ORIGINAL RESEARCH

Conceptual change and conceptual enrichment: a frame-based reconstruction of Austin's theory of speech acts

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Abstract
In this article, I will use the frame-model to analyze different kinds of concept change. Mainly, I will use frames to distinguish between what I will call *inter-conceptual change* and *intra-conceptual change* as well as between *conceptual structure change* and *conceptual content change*. Further, I will introduce the notion of *conceptual enrichment* as opposed to conceptual change. To achieve these goals, I will expand the frame-model where necessary and exemplify the proposed extensions by means of a frame-based analysis of John L. Austin's distinction between constative and performative utterances.

Keywords Frame model · Conceptual change · Inter-conceptual change · Intra-conceptual change · Conceptual enrichment · Speech act · Constative · Performative

1 Introduction

Originally, frames were developed in cognitive psychology (Barsalou, 1992; Barsalou & Hale, 1993). Very soon, the frame model found its way into the philosophy of science where it has been successfully used to investigate scientific concepts and conceptual change (Andersen et al., 1996, 2006; Votsis & Schurz, 2012, 2014). It was specified and elaborated to analyze different types of scientific concepts (Kornmesser, 2017, 2018) and in addition to scientific concepts, to analyze scientific theories (Kornmesser & Schurz, 2020). Further, much effort was made to formalize frames by graph theory

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(Petersen, 2007; Kornmesser, 2016) and to develop an ontology for frames (Hommen, 2019, 2020).[1]

The starting point of the line of thought of this article is Andersen et al. (2006) who showed that frames are a powerful tool to analyze scientific concept shifts with respect to T. Kuhn's approach of scientific revolutions. In the following, it will be argued that the frame model provides the means for even more detailed analysis of conceptual change. To this end, I will develop and apply frame analyses of what I call the distinction between *inter-* and *intra-conceptual change* (Aim 1) as well as the distinction between *conceptual structure change* and *conceptual content change* (Aim 2). Further, I will introduce the notion of *conceptual enrichment* as opposed to conceptual change (Aim 3). I will point out some consequences of the conceptual changes introduced for the relation between scientific concepts[2] and theories. In order to apply and to exemplify the different kinds of concept change of Aims 1 to 3, I will provide a diachronic frame analysis from John Austin's constative/performative-distinction to the introduction of his speech act concepts and post-Austin approaches of performatives (Aim 4). Aim 5 is to show that the frame model is a highly useful tool to analyze scientific concepts and conceptual change due to the attribute-value structure of frames (see below) and the easily accessible graphical representation of conceptual structures. However, as we will see, the frame model is not yet fully developed. Therefore, as part of Aim 5, I will improve the frame model where necessary throughout this investigation.

The article is structured along the line of pursuing Aim 4—a diachronic analysis of the central concepts of Austin's investigation of how to act with language. In Sect. 2, I will analyze the basic idea of Austin's constative/performative-distinction. I will provide frame representations of conceptual changes of the concepts *constative* and *performative* in the Sects. 3 and 4. Section 5 contains a frame analysis of the starting point of Austin's speech act theory. In order to make it as comfortable as possible for the reader, I will not start out by introducing all definitions of frames and kinds of conceptual changes at once in the beginning of the article, but I will introduce them step by step as we go along. In the conclusions of Sect. 6, I will sum up the results.

Just to be sure some final remarks on the program of the article: Please note that this article is dedicated to questions of scientific concepts and concept change within the philosophy of science and uses Austin's philosophy of language as an application of the notions introduced in the following. Throughout this article, I will reconstruct the most important of Austin's attempts to adequately determine the constative/performative-distinction. However, as is widely known, Austin himself dismisses his own attempts to determine this distinction and introduces his speech act theory. I will use the most important of Austin's conceptual developments to apply the notions of different kinds of conceptual change and of conceptual enrichment that I introduce in this article. That said, let's start accomplishing the aims.

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[1] I just mentioned a few essential readings regarding the role of frames for the philosophy of science without claiming to be complete. Of course, frames have been used in other disciplines as well, such as linguistics and psychology as can be seen in the publications of the SFB991 *The Structure of Representation in Language, Cognition, and Science* (https://frames.phil.uni-duesseldorf.de).

[2] I use the term "scientific concepts" in a wide sense also referring to concepts of the humanities.

2 A frame-representation of John L. Austin's constative/performative-distinction

In this section, I will provide a frame analysis of the concepts *constative* and *performative* as introduced by Austin (1962) *How to do things with words*. In doing so, I will briefly recapitulate Austin's well-known constative/performative-distinction and subsequently, introduce the notion of different types of frames.

According to Austin (1962, pp. 1–11), constative utterances express statements and hence, are true or false. In contrast, performative utterances do not express statements, even if they can grammatically look like utterances expressing statements—this is why Austin (1962, p. 4) also calls them *masqueraders*. Performative utterances are not true or false, but uttering them is to *do* something. For example, utterance (1) is constative, expressing the statement that the moon turns around the earth, and utterance (2) is performative because the act of promising is performed by uttering (2).

(1)   The moon revolves around the earth.
(2)   I promise to tidy up the room.

