type  $\langle s, s \rangle$ . The two interpretations are linked via the rule mentioned above: If  $\varphi$  is a meaning of type  $\langle s, t \rangle$ , a function from indices  $i$  to truth values  $\lambda i.\varphi(i)$ , then the corresponding meaning of type  $\langle s, s \rangle$  is  $\lambda i.i+\varphi$ , a function from indices to minimally different indices where  $\varphi$  is true.

It is only at the final step in the derivation of sentences that informative and performative expressions are treated in distinct ways. In addition to Montague's syntactic rule S17, which introduces tense and negation for informative meanings, Szabolcsi proposes a rule S17' for performative meanings.<sup>5</sup> It is interpreted by a translation rule T4' that effectively results in the meaning  $\lambda i.i+\varphi$ , where  $\varphi$  is whatever the informative update rule for present perfect sentences would have given us. For example, for the performative form *I congratulate you*, we get the interpretation  $\lambda i.i[\text{'speaker has congratulated addressee'}(i)]$ , where 'speaker has congratulated addressee' is interpreted as  $H(\text{'speaker congratulates addressee'})$ , which is  $\lambda i.\exists i'<i[\text{'speaker congratulates addressee at } i']$ . This function maps indices  $i$  to truth iff there is a preceding index  $i'$  at which the speaker congratulates the addressee. This means that the performative interpretation of *I congratulate you* is the function  $\lambda i.i+\lambda i'.\exists i''<i'[\text{'speaker congratulates addressee at } i'']$ , a function that maps indices  $i$  to the index  $i''$  that is identical to  $i$  except that  $i \leq i''$  and  $\exists i''<i''[\text{'speaker congratulates addressee at } i'']$ .

There is an interesting consequence of this treatment, not pointed out by Szabolcsi. It is reasonable to assume that  $i'' = i$ , that is, the congratulation happens at the very index  $i$ , the one at which the performative sentence is interpreted. If  $i''$  would be situated before  $i$ , that is, if  $i'' < i$ , then the congratulation would have already been performed at the index  $i$ , and the performative update would not lead to any change. But performative utterances typically involve a change, otherwise they would be superfluous. Equating  $i''$  with  $i$  is a welcome consequence, as it means that whenever the sentence *I congratulate you* is interpreted at index  $i$ , the proposition 'the speaker congratulates the addressee', understood as a perfective sentence, is also true at  $i$ . This motivates Koschmieder's notion of "coincidence": the utterance of the sentence, i.e. the interpretation at an index, coincides with the change it brings about.

In the following two sections, we will refine Szabolcsi's notion of index change and propose another way of treating descriptive and performative expressions within a dynamic framework.

### 3. The notion of index change

Szabolcsi requires that there is, for an index  $i$ , a *unique* index  $i'$  with  $i \leq i'$  such that  $i'$  differs from  $i$  *minimally* insofar as  $\varphi$  is true at  $i'$ . It turns out that this notion of functional index change is difficult to satisfy and has to be amended. One problem with definition (6) is that it excludes independent changes that happen at the same time. Imagine that the speaker  $s$  utters to the addressee  $a$  at the index  $i$ , *I congratulate you*. Szabolcsi models this as the functional update

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<sup>5</sup> Szabolcsi's rule S17' states that the verb should appear in its "appropriate present perfect form" – this should be "appropriate simple present form". Montague (1973) did not provide for simple present tense or for first and second person, hence the vague term "appropriate", as performative sentences in the form discussed by Szabolcsi have a first person subject.

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with  $i+\varphi$  has congratulated  $a$ , the index  $i'$  with  $i \leq i'$  that is most similar to  $i$  except that at  $i'$ , the effect of the congratulation of  $a$  by  $s$  has taken effect. The similarity condition will force  $i'$  to be temporally as close to  $i$  as possible – otherwise, other events would have happened in-between, and  $i$  and  $i'$  would be more different. But we do not want to exclude that other, unrelated changes happen at precisely the same moment, changes that went unnoticed by the participants or that are part of their joint attention. For example, we would not like to exclude that at the time  $s$  says *I congratulate you*,  $a$  sneezes.

To discuss how the problem of independent changes can be avoided, let us assume a framework of branching time (Thomason 1984). We assume a transitive relation  $<$  on the set of indices  $I$  with the condition of backwards linearity, i.e. it holds for all  $i, i', i'' \in I$  that if  $i' < i$  and  $i'' < i$ , then either  $i' = i''$  or  $i' < i''$  or  $i'' < i'$ . This entails that for each index  $i$ , the past is fixed, and the future is open. We now define functional index change as follows:

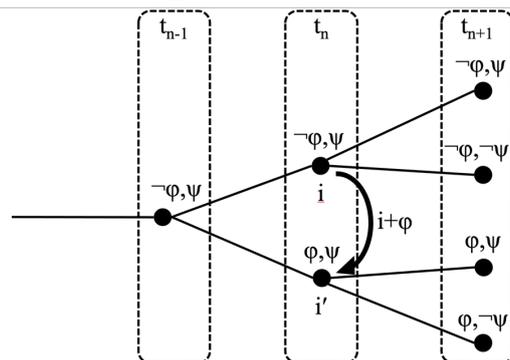
- (7) Functional index change with respect to a temporal order  $<$ :
- $i+\varphi$  is the unique index  $i'$  such that
    - a. for all  $i''$ :  $i'' < i \leftrightarrow i'' < i'$
    - b.  $\varphi(i') = 1$
    - c.  $i$  and  $i'$  do not differ in any other relevant proposition except  $\varphi$

(7)(a) guarantees that  $i$  and  $i'$  have the same history, (b) states that the proposition  $\varphi$  is true for the changed index  $i'$ , and (c) ensures that  $i$  and  $i'$  differ in no other respect. Notice that in case  $\varphi(i) = 1$ ,  $i$  and  $i'$  are identical, following (c). In the crucial case where  $\varphi(i) = 0$  and  $\varphi(i') = 1$ , the indices  $i$  and  $i'$  are not ordered by  $<$ ; rather, a branch has occurred with  $\varphi(i) = 0$  and  $\varphi(i') = 1$ . But  $i$  and  $i'$  are cotemporaneous,  $i \sim i'$ , a notion defined recursively as in (8).