The act of promising is performed in saying "I promise to tidy up the room".[3] That is, (2) is an action and, hence, it is not true or false. However, it can be successful (in Austin's words: *happy*) or unsuccessful (*unhappy*): If there is no one in the room who is listening to my utterance, the action of promising is unsuccessful and, thus, the performative is unhappy. As opposed to utterance (2), uttering (1) is not to perform an act in saying something but merely the act *of* saying something which is true or false. Therefore, utterance (1) is constative.

In sum, Austin (1962, p. 5) suggests two criteria to distinguish between constative and performative utterances: First, constative utterances have a truth value, that is, they are true or false. In contrast, performative utterances do not have a truth value, that is, they are neither true nor false. Second, performative utterances are actions, that is, uttering a performative is the doing of an action in saying something in addition to the act of saying something. In contrast, by uttering a constative one is not doing an action in addition to the action of saying something.[4]

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[3] This paper is only concerned with *explicit* performatives, i.e., with performatives that contain the verb that is commonly used to name the act that is performed with the utterance (see Austin, 1962, p. 32), e.g., the verb "promise" in (2). Austin (1962, p. 69) contrasts explicit performatives with *primary* performatives like "I will do the dishes" (2*), which could also be a promise, but does not contain a verb making explicit which action is performed. In the following, the term "performative" refers only to explicit performatives. The distinction between explicit and primary performatives will be made explicit where relevant.

[4] Please note that in the post-Austin philosophy of language, there is still an extensive debate about what performative utterances are. As Hornsby (2006, p. 904) notices, Austin's point of view is rejected by several philosophers of language working on performativity subsequent to Austin (see also Tsohatzidis, 2018, pp. 97–103). For example, according to Lemmon (1962), Quine (1981), Heal (1974), Bach (1975), Graham (1977) and Searle (1989), performative utterances like (2) are actions in fully accordance to Austin, but additionally, in contrast to Austin, they have a truth value due to the simple fact that their truth conditions are satisfied "simply by uttering the sentence in the right circumstances" (Soames 2003, p. 127). For instance, in uttering (2), one is performing a promise, and because of this (2) rightly describes what is done, and, hence, (2) is true. From this point of view, a (happy) performative "makes itself true" (Quine 1981, p. 90) and, thus, performatives are "verifiable by their use" (Lemmon 1962, p. 88) or simply "self-verifying" (Heal 1974, pp. 116–117, see Bach 1975 for another way of arguing that performatives have truth

Figure 1 shows a representations of Austin's basic constative/performative-distinction by means of a *taxonomy frame*. A taxonomy frame is a structure consisting of edges and nodes. The starting node at the left end is the *superordinate concept* (here in grey) and the node(s) at the right end are the *subordinate concepts* (here in light green). The frame of Fig. 1 is a taxonomy frame subclassifying the superordinate concept *natural language utterance* into the subordinate concepts *constative* and *performative*. In between is a structure of *attributes* (the hexagons) followed by *values* (the nodes *yes* and *no*). The attributes of a frame are functions assigning values to the elements of the extension of the superordinate concept. For example, the attribute *truth value* assigns the value *yes* to a natural language utterance, if it is true or false, and the value *no* otherwise. The edges connecting the values with the subordinate concepts determine the content of the subordinate concepts and, thus, are called *determination links*. For example, a natural language utterance is called *performative*, if it is an action and does not have a truth value. The edges connecting the values are called *constraints* (in Fig. 1 represented by blue dotted arrows). They represent empirical nomological relations in addition to the determination of the conceptual content of the subordinate concepts. For example, the constraint between the value *no* of the attribute *truth value* and the value *yes* of the attribute *action* says that a natural language utterance is an action if and only if it does not have a truth value. Constraints express strict nomological relations (strict laws) allowing no exceptions or statistical relations (statistical laws) that are high conditional probabilities. For the constative/performative-distinction, a statistical interpretation might be more suitable.

The values connected to a subordinate concept provide information concerning the content of the respective subordinate concepts. However, it does not provide any information concerning the structure of the subordinate concepts. For example, without further specifications, we do not know whether *constative* is a defined concept, a prototype concept or even another kind of concept. The structure of a subordinate concepts depends on which relation is represented by the determination links. Therefore, in the course of this article I will define different kinds of frames with respect to the specific relations of the determination links beginning with Austin's basic idea of constative and performative utterances. I call a certain kind of frame classified by the way its determination links work a *frame type*.[5]

According to Tsohatzidis (2018, p. 100) and Grewendorf (1976, p. 101), Austin determined constative and performative utterances by means of necessary and jointly sufficient conditions.[6] For example, an utterance is performative, if and only if it does not have a truth value and it is the performance of an action. Thus, the concepts *constative* and *performative* are determined by a conjunctional definition and, hence,

Footnote 4 continued

values). Therefore, performative utterances are (or, better, express) statements, too. However, there are also authors who explicitly support Austin's view that performative utterances do *not* have truth values (e.g., Tsohatzidis, 2018, pp. 103–118). Hence, there is no final agreement on this point. This article is concerned with Austin's approach of constative and performative utterances. Thus, I focus on the concepts *constative* and *performative* as they were introduced and refined by Austin.