- (8) Cotemporaneity across branches:
- a. For all  $i, i' \in I$ : If  $\forall i'' [i'' < i \leftrightarrow i'' < i']$ , then  $i \sim i'$
  - b. For all  $i, i' \in I$ : If  $\forall i'' < i \exists i''' < i' [i'' \sim i''']$ , then  $i \sim i'$
  - c. For all other  $i, i' \in I$ :  $\neg [i \sim i']$

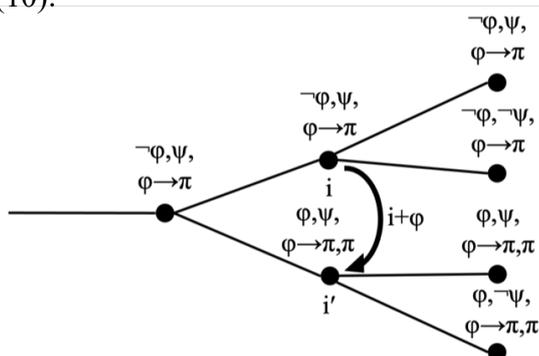
This creates equivalence classes of indices that are cotemporaneous,  $\{\{i \in I \mid i \sim i'\} \mid i' \in I\}$ . These equivalence classes, or “times”  $t$ , are ordered; we have  $t < t'$  iff  $\forall i \in t \forall i' \in t' [i < i']$ . Under certain conditions the order for times is linear (cf. Di Maio & Zanardo 1992 for “synchronized histories”), namely if  $I$  has a unique root and all indices have at least two successors. To illustrate, (9) shows seven indices, represented by dots, and the successive times  $t_{n-1}$ ,  $t_n$  and  $t_{n+1}$  they belong to. The diagram highlights four propositions  $\varphi$ ,  $\neg\varphi$ ,  $\psi$  and  $\neg\psi$  that obtain at these indices. Notice that the indicated functional index change  $i+\varphi$  is momentaneous as it does not take time; we have  $i \sim i'$ , and  $i, i' \in t_n$ .

- (9) Functional index change:  
 $i+\varphi = i'$  in a discrete model



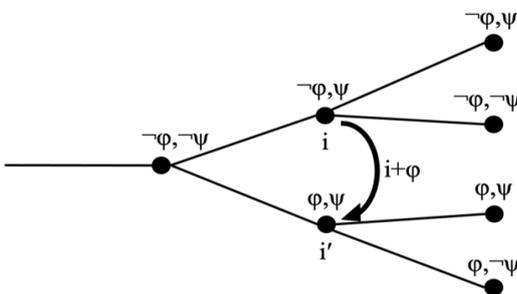
We now turn to the condition (7c): What does “any other relevant proposition except  $\varphi$ ” mean? First, there are propositions  $\pi$  that follow from  $\varphi$ . These propositions may be entailed by  $\varphi$  logically, such as in case  $\pi$  is  $[\varphi \vee \varphi']$ , or it might be that it has been established in the current history that whenever  $\varphi$  is true,  $\pi$  is true as well. This situation does not have to bother us. Assume that there is an index  $i''$  with  $i'' < i$  such that for all  $i'''$  with  $i'' \leq i'''$  it holds that  $\varphi(i''') \rightarrow \pi(i''')$ . The functional index change  $i + \varphi$  will result in an index  $i'$  for which not only  $\varphi$  is true but  $\pi$  is true as well, as illustrated in (10):

- (10) Functional index change  
with dependent index change:  
 $i + \varphi = i'$ ,  
where  $\varphi \rightarrow \pi$  is established  
throughout the current histories



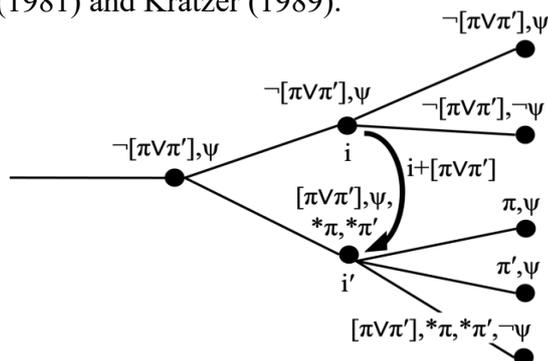
But it also might happen that with the change from  $i$  to  $i + \varphi$ , there is another, coincidental change. Assume that at the indices before  $i$ , both  $\varphi$  and  $\psi$  are false, and that  $\psi$  happens to become true at index  $i$ . The index change  $i' = i + \varphi$  will keep  $\psi$  as true, as illustrated in (11). Compared to the predecessor of  $i'$ , both  $\varphi$  and  $\psi$  have become true, but only the first change was triggered by the performative update  $i + \varphi$ , the second change is independent of it.

- (11) Functional index change  
with independent index change  
 $i + \varphi = i'$ ,  
with cotemporaneous change  
from  $\neg\psi$  to  $\psi$ .



Another case to consider are situations in which there are multiple ways to make a proposition  $\varphi$  true. For concreteness, take  $\varphi = \lambda i[\pi(i) \vee \pi'(i)]$ , for which we write  $[\pi \vee \pi']$ . Then the change  $i' = i + \varphi$  requires that  $\varphi(i') = [\pi \vee \pi'](i') = 1$ , but leaves it open whether  $\pi$  or  $\pi'$  is true at  $i'$ . If we want to retain the idea that index changes are functions, i.e. right-unique relations, then we would have to allow that propositions can be undetermined at particular indices (as e.g. situations in the sense of Barwise & Perry (1981) and Kratzer (1989)).

- (12) Functional index change  
with a proposition  $[\pi \vee \pi']$ ,  
where \* denotes indeterminacy,  
with further change to  $\pi$  and  $\pi'$ .