[5] In this article, I will keep the definitions of different frame types as easy as possible. For more precise set- or graph-theoretical definitions see Kornmesser (2016, 2018).

[6] One might argue that it would be more appropriate to think of the concepts *constative* and *performative* as prototype concepts or family resemblance concepts. However, this would not detract from the investigation of different kinds of conceptual change targeted in this article.
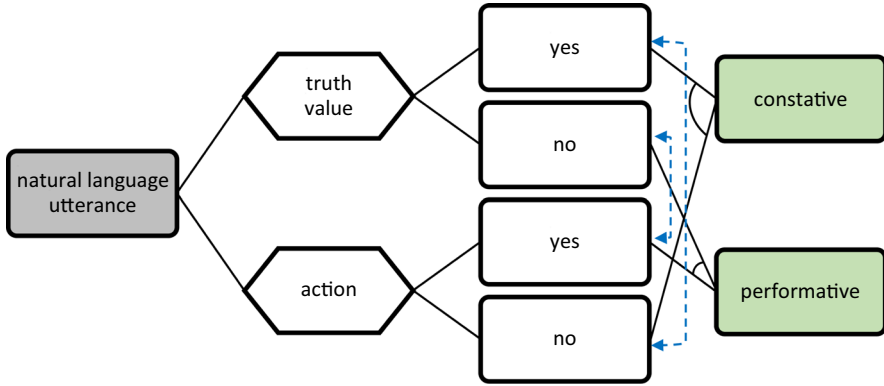
Fig. 1 Conjunctive defining taxonomy frame for the subordinate concepts constative and performative. A curved arc connecting two determination links means that the values determining the linked subordinate concept are necessary and jointly sufficient for the subordinate concept

are represented by what I call a *conjunctive defining taxonomy frame* that is defined as follows:

Frame type: conjunctive defining taxonomy frame A frame is a *conjunctive defining taxonomy frame* if and only if the values linked to a subordinate concept by determination links are necessary and jointly sufficient conditions for that subordinate concept.

The type of the frame of Fig. 1 as a conjunctive defining taxonomy frame tells us that the attribute values are necessary and jointly sufficient conditions for the subordinate concepts. This is graphically represented by the curved arcs connecting two determination links. The determination of the subordinate concepts is a linguistic convention and, thus, analytical and a priori. I call concepts whose determination is a linguistic convention (analytical and a priori) *contentually closed* and concepts whose determination is empirical (synthetic and a posteriori) *contentually open*. The subordinate concepts *constative* and *performative* in Fig. 1 are contentually closed because the frame is of the type *conjunctive defining taxonomy frame*. Note that the constraints of Fig. 1 are empirical nevertheless. The nomological relations between the values are not entailed by the determination of the subordinate concepts. They would follow from the determination of the subordinate concepts if the subordinate concepts would be presupposed to be a nominal scale for natural language utterances, i.e., if their extensions were disjunct and exhaustive for the extension of the superordinate concept.[7]

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[7] At this point I am indebted to an anonymous reviewer who pointed out that if the extensions of the subordinate concepts *constative* and *performative* are exhaustive for the extension of the superordinate concept, that is if all utterances are either constative or performative and hence, being performative equals not being constative and vice versa, then there *must* be the given constraints because there wouldn't be any other possible constellations of the attribute-values. However, Austin discusses several categories of utterances that could hardly be characterized as constative or performative as, for example, utterances that are *parasitic* upon their normal use like a promise given by an actor on stage (see Austin, 1962, pp. 18–24).

3 Grammatical determination of the constative/performative-distinction

The determination of the concepts *constative* and *performative* in Fig. 1 is based on the attributes *truth value* and *action*. However, Austin (1962, p. 55) raises doubts about the determination of performative and constative utterances due to whether one performs an action or expresses a statement by saying something true or false. He argues that "considerations of the happiness and unhappiness type may infect statements (or some statements) and considerations of the type of truth and falsity may infect performatives (or some performatives)". Recognizing that determining *constative* und *performative* as represented in Fig. 1 does not lead to a clear distinction between constative and performative utterances, Austin (1962, pp. 55–56) suggests a *grammatical* classification of constative and performative utterances. He notices that the verbs of performative utterances are usually in first person singular present tense indicative active.[8] Intuitively, the reason for this is obvious: Utterances with other grammatical forms are, for example, reports of what other people do (not first person singular) or what the speaker or other people did or will do (not present tense) or what is done to them (not active) or what they would do (not indicative). Therefore, to perform an action with an utterance seems to require first person singular present tense indicative active verbs. However, Austin (1962, pp. 61 f.) proposes further specifications for the concept *performative* due to utterances like (3) and (4).

(3)   All passengers are requested to put on the protective vests.
(4)   I go home.

Utterance (3) is clearly performative, but in passive voice. Therefore, at least the passive voice cannot be necessary for being performative. Further, utterance (4) is not performative. Thus, the grammatical properties first person, singular, present tense, indicative, and active cannot be sufficient for performative utterances. As a consequence, Austin (1962, p. 61 f.) suggests that (a) every performative utterance should be *transferable* into an utterance with a verb in first person singular present tense indicative active. Hence, (3) would not be a counterexample anymore because it is transferable to

(3*)   I request all passengers to put on the protective vests,

containing a verb in first person singular present tense indicative active. Additionally, Austin (1962, p. 63) suggests (b) that performative utterances contain verbs that have a specific *asymmetry*. For example, for the verb "bet", but not for the verb "go", this asymmetry arises since from "He bets" to "I bet" there is a change from constative to performative, but not from "He goes" to "I go". If this asymmetry is a necessary condition for performative utterances, it rules out counterexamples like (4).

Footnote 7 continued

Utterances of this kind might have the value *no* of the attribute truth-value and the value *no* of the attribute action. This indicates that the categories constative and performative are not exhaustive for the extension of the superordinate concept.

[8] To protect Austin from the immediate objection that these grammatical properties might not apply to implicit performative utterances: As already mentioned in Footnote 3, this article is only concerned with explicit performatives.

In sum, the five grammatical properties, the transferability of performatives and the asymmetry of the verbs of performatives should be necessary and jointly sufficient conditions for an utterance to be performative.[9] Determining performative utterances this way leads to the question of how constatives could be determined by means of grammatical conditions. There is no way to obtain a conjunctional definition with necessary and jointly sufficient grammatical conditions for constative utterances. For example, a verb in past tense cannot be necessary for being a constative utterance since it could also contain a verb in one of the other tenses, even in present tense if at least one of the other grammatical properties is not first person, singular, active or indicative.

Rather, it is the other way round: each grammatical property different from first person singular present tense indicative active is not necessary, but *sufficient* for being a constative utterance and the disjunction of all grammatical properties of the verb except first person singular present tense indicative active is necessary for being a constative utterance. The same holds for utterances that are not transferable to performatives or contain verbs that do not have the specific asymmetry. That is, the determination of the concept constative utterance changes from a conjunctive definition to a disjunctive definition. I define a disjunctive defining taxonomy frame as follows:

Frame type: disjunctive defining taxonomy frame A frame is a *disjunctive defining taxonomy frame* if and only if each of the values linked to a subordinate concept by a determination link is sufficient and the disjunction of all values linked to a subordinate concept by determination links is necessary for that subordinate concept.

The frame of Fig. 2 contains a conjunctive defining frame for the subordinate concept *performative* and a disjunctive defining frame for the subordinate concept *constative*.[10] Hence, it is a mixed taxonomy frame according to the following definition.
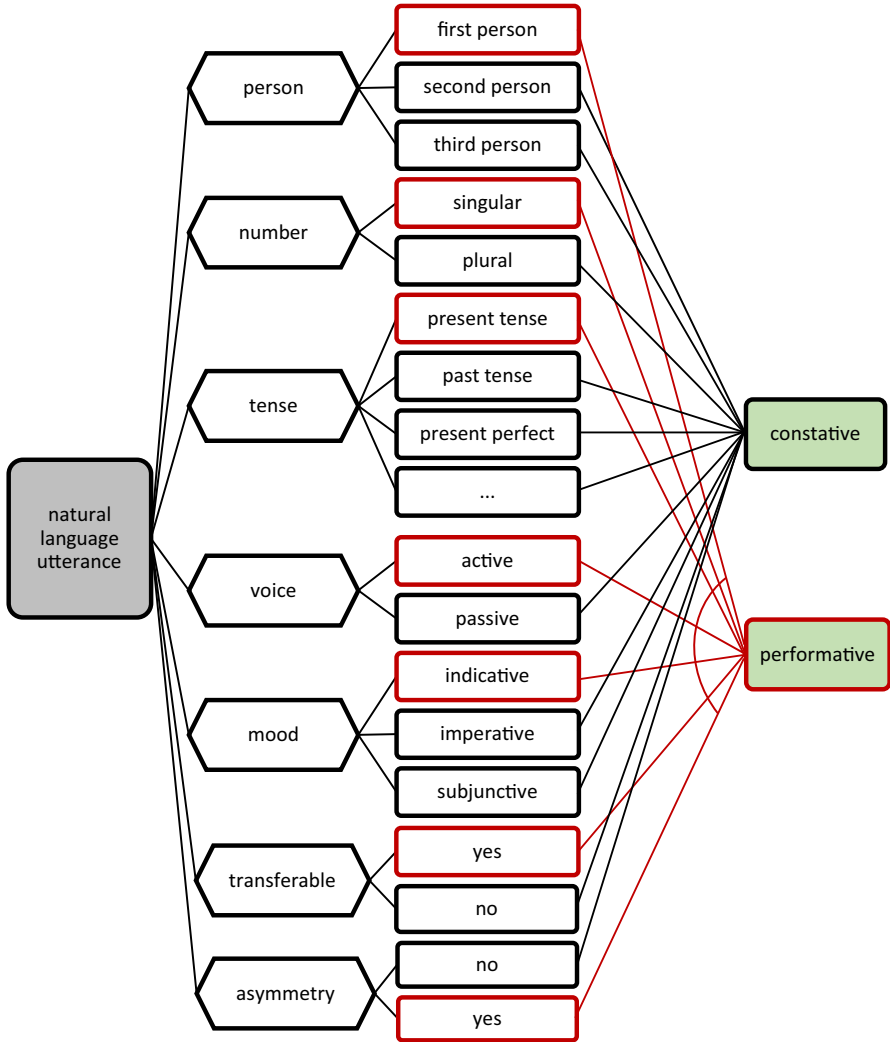
Mixed taxonomy frame A frame is a *mixed taxonomy frame* if and only if it contains at least two frame types.