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The notation  $*\pi$  for indeterminacy suggests an approach with a three-valued logic. However, such logics generally exclude that a disjunction is true but both disjuncts are undefined. It is rather the indeterminacy of quantum logic, to model that it is known that a particle is in one state or another, without knowing in which state it is (cf. Aerts et al. 2000)

Another option for dealing with the problem of multiple ways of satisfying a proposition is to retain classical indices that determine the truth value of all propositions, and assume that index change is a relational, not a functional notion (Krifka 2014). To illustrate, we can define  $i+[\varphi]$  as the *set* of indices  $i'$  that are minimally different from  $i$ , as follows:

(13) Relational index change:

$i' \in i+[\varphi]$  iff

a. for all  $i''$ ,  $i'' < i \leftrightarrow i'' < i'$

b.  $\varphi(i') = 1$

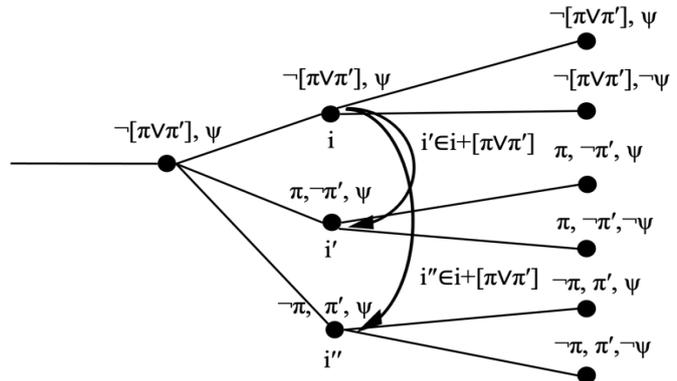
c.  $i$  and  $i'$  do not differ in any other relevant proposition but  $\varphi$ .

Example (14) illustrates relational index change, as the  $i$  can be changed in two equally minimal ways to make  $[\pi \vee \pi']$  true.

(14) Relational index change:

$i+[\pi \vee \pi']$ ,

where  $\pi, \pi'$  are mutually exclusive



The choice between functional index change and relational index change is reminiscent of two prominent treatments of counterfactual conditionals. For the semantics of *if  $\varphi$  were the case then  $\psi$  would be the case*, interpreted at index  $i$ , Stalnaker (1968) proposes access to the unique index  $i'$  that is as similar to  $i$  except that  $\varphi$  holds, whereas Lewis (1973) argues that this index is not unique, and allows for a set of such indices. I consider relational index change the more plausible option and use this notion for the remainder of the paper.

## 4. Informative and performative updates

Szabolcsi (1982) is an example of a dynamic theory of meaning, but only for performative expressions, as they are functions from input indices to output indices. Dynamic theories have been developed several years earlier by Stalnaker (1978) for descriptive expressions. The central assumption of such models is that conversation consists of the update of the common ground by the interlocutors, where “common ground” is understood as the beliefs about the actual world and current time that the interlocutors assume to be shared (Stalnaker 2002).

Stalnaker (1978) works with a simple model of common ground, so-called “context sets”, which we understand as sets of world-time indices. A context set  $c$  can be updated by the information present in the proposition  $\varphi$  as follows, which we call “informative update”; the set  $c$  is restricted to those indices for which  $\varphi$  is true as well. Notice that the indices in  $c$  are not changed;  $c$  is just reduced to those indices for which  $\varphi$  is true.

(15) Informative update:

$$c + \text{inform}(\varphi) = \{i \mid i \in c \wedge \varphi(i) = \text{true}\} = \{i \in c \mid \varphi(i)\}$$

Participants of a face-to-face conversation assume that they share their notion of current time, hence we have for all  $c, \forall i, i' [i \in c \wedge i' \in c \rightarrow i \sim i']$ .

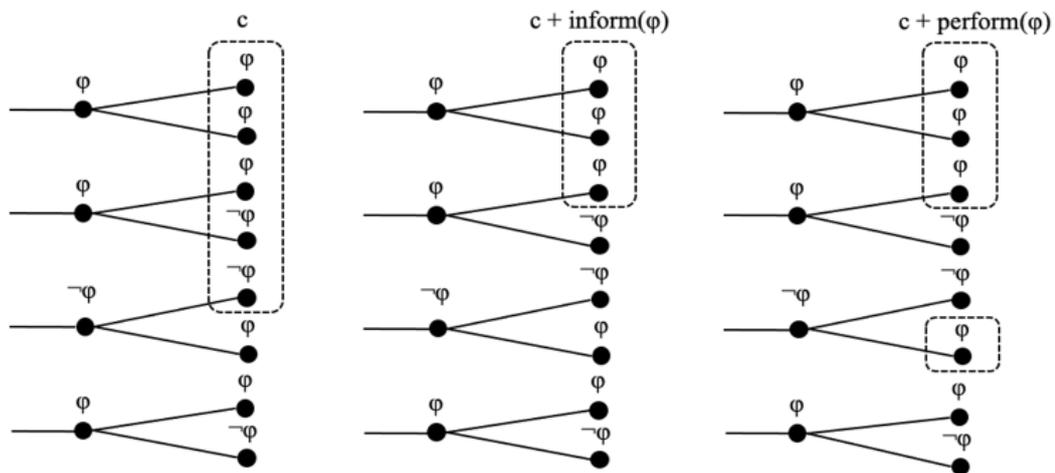
We now define an update of a context set that is based on relational index change as defined in Section 3; we call this “performative update”:

(16) Performative update, based on relational index change:

$$c + \text{perform}(\varphi) = \{i' \mid \exists i \in c [i' \in i + [\varphi]]\}$$

While informative update reduces a context set  $c$ , performative update changes the indices in  $c$ . We always have  $c + \text{inform}(\varphi) \subseteq c$ , but this relation typically does not hold for performative update, and often we will even have  $[c + \text{perform}(\varphi)] \cap c = \emptyset$ . In a branching time model, informative and performative update of a context set can be illustrated as in (17).

(17) Informative and performative update of a context set  $c$



As we see, performative update can introduce new indices into a context set that were not in it before. For typical cases of performative updates  $c + \text{perform}(\varphi)$ , the proposition  $\varphi$  is not true at the indices of the input context set  $c$ , i.e. we have  $c + \text{inform}(\varphi) = \emptyset$ .

Informative and performative updates have one thing in common: They change the context set. This is motivated when we want to use them to model assertions and declarations, as both are communicative acts that are supposed to leave their mark on the common ground. However, declarations seem to have a wider effect than just on common ground of a conversation. If a manager declares in a meeting to give a pay raise to an employee, this has lasting effects beyond

the conversation in the meeting. This might necessitate a distinction between the world in which the communication happens on the one hand, and the context set that represents the shared assumptions about this world on the other (cf. Buch 2023 for a proposal).