Note that the frame of Fig. 2 does not say that the verbs of constative utterances could not be in first person (as, e.g., in "Yesterday I went at home") because there is no determination link between the value *first person* and the subordinate concept *constative*. It just says that the grammatical properties first person, singular, present tense, indicative, and active are not conceptually relevant for categorizing constative utterances because they are neither necessary nor sufficient for the subordinate concept *constative*.

What happened in the conceptual change from the frame of Fig. 1 to the frame of Fig. 2? Does the frame of Fig. 2 determine the same subordinate concepts as the frame of Fig. 1? In a strict sense, in Fig. 2 the subordinate concepts are different to those of Fig. 1 because the intensions of the linguistic expressions "constative" and "performative" change due to the newly introduced grammatical definitions. However, the determinations of the subordinate concepts are refined in a way that the

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[9] Surprisingly, Austin did not notice that his refined definition of *performative* is circular due to the fact that the asymmetry of verbs used to determine performative utterances already presupposes a notion of being performative. That is, the notion of performativity is necessary for the notion of asymmetry.

[10] Note that the attribute *transferable* also assigns the value yes to each utterance which already contains a verb in first person singular present tense active indicative.

Fig. 2 Mixed taxonomy frame containing a conjunctive defining frame for the subordinate concept *performative* (highlighted in red) and a disjunctive defining frame for the subordinate concept *constative*. Not all values of the attribute *tense* are listed. A curved arc connecting determination links means that the values determining the linked subordinate concept are necessary and jointly sufficient for the subordinate concept. (Color figure online)

extensions of both concepts are (approximately) the same. In other words: The terms "constative" and "performative" obtained a new meaning (intension) while referring to (approximately) the same sets of entities (extensions). The aim of the new definition is to categorize (almost) the same sets of utterances in a more sharpened way. This is why I call the subordinate concepts of the frames of Figs. 1 and 2 to be *extensionally convergent*.

Extensionally convergent concepts Two concepts A and A* or two sets of concepts $\mathfrak{A}$ and $\mathfrak{A}$* are *extensionally convergent* if and only if the extension of A or the extensions of the concepts of $\mathfrak{A}$ contain the same kinds of entities and have approximately the same scope as A* or the concepts of $\mathfrak{A}$*.

For example, the extension of the concept *constative* in Fig. 1 contains the same kind of entities as the extension of the concept *constative* of Fig. 2—both extensions contain utterances. Further, the frame of Fig. 2 aims to specify the set of constative utterances in a more adequate way with approximately the same scope. Due to this reason, the names of the subordinate concepts, i.e., the linguistic expressions "constative" and "performative", are kept. That is, the words "constative" and "performative" refer to (approximately) the same entities. In the following, I call concept changes of this kind intra-conceptual change.

Intra-conceptual change A conceptual change from a concept A of a frame ϕ to a concept A* of a frame ψ is an *intra-conceptual change* if and only if the definitions of A and A* by the attribute-values of ϕ and ψ are different and A and A* are extensionally convergent. Usually the same linguistic expression "A" is used to name the extensions of A and A*.

Given these definitions, the conceptual change of the concepts *constative* and *performative* from Figs. 1 and 2 is an intra-conceptual change. That is, Austin suggests new definitions of the concepts *constative* and *performative* that replace the definitions given in the frame of Fig. 1. Hence, the concepts *constative* and *performative* as determined in Fig. 2 are contentually closed.[11]

The counterpart to intra-conceptual change is *inter-conceptual change* which is defined in Sect. 5. In addition to the distinction between intra- and inter-conceptual change, I distinguish between a *conceptual content change* and a *conceptual structure change*. First, a concept change might be caused by a change of the attribute-values connected to a concept by determination links. In this case, the content of the concept changes. Second, the change of a concept can be based on a change of the structure of how the concept is determined. For example, it can be determined by a conjunctive definition or a disjunctive definition. That is, conceptual structure change is based on a change in the way the determination links of the frame work. In other words, conceptual structure change is caused by a change of the frame type.

Conceptual content change A conceptual change from concept A of a frame ϕ to a concept A* of a frame ψ is a *conceptual content change* if and only if there is a change from the attribute-values defining A in frame ϕ to the attribute-values defining A* in frame ψ.

Conceptual structure change A conceptual change from a concept A of a frame ϕ to a concept A* of a frame ψ is a *conceptual structure change* if and only if ϕ and ψ are of a different frame type.

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[11] The intra-conceptual change is in some way similar to Carnap's (1950) approach of explication. However, Carnap also proposes other desiderata for explications like, for example, simplicity. Further, in Carnap's well known example of explicating the concept fish, the linguistic expression changes from "fish" to "pisces", contrary to intra-conceptual changes as proposed here.