## 5. The syntactic realization of declarations and assertions

We now turn to the interpretation of declarative sentences and consider what causes their interpretation as assertions or declarations. Recall that Szabolcsi (1982) stipulated different syntactic categories and semantic types for all subexpressions. This is not necessary.

Let us start with declarations and assume that they are based on a TP that denotes a proposition to which an operator  $\bullet$  is applied that turns this into a performative update of a context set. This is an illocutionary operator in the sense of Searle (1969). Syntactically, it results in what we call here an “Act Phrase”, ActP, where  $\bullet$  forms the head of this ActP (cf. also Krifka 2014), cf. (18). This is a function that takes input assignments  $c$  and turns them into output assignments, where every index  $i$  in  $c$  is changed minimally so that the TP proposition becomes true.

$$\begin{aligned}
 (18) \quad & \llbracket [\text{ActP } \bullet \text{ } [\text{TP } \textit{the meeting is adjourned}]] \rrbracket \\
 & = \llbracket \bullet \rrbracket (\llbracket [\text{TP } \textit{the meeting is adjourned}] \rrbracket) \\
 & = \lambda p \lambda c [c + \text{perform}(p)] (\lambda i [\textit{the meeting is adjourned at } i]) \\
 & = \lambda c [c + \text{perform}(\lambda i [\textit{the meeting is adjourned at } i])] \\
 & = \lambda c \{i' \mid \exists i \in c [i' \in i + [\lambda i [\textit{the meeting is adjourned at } i]]]\}
 \end{aligned}$$

Declarations come with preconditions. Searle (1989) pointed out that performatives like *I hereby fry this egg* would not work, as the egg won’t be cooked by just declaring so. What we can change with our utterances are the social facts (cf. Searle 2010 for the fundamental role of declarations to build up our societies). But even for those changes, the speaker must have the prerequisite entitlements for the change to occur. We can model such felicity conditions by a presupposition, as already suggested by Szabolcsi (1982). In (19),  $s$  refers to the speaker.

$$(19) \quad \llbracket \bullet \rrbracket^s = \lambda p \lambda c. s \text{ is entitled in } c \text{ to enact the update of } c \text{ to } \text{perform}(p) [c + \text{perform}(p)]$$

Explicit performatives are analyzed as a special case of declarations that name the speech act that is performed. We assume here that they refer to events (cf. also Eckardt 2012).

$$\begin{aligned}
 (20) \quad & \llbracket [\text{ActP } \bullet \text{ } [\text{TP } \textit{I declare the meeting to be adjourned}]] \rrbracket^s \\
 & = \llbracket \bullet \rrbracket^s (\llbracket [\text{TP } \textit{I declare the meeting to be adjourned}] \rrbracket^s) \\
 & = \lambda c [c + \text{perform}(\lambda i \exists e [e \text{ at } i \wedge e: s \text{ declares the meeting to be adjourned}])]
 \end{aligned}$$

This changes the indices  $i$  of  $c$  minimally to  $i'$  so that for all indices in the output context set there is an event  $e$  that is at (= ends at)  $i'$ , where  $e$  is a declaration that the meeting is adjourned, and  $s$  is the agent of  $e$ . As before,  $s$  must be entitled to perform this change, and if  $s$  is entitled, then the existence of this event will bring it about that the meeting is adjourned. This means that the proposition  $\lambda i [\textit{the meeting is adjourned at } i]$  will hold in the output of (20) as well.

Let us now turn to assertions. One straightforward way to model assertions is to assume another illocutionary operator,  $\circ$ , that triggers an informative update:

$$(21) \llbracket \circ \rrbracket^s = \lambda p \lambda c [c + \text{inform}(p)]$$

However, there are good reasons to assume that assertions do not change the common ground by brute force, as suggested by (21). Rather, this change only happens if the addressee agrees or at least does not object to it (cf. Farkas & Bruce 2010, Lauer 2013, Krifka 2015, 2022). I model this by assuming that the basic meaning of an assertion is to introduce a commitment of the speaker to the truth of the proposition, and that, with this support, the speaker wants that the addressee accepts the proposition to the common ground (cf. Geurts 2019, Shapiro 2020 for the commitment view of assertions). I express this by “ $s \vdash_{i,e} \phi$ ”, which stands for “ $s$  commits him/herself by the event  $e$  that occurs at  $i$  to the proposition  $\phi$ ”. I assume that the commitment operator is introduced by its own projection, the ComP (“commitment phrase”):

$$(22) \begin{aligned} & \llbracket [\text{ActP} \bullet [\text{ComP} \vdash [\text{TP } \textit{the meeting is adjourned}]]] \rrbracket^s \\ &= \llbracket \bullet \rrbracket^s (\llbracket \vdash \rrbracket^s (\llbracket [\text{TP } \textit{the meeting is adjourned}] \rrbracket^s)) \\ &= \lambda c [c + \text{perform}(\lambda i \exists e [s \vdash_{i,e} \lambda i [\textit{the meeting is adjourned at } i]])] \end{aligned}$$

This is a performative update in which  $s$  changes the indices  $i$  of the context set so that they support there being an event  $e$  at  $i$  in which the speaker  $s$  vouches for the truth of the proposition that the meeting is adjourned. This is a performative update:  $s$  changes the social world from a state where  $s$  did not have this commitment to one in which  $s$  has. This captures the performative aspect of constatives, which was noted already by Austin (1962) noticed. The presupposition (19) is satisfied, as persons are generally entitled to make truth commitments.

The social commitment to the truth of a proposition undergone by the speaker is the reason why other participants put the proposition into the common ground. In general, this uptake is the intention of the speaker that asserts a proposition; it is the primary perlocutionary effect intended by the speaker. It can be modelled by informative update  $\circ$ . Krifka (2015) argues that this informative uptake is a conversational implicature, as it can be cancelled, and can be derived as a plausible goal of a speaker that undergoes a commitment. Krifka (2022) models it as a disjunction between the informative update of the proposition and, alternatively, an action of the addressee that expresses disagreement with this, in which case the informative update does not happen. The table model of Farkas & Bruce (2010) provides another mechanism to capture the negotiation aspects that lead to the uptake of an asserted proposition.

The commitment operator  $\vdash$  and a syntactic projection of a ComP can explain the presence of expressions that strengthen or weaken the commitment of speakers, as a way to shield their reputation in case the proposition turns out false. This is illustrated in (23) with *really*, which I assume expresses that the commitment event  $e$  is strong.

$$(23) \begin{aligned} & \llbracket [\text{ActP} \bullet [\text{ComP } \textit{really} [\text{ComP} \vdash [\text{TP } \textit{the meeting is adjourned}]]] \rrbracket^s \\ &= \lambda c [c + \text{perform}(\lambda i \exists e [\text{strong}(e) \wedge s \vdash_{i,e} \lambda i [\textit{the meeting is adjourned at } i]])] \end{aligned}$$

Assertions also allow for epistemic and evidential modification. Following Krifka (2023), assertions with subjective epistemic modifiers can be analyzed as commitments to a positive epistemic attitude of the speaker towards the TP proposition. This gives sufficient support for the TP proposition to be accepted to the common ground. At the same time, it shields the

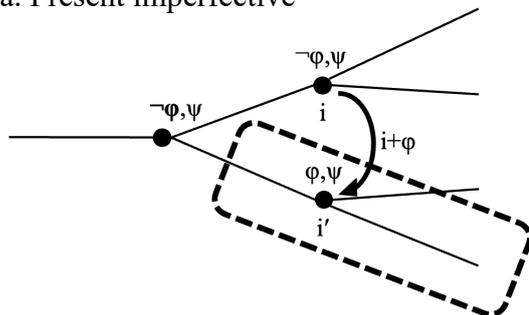


habits because they show the subinterval property (if such clauses are true at an interval, they are also true at the parts of that interval). According to them, this should rule out progressives.

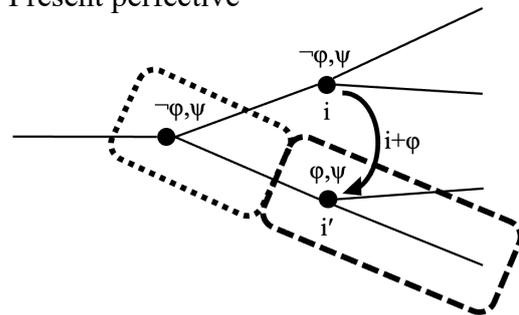
However, Fortuin (2019) points out that there are languages that allow for progressives. One example is Mongolian for explicit performatives; however, it appears that the progressive of episodic verbs has a futurate meaning that does not imply that the event in question is ongoing. English also allows for the progressive with some verbs, as in *I am warning you!* or *I am dedicating this performance to my spouse*. De Wit et al. (2018) suggest that progressives make the speech act more prominent, perhaps by indicating that the involved action is more complex. They might also refer to the locutionary part, which is temporally extended; see Section 7.

The situation in Slavic languages is varied, and it sometimes depends on the lexical nature of the verbs. In general, the imperfective present is used, which is also the simplest verb form in Slavic. Also, while the imperfective is compatible with a clause that is true over an extended interval but is compatible with an initial evaluation index. Hence, it can be used to express explicit performatives, cf. (26a). As for the use of the perfective present, this is possible if perfective expresses that at the index of evaluation the clause has become true already. The use of the perfective then presupposes indices before at which the clause was not true yet, and the index of change is the first one for which this is the case, cf. (26b).

(26) a. Present imperfective



b. Present perfective



In non-performative utterances, the present perfective typically has a future meaning. A plausible reason is that it would be very rare to report on an event that is completed precisely at the index of utterance. Typically, the completion is already in the past, in which case the past tense perfective can be used. The systematic exception to this rule are precisely explicit performatives, which, as we have argued, become true exactly at the moment of utterance.

Fortuin (2019) also identified a number of other languages, mostly of the Afro-Asiatic and Niger-Congo family, that express explicit performatives in the present perfect. The motivation for this form is similar to the perfective above: At the index of interpretation of a perfect clause, the end-state of a phase change has been reached, and the index of explicit performatives is the first such index at which the perfect clause is true. This motivation also underlies the use of perfect participles in German performances such as *Versprochen!* ‘Promised!’), also in urgent commands, such as *Stillgestanden!* ‘stand still!’ (Ørsnes 2020).

There are languages that can use a past tense form to express performatives. This appears in inscriptions of ancient languages of the Levante and in Old Russian (Dekker 2018) and could

## Performative and assertive updates

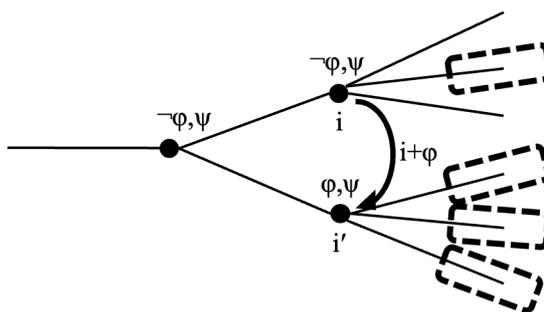
plausibly be explained by reference to a preceding oral act. However, it also occurs in the spoken language, e.g. in modern Persian:

- (27) *Hamintowr raha šodi*  
 hereby free become.2SG.PST  
 ‘You are hereby free’, lit. ‘You became hereby free’ (Perry 2007: 999)

Perry (2007) describes this use as expressing “irrevocable intent”, and the realis flavor past tense might contribute to the sense of irrevocability. Still, it does not fit into the model of perfectives presented here. This also holds for the use of the aorist in Ancient Greek; Bary (2012) explains this as a marker of punctual or complete events that may apply to the index of evaluation, as there is no present aorist in the language. The occurrence of past tense forms corresponds to Szabolcsi’s use of the H operator in the analysis of performatives.

There are languages that can use future-related verb forms to express performatives; Fortuin (2019) mentions Tibetan and Bulgarian. This is compatible with the model of performatives developed here: A future clause is true at an index  $i$  if all continuations of  $i$  (or all normal continuations) are such that the clause will become true at them. Performative update then can be seen as a minimal change from an index where this is not the case to an index where it is:

- (28) Future performative



Fortuin (2019) discusses rare cases of English future performatives as the following example:

- (29) *I will promise you this, that if we have not gotten our troops out by the time I am president, it is the first thing I will do.*

This can be analyzed as a double performative. Notice that future clauses with first person subjects can be understood in general as performatives. The sentence *I will come to your party* can not only be understood as a prediction about the future developments but also a performative, where  $s$  changes the index so that in all accessible future developments,  $s$  will come to the party, as in (28). Hence (29) can be analyzed as a promise to give a promise, which is pragmatically equivalent to a simple promise.