Given the precise classifications of different kinds of conceptual change, between the frames of Figs. 1 and 2 we can observe an intra-conceptual structure change for the concept *constative* in changing from a conjunctive definition to a disjunctive definition as well as intra-conceptual content changes for the concepts *constative* and *performative* determining these concepts by grammatical instead of action- or truth-value-related attribute-values. There is no intra-conceptual structure change for the concept *performative* because for this concept there is no change in the frame type from the frame of Fig. 1 to the frame of Fig. 2.

However, Austin's investigation of how to act with language does not end here. Austin (1962, pp. 64–66) raises several criticisms on the determination of the concepts *constative* and *performative* as given in Fig. 2. He lists seven arguments of why it should be rejected. For example, an utterance with an asymmetric verb in first person singular indicative active like "I bet (every morning)" could still be a constative describing habituative behavior (Austin, 1962, p. 64) and, hence, being true or false. In sum, Austin rejects the determination of constative and performative utterances by grammatical properties.

4 Operationalizing the constative/performative-distinction

In the sixth lecture, Austin makes a new attempt to determine the distinction between constative and performative utterance. In a first step, I will reconstruct this new attempt, and, in a second step, I will make a case distinction as to whether the new attempt is an addition to the above definitions of constative and performative utterances (Fig. 1) or whether it replaces the definitional approach.

Austin (1962, pp. 79–80) introduces four tests to detect whether what he calls *half descriptive utterances* should be understood as constative or performative utterances. (5) is an example of a half descriptive utterance.

(5)   I am sorry.

Utterance (5) could be understood to be an apology. In this case it would be an action and, hence, a performative utterance. However, (5) could also be meant to express the cognitive state of feeling sorry. In this interpretation, it would not be an action, but a report that could be true or false and, thus, would be constative.

However, Austin does not only use the tests to classify half descriptive utterances, but he also applies them to constative and performative utterances in order to show that they discriminate between both kinds of utterances. Therefore, I take the four tests to be *operationalizations* designed to identify constative and performative utterances—or to decide whether a half descriptive is used as a constative or a performative utterance.

What is the difference between a definition and an operationalization and what does this difference mean for the constative-performative distinction? The definitions of the subordinate concepts *constative* and *performative* tell us what constatives and performatives are. They are *contentually closed* because they are linguistic conventions. Contrary to this, operationalizations do not tell us what constatives and performatives *are*, but they are a kind of tool to detect whether a certain utterance is constative or

performative.[12] That is, the operationalizations of the concepts *constative* and *performative* are *contentually open* because they do not define constative and performative utterances, but entail empirical statements concerning both kinds of utterances.

The logical structure of the given operationalizations can be expressed by reduction sentences according to Carnap (1936). In the sentences (i) and (ii), I exemplify unilateral and bilateral reduction sentences for the subordinate concept *constative* that is to be determined.

(i) If a *test condition* for an utterance x is given, then x is *constative* if the *test reaction* for x is *yes* (or *no*, depending on the specific test).

(ii) If a *test condition* for an utterance x is given, then x is *constative* if and only if the test reaction for x is *yes* (or *no*, depending on the specific test).

Sentences (i) and (ii) are reduction sentences for the subordinate concept *constative*. Reduction sentence (i) is called a *unilateral reduction sentence* and (ii) a *bilateral reduction sentence* due to whether the test reaction is only sufficient (unilateral) or sufficient and necessary (bilateral) for the concept that is determined (*constative*). In the frame model, operationalizations are analyzed by unilateral or bilateral operationalization frames defined as follows.[13]

Frame type: unilateral operationalization taxonomy frame A frame is a *unilateral operationalization taxonomy frame* if and only if each of the values linked to a subordinate concept by a determination link is sufficient for that subordinate concept.

Frame type: bilateral operationalization taxonomy frame A frame is a *bilateral operationalization taxonomy frame* if and only if each of the values linked to a subordinate concept by a determination link is necessary and sufficient for that subordinate concept.

In the following, I will first introduce and discuss the four operationalizations as they were developed by Austin. Second, I will develop the corresponding operationalization frames. To this end, I will use bilateral operationalization frames. Thereafter, I will discuss why bilateral and not unilateral operationalization frames represent an adequate understanding of Austin's tests. Let's start with the first test which I call "Test Doubt".

Test Doubt: Does it make sense to ask "Does she really"? That is to say, can one reasonably doubt that a speaker is doing what she is saying. According to Austin, if the answer is *no*, the utterance is performative, and if the answer is *yes*, the utterance is constative. As an example, let's apply Test Doubt to the utterances (6) and (7).

(6) I thank.

(7) I feel grateful.

According Austin (1962, p. 79), (6) is a performative utterance because the speaker performs the action of thanking by uttering (6), and (7) is a constative utterance because

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[12] That is, the tests proposed by Austin are like the litmus test for detecting acidity. The litmus test is a tool to detect an acid, but it does not determine what an acid *is*.