I would like to add two more data point to the discussion of the morphological forms. One concerns explicit performatives. There are many languages that differentiate between two modal forms, “realis” and “irrealis”, for example Oceanic languages (cf. von Prince et al. 2022). The basic distinction is between a form that is applied for events and states that are “real” because they hold at the actual world and current time or some time before that, and another form for events and states that are not real, for example because they hold in the future or at an non-actual development. One interesting question is which form explicit performatives

take in such languages. On the one hand, when uttered felicitously, they make the world adhere to the words, hence we would predict a realis form. On the other, their proposition is not real yet at the very moment of utterance, hence we would predict an irrealis form. I investigated this issue for the language Daakie (Ambrym, Vanuatu). Daakie has a realis – irrealis distinction; in fact, it has three irrealis forms, one of which denotes counterfactuality and is restricted to dependent clauses (Krifka 2016). The two forms that are of concern here are the simple irrealis, which is used in root clauses for expressing commands and promises, and a combination of a prefix *a-* with that irrealis form, forming a future that is used for predictions. The following examples illustrate the simple irrealis (glossed PT for “potentialis”) as a command, and contrasts it with the future:

- (30) *Mwe kie ka, Andri, nyak ko-p van* RE: Realis, C.IR: Irrealis complementizer  
 RE say C.IR Andri 2SG 2SG-PT go PT: Potentialis  
 ‘He said, Andri, you go!’ (Andri5.032)
- (31) *ngale a-ko-p mee soaa lan bogon*  
 then FUT-2SG-PT come come.out at point  
 ‘Then you will come out at the (agreed) point’ (Aiben2.048)

Interestingly, speakers use the irrealis in explicit performatives. This form can be elicited but also occurs in actual conversations as in (32), which was uttered by a high-ranking visitor, as part of a public speech, when he handed over a tent to congregation of chiefs and church elders.

- (32) *na-p sengane man tiri kingyee nge* CL2: possessive classifier  
 1SG-POT give CL2-3SG something DEM.PL FOC FOC: focus  
 ‘I hereby give these all these things’ (Obed1.040)

The other data point concerns declarations excluding explicit performatives, that is, declarations that do not name the action itself. German has a morphological form that is known as a reportative evidential, the “Konjunktiv I” (cf. Sæbø & Fabricius-Hansen 2003). This form has another use to mark declarations (so-called “Heischesatz”, cf. Jäger 1970).

- (33) a. *Es werde Licht!* ‘Let there be light!’  
 b. *Dein Wunsch sei dir gewährt.* ‘Your wish is granted.’  
 c. *Es sei n eine Primzahl.* ‘Let n be a prime number.’

The two functions of “Konjunktiv I” have in common that they exclude assertions by the speaker. In the reportative use, the committer must be distinct from the speaker; as “Heischesatz”, the sentence is not an assertion but a declaration.

## 7. Locutionary acts as index changers

The speech acts we looked at so far where illocutionary acts. They create new facts in the world, even with assertions, which create truth commitments. However, in order to perform such acts, the speaker must also produce a linguistic sign, which Austin (1962) called the “locutionary” act. Uttering a sentence clearly also changes the world in the common ground,

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and we should be able to model this as a performative update as well.<sup>7</sup> Locutionary acts are typically temporally extended, hence cannot become true at instances. In this, they differ from illocutionary acts like declaring (20) or committing to the truth of a proposition (22). In the terminology of Vendler (1957), illocutionary acts are achievements, whereas locutionary acts are accomplishments.

To integrate locutionary acts into our framework we have to refer to the wording used by the speaker. Let us assume a predicate SAY that takes a linguistic representation as an argument, together with the speaker, the addressee, an interval, and an event that happens at that interval. (34) is a non-performative example, for illustration. I use  $j, j'$  etc. for intervals, totally ordered sets of indices; that is, for all intervals  $j$  it holds that  $\forall i, i' \in j [i < i' \vee i' < i \vee i = i']$ . We have that  $j < j'$  iff  $\forall i, i' [i \in j \wedge i' \in j' \rightarrow i < i']$ .

$$(34) \quad \llbracket \llbracket_{\text{TP}} \text{Sue said "I congratulate you" to Max} \rrbracket \rrbracket^{s,a}$$

$$= \lambda i \exists e \exists j [j < i \wedge \text{SAY}(j)(e)([I \text{ congratulate you}])(\text{max})(\text{sue})]$$

Locutionary acts can be represented by performative updates as in (35). This changes the indices  $i$  of the input context  $c$  first to indices  $i'$  that are minimally different from  $i$  insofar they are the initial point of an interval  $j$  at which there is an event  $e$ , where Sue says to Max, *I congratulate you*. The output indices  $i''$  are the final points of these intervals:

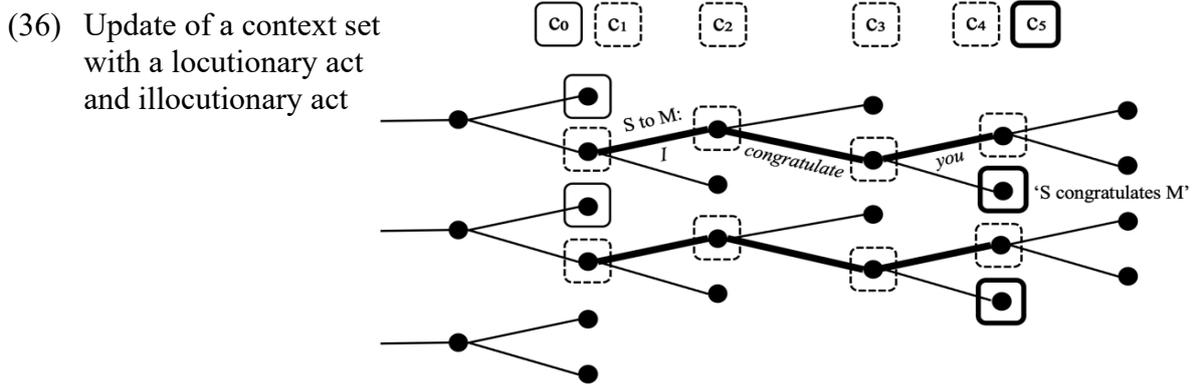
$$(35) \quad \text{Sue says to Max: } [\text{ActP} \bullet [\text{TP } I \text{ congratulate you}]] \quad \text{where}$$

$$= \lambda c \{i'' \mid \exists i \in c \exists i' [i' \in i + [\lambda i'' \exists e \exists j [i'' = \text{ini}(j) \wedge i'' = \text{fin}(j) \wedge \text{SAY}(j)(e)([I \text{ congratulate you}])(m)(s)]]]\}$$

$$i = \text{ini}(j) \text{ iff } i \in j \wedge \neg \exists i' < i [i' \in j]$$

$$i = \text{fin}(j) \text{ iff } i \in j \wedge \neg \exists i' > i [i' \in j]$$

The performative update with the locutionary act, which consists in producing a linguistic expression, is followed by the performative update with the illocutionary act, which consists of interpreting this expression. This is illustrated in (36).



The input context set  $c_0$  represents the information that is mutually shared at the point where Sue makes this utterance. When Sue starts to pronounce the first word, she initiates a change of the indices in  $c_0$ , with the resulting context set  $c_1$ . The pronunciation of the first word *I* leads to the context set  $c_2$ , the pronunciation of the second word *congratulate* to  $c_3$  and the

<sup>7</sup> See Buch (2023) for an architecture that distinguishes between the situation at which a conversation takes place and the content of what has been communicated so far.

pronunciation of the third word *you* to  $c_4$ . The indicated changes may include other events during the uttering of this sentence. After the locutionary act is completed, the illocutionary effect arises: The indices of the context set  $c_4$  are updated with the proposition ‘Sue congratulates Max’, as a result of the utterance of the sentence. This results in the context set  $c_5$ .

In general, locutionary acts are based on a linguistic form  $\alpha$  performed by a speaker  $s$  directed to an addressee  $a$ . Let us use double angled brackets  $\langle\langle \dots \rangle\rangle$  for the phonological interpretation of a linguistic form as in (37). The speech act can be modeled by dynamic conjunction, or function composition, of a locutionary act with an illocutionary act as in (38).

$$(37) \langle\langle \alpha \rangle\rangle^{s,a} = \lambda c \{i''' \mid \exists i \in c \exists i' [i' \in i + [\lambda i'' \exists e \exists j [i'' = \text{ini}(j) \wedge i''' = \text{fin}(j) \wedge \text{SAY}(j)(e)(\alpha)(a)(s)]]]\}$$

$$(38) \langle\langle \alpha \rangle\rangle^{s,a}; [\alpha]^{s,a} = \lambda c [[\alpha]^{s,a}(\langle\langle \alpha \rangle\rangle^{s,a}(c))]$$

Applied to example (35) we get the interpretation (39) for the combined illocutionary and perlocutionary act:

$$(39) \lambda c \{i''' \mid \exists i \in c \exists i', i'' [i' \in i + [\lambda i'' \exists e \exists j [i'' = \text{ini}(j) \wedge i''' = \text{fin}(j) \wedge \text{SAY}(j)(e)([I \text{ congratulate } you])(m)(s) \wedge i''' \in i' + [\lambda i'' \exists e' [\text{congratulate}(i''')(e')(m)(s)]]]]]\}$$

One might ask exactly when the illocutionary effect happens with respect to the locutionary act. For certain performatives, the precise timing of the change can be of importance, and then can be marked by an instantaneous signal. For example, in auctions the auctioneer marks the end of the bidding with the knock of a gavel on the lectern. For most purposes, the precise timing of the illocutionary act with respect to the locutionary act is of no great importance, and in general, the final point of locutionary act is the obvious candidate.

## 8. Hereby / hiermit as referring to the locutionary act

Koschmieder and Austin pointed out that *hiermit* in German and *hereby* in English mark explicit performatives. Eckardt (2012) analyzes this term as referring to the “ongoing act of information transfer”. In an explicit performative like *I hereby promise to clean the kitchen*, this act is introduced as an argument of the performative verb *promise* (cf. also Močnik 2015). This raises the issue how declarations that do not contain such performative verbs should be handled, such as *I hereby open the exhibition* (an example used by Eckardt).

The analysis of speech acts as a composition of a locutionary act and an illocutionary act as in (38) provides an event for the locutionary act that is independent from performative verbs like *promise*. The adverbs *hereby* and *hiermit* can be analyzed as referring to the utterance event, or to a concomitant event such as a signature under a contract or a handshake. For example, in the variant of (39), *I hereby congratulate you*, the deictic adverb *hereby* would express that the illocutionary event  $e'$  that Sue congratulates Max is causally connected to the locutionary event  $e$  of saying this sentence. Different from Eckardt (2012), the antecedent for *hereby* is not an event that is explicitly named in the sentence (like the regret or the obligation to inform); rather, the antecedent is the utterance itself, the locutionary act.

This explains an apparent puzzle, that *hereby* can occur in embedded clauses (cf. Lee 1975):

(40) *I regret that I have to inform you that you are hereby fired.*

We do not have to assume here an embedded speech act *you are hereby fired*, which corresponds to the fact that German typically shows verb-final dependent clause syntax in such cases. Rather, *hereby* is interpreted in its host TP *you are ... fired* and expresses that the state of the addressee being fired is causally connected to the utterance event of the whole sentence.