[13] Both definitions presuppose that the test condition is satisfied (otherwise the attribute would not assign values to the elements of the extension of the superordinate concept).

the speaker truly or falsely describes what they feel. The answer to the question of Test Doubt shall provide the right classification of (6) and (7) as constative or performative utterances. With respect to utterance (6) the answer to the question of Test Doubt is *no* because it does not make sense to ask "Does she really thank (someone)?" if one utters (6) since uttering (6) *is* the action of thanking, so they are obviously thanking. On the contrary, the answer to the question of Test Doubt with respect to utterance (7) is *yes* because if one utters (7) it does makes sense to doubt that they feel grateful since they are just describing a mental state and the description could be false. Formally, Test Doubt is a function and, thus, an attribute in a frame that assigns the values *yes* or *no* to natural language utterances. The subordinate concepts *constative* and *performative* are determined with respect to the values of the attribute *test doubt*. For the frame represents a bilateral reduction sentence, each determination link is the equivalence relation *if and only if*. Therefore, a natural language utterance is constative if and only if the answer to Test Doubt is *yes* and it is performative if and only if the answer is *no*. The bilateral operationalization taxonomy frame for Test Doubt is given in Fig. 3. The determination links are dotted lines instead of solid lines indicating that they do not represent analytical relations (as in the defining frames of Figs. 1 and 2), but empirical relations.

Test Speaking: Can one really doing it without saying anything? The idea of this test is that a performative utterance is an action that could not be performed without uttering it. In contrast to performative utterances, a speaker can do what they describe with a constative utterance without uttering it. Hence, according to Austin's intuition, if the answer to the question of Test Speaking is *no*, the utterance is identified to be performative, and if the answer is *yes*, the utterance is identified to be constative. With respect to (6) and (7), one can feel grateful without saying "I feel grateful", but one cannot thank someone without saying "I thank" or anything similar.[14] The bilateral operationalization taxonomy frame for Test Speaking is given in Fig. 4.

Test Deliberate: Does it make sense to insert the adverb "deliberately"?[15] According to Austin's intuition, if the utterance is performative, then it shall be possible to

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[14] However, note that Test Speaking conflicts with Austin's comments on conventional actions. According to Austin (1962, pp. 18 f.), performatives are a subclass of conventional actions. Beside performatives, there are other conventional actions like rituals or ceremonials that can be performed non-linguistically. All conventional actions can be unhappy according to the scheme of infelicities (Austin, 1962, p. 18). Therefore, there are conventional actions that can be performed without saying anything. Now, Austin (1962, p. 8) points out with respect to performative utterances that "[i]n very many cases it is possible to perform an act of exactly the same kind *not* by uttering words, whether written or spoken, but in some other way. For example, I may in some places effect marriage by cohabiting, or I may bet with a totalizator machine by putting a coin in a slot." Hence, according to Austin, there are "very many cases", in which one and the same action can be performed by means of a performative or in a corresponding non-linguistic conventional way. In all these cases, the answer to the question of Test Speaking would be *yes* although it refers to a performative utterance, and, thus, the test would lead to a wrong result. Thus, "I thank" might be erroneously classified to be constative by Test Speaking because it could be possible to thank someone without saying something like "I thank".

[15] Actually, Austin's (1962, p. 80) question is, whether we *can* insert the adverb "deliberately". However, of course it is always possible to insert a word into a sentence, but the intention of Test Deliberate is to determine, whether it *makes sense* to insert the adverb "deliberately" or whether this leads to a nonsensical sentence.
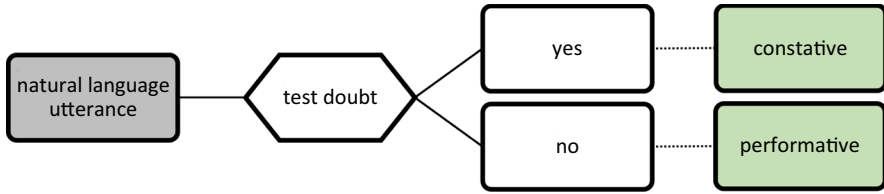
Fig. 3 Bilateral operationalization taxonomy frame for the subordinate concepts *constative* and *performative* (Test Doubt). The determination links are represented as dotted (not solid) lines indicating that they are not analytical, but empirical relations
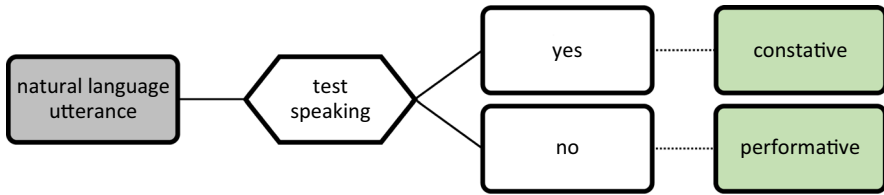
Fig. 4 Bilateral operationalization taxonomy frame for the subordinate concepts *constative* and *performative* (Test Speaking). The determination links are represented as dotted (not solid) lines indicating that they are not analytical, but empirical relations

insert "deliberately", because the utterance is the doing of an action, and, thus, it should be possible to be done deliberately. Therefore, if the answer is *yes*, the utterance is identified to be performative, and if the answer is *no*, the utterance is identified to be constative. For example, one can thank deliberately, but one cannot feel grateful deliberately. Note that "deliberately" is not inserted into the performative utterance itself, but into a report of the performative utterance, which is a constative. The report of the performative utterance is constructed by changing the tense from simple present to simple past. Hence, the performative (6) becomes the constative (8), into which "deliberately" is inserted (9).

(8) I thanked.
(9) I thanked deliberately.

Utterance (9) sounds perfectly reasonable as opposed to (10) because it is questionable whether one can have the feeling of being grateful deliberately.

(10) I felt grateful deliberately.

Therefore, according to Test Deliberate, utterance (6) is performative and utterance (7) is constative. The bilateral operationalization taxonomy frame for Test Deliberate is given in Fig. 5.

Test Falsity: Can the utterance be literally false (or could it only be an abuse and would thus be unhappy)? An abuse is a certain kind of infelicity and, thus, makes a performative to be unhappy (Austin, 1962, pp. 14–18). For example, utterance (7) would be literally false, if one does not feel grateful. However, (6) could not be false in
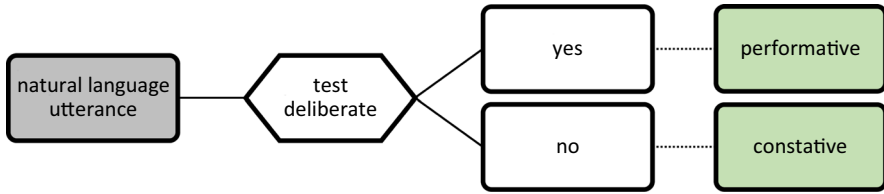
Fig. 5 Bilateral operationalization taxonomy frame for the subordinate concepts *constative* and *performative* (Test Deliberate). The determination links are represented as dotted (not solid) lines indicating that they are not analytical, but empirical relations

this sense, but it could be an abuse if, for example, the speaker is insincere. In this case, it would be unhappy. Therefore, if the answer is *yes* (i.e., it could be literally false), the utterance is identified to be constative, and if the answer is *no* (i.e., it could not be literally false, but it could be unhappy), the utterance is identified to be performative. The bilateral operationalization taxonomy frame for Test Falsity is presented in Fig. 6.

Now, I come to the question of what kind the given operationalizations are: unilateral or bilateral? That is, is the determination link a conditional or a biconditional? Let's see which interpretation would be more adequate by looking at how Austin introduced the tests. Does Austin implicitly give any hints of how constative and performative are logically determined by the tests and test results? One way of the conditionals represented by the determination links seems to be obvious. The tests are meant to determine whether a certain utterance is constative or performative. Hence, for, say, the third test, we get: *If the answer to the test is yes/no, then the utterance is performative/constative*. Further, Austin (1962, p. 80) says that "if the utterance is the doing of an action, then it is surely something that we ought to do be able (on occasion) to do deliberately or to be willing to do." Thus, Austin states that *if the utterance is performative (or constative, respectively), then the answer to the test question is yes (or no, respectively)*. In sum, it seems adequate to say that Austin proposed a biconditional relation between the subordinate concept and the test result represented by the attribute-value: If and only if an utterance is performative (or constative, respectively), then the answer to the test question is *yes* (or *no*, respectively). Therefore, it seems adequate to analyze the operationalizations by a bilateral operationalization taxonomy frame.
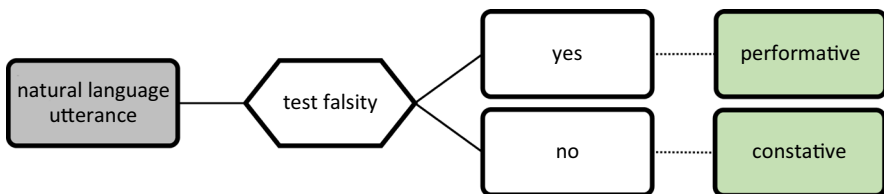
Fig. 6 Bilateral operationalization taxonomy frame for the subordinate concepts constative and performative (Test Falsity). The determination links are represented as dotted (not solid) lines indicating that they are not analytical, but empirical relations

What kind of concept change do we obtain due to the operationalizations introduced in the frames of Figs. 3, 4, 5 and 6? Are the operationalizations an addition to the given definitions of constative and performative utterances or are they intended to replace the definitions? Austin (1962, p. 80 f.) is not clear on this point.

On the one hand, the fourth test repeats the properties used to define constative and performative utterances. The possibility of being literally false or of involving insincerity and hence, being unhappy and thus, being an action were used beforehand to define constative and performative utterances (see Fig. 1). This suggests that the operationalizations are considered to replace the definitions. In this case, the operationalizations are the only way to determine the concepts *constative* and *performative*.

However, on the other hand, in order to show that the tests work, he applies them to utterances that are presupposed to be performative – either due to the definitions of Fig. 1 or in an intuitive and pre-theoretical way. If the utterances are presupposed to be performative due to the definitions of Fig. 1, this suggests that he introduced the tests in addition to the given definitions.[16]

It might be most useful to make a case distinction as to which interpretation would lead to which result. In Case 1, the operationalizations replace the definitions of the subordinate concepts *constative* and *performative*. Case 1 is given by the frame of Fig. 7 combining the frames of Figs. 3, 4, 5 and 6 into one frame