## References

- Aerts, D., E. D'Hondt, & L. Gabora. 2000. Why the disjunction in quantum logic is not classical. *Foundations of Physics* 30, 1473-1480.
- Austin, J. L. 1961. Performative utterances. Ed. J.O. Urmson & G.J. Warnock, *Philosophical Papers*. Oxford: Clarendon Press. 233-253.
- Austin, J. L. 1962. *How to do things with words*. Oxford: Clarendon Press.
- Barwise, J. & J. Perry. 1984. *Situations and Attitudes*. Cambridge, MA: The MIT Press.
- Bary, C. 2012. The Ancient Greek tragic aorist revisited. *Glotta* 88, 31-53.
- Buch, F. 2023. *Speech Act Deixis: A situated dynamic account for observational and experimental insights into spoken German*. Doct. diss., Humboldt-Universität zu Berlin.
- Condoravdi, C., & Lauer, S. 2011. Performative verbs and performative acts. *Sinn und Bedeutung* 15, 1-15.
- Dekker, S. 2018. *Old Russian birchbark letters: A pragmatic approach*. Leiden: Brill.
- De Wit, A., F. Brisard, & M. Meeuwis. 2018. The epistemic import of aspectual constructions: the case of performatives. *Language and Cognition* 10(2), 234-265.
- Di Maio, M.C., & Zanardo, A. 1994. Synchronised histories in Prior-Thomason representation of branching time. *International Conference on Temporal Logic*, 265-282.
- Eckardt, R. 2012. *Hereby explained: An event-based account of performative utterances*. *Linguistics and Philosophy* 35, 21-55.
- Farkas, D. F., & K. B. Bruce. 2010. On reacting to assertions and polar questions. *Journal of Semantics* 27, 81-118.
- Geurts, B. 2019. Communication as commitment sharing: speech acts, implicatures, common ground. *Theoretical Linguistics* 45(1-2), 1-30.
- Hunter, J., N. Asher, & A. Lascarides. 2018. A formal semantics for situated conversation. *Semantics and Pragmatics* 11(10), 1.
- Jäger, S. 1970. Indirekte Rede und Heischesatz. Gleiche formale Strukturen in ungleichen semantischen Bereichen. *Studien zur Syntax des heutigen Deutsch*. IDS Mannheim. 103-117.
- Keck, G. & M. Stubbs. 1984. Koschmieder on speech act theory: A historical note. *Journal of Pragmatics* 8, 305-310.
- Koschmieder, E. 1930. Durchkreuzungen von Aspekt- und Tempussystemen im Präsens. *Zeitschrift für Slavische Philologie* 7, 341-358.
- Kratzer, A. 1989. An investigation in the lumps of thought. *Linguistics and Philosophy* 12, 607-653.
- Krifka, M. 2014. Embedding illocutionary acts. Ed. T. Roeper & M. Speas, *Recursion. Complexity in cognition*. Springer. 125-155.
- Krifka, M. 2015. Bias in Commitment Space Semantics: Declarative questions, negated questions, and question tags. *Semantics and Linguistic Theory (SALT)* 25, 328-345.

- Krifka, M. 2016. Realis and non-realis modalities in Daakie (Ambrym, Vanuatu). *SALT* 26, 566-583.
- Krifka, M. 2022. Adjacency pairs in common ground update: Assertions, questions, greetings, offers, commands. *Proceedings of the 26th Workshop on the Semantics and Pragmatics of Dialogue*, 94-105.
- Krifka, M. 2023. Layers of assertive clauses: Propositions, judgments, commitments, acts. Ed. J. Hartmann & A. Wöllstein, *Propositionale Argumente im Sprachvergleich: Theorie und Empirie*. Tübingen: Gunter Narr. 115-181.
- Krifka, M. 2024. Performative updates and the modeling of speech acts. *Synthese* 203(1).
- Lascarides, A. & Asher, N. 2003. Imperatives in dialogue. Ed. P. Kuehnlein, H. Rieser, & H. Zeevat, *Perspectives on dialogue in the new millenium*. Amsterdam: Benjamins.
- Lauer, S. 2013. *Towards a dynamic pragmatics*. Doctoral dissertation, Stanford University.
- Lee, Ch. 1975. Embedded performatives. *Language* 51, 105-108.
- Lewis, D. 1973. *Counterfactuals*. Cambridge, Mass.: Harvard University Press.
- Marsili, N. 2021. Lies, common ground and performative utterances. *Erkenntnis*.
- Montague, R. 1973. The proper treatment of quantification in ordinary English. Ed. K.J.J. Hintikka, et al., *Approaches to Natural Language*. Dordrecht: Reidel. 221-242.
- Močnik, M. 2015. *Slovenian perfective and imperfective performative utterances*. MSc Thesis, University of Amsterdam.
- Ørsnes, B. 2020. On the Performative Use of the Past Participle in German. *Journal of Germanic Linguistics* 32(4), 335-419.
- Perry, J. R. 2007. Persian morphology. Ed. Alan S. Kaye, *Morphologies of Asia and Anfrica*. Eisenbrauns.
- Recanati, F. 1987. *Meaning and force*. Cambridge: Cambridge University Press.
- Sæbø, K.-J. & C. Fabricius-Hansen. 2004. In a mediative mood: The semantics of the German reportative subjunctive. *Natural Language Semantics* 12, 213-257.
- Sbisà, M. 2002. Speech acts in context. *Language & Communication* 22, 421-436.
- Searle, J. R. 1969. *Speech acts. An essay in the philosophy of language*. Cambridge: Cambridge University Press.
- Searle, J. R. 1976. A classification of illocutionary acts. *Language in Society* 5, 1-23.
- Searle, J. R. 1989. How performatives work. *Linguistics and Philosophy* 12, 535-558.
- Searle, J. R. 2010. *Making the social world. The structure of human civilization*. Oxford University Press.
- Shapiro, L. 2020. Commitment accounts of assertion. Ed. S. Goldberg, *Oxford Handbook of Assertion*. Oxford: Oxford University Press. 73-97.
- Stalnaker, R. 1968. A theory of conditionals. Ed. N. Rescher, *Studies in logical theory*. Oxford: Basil Blackwell. 98-112.
- Stalnaker, R. C. 1978. Assertion. Ed. P. Cole, *Pragmatics*. New York: Academic Press. 315-323.
- Stalnaker, Robert. 2002. Common ground. *Linguistics and Philosophy* 25, 701-721.
- Szabolcsi, A. 1982. Model theoretic semantics of performatives. Ed. Ferenc Kiefer, *Hungarian linguistics*. Amsterdam: John Benjamins. 515-535.
- Thomason, R. H. 1984. Combinations of tense and modality. Ed. D. Gabbay & F. Guentner, *Handbook of Philosophical Logic II*. Dordrecht: Reidel. 135-165.
- Vendler, Z. 1957. Verbs and times. *The Philosophical Review* LXVI, 143-160.
- von Prince, K., A. Krajinović, & M. Krifka. 2022. Irrealis is real. *Language* 98(2), 221-249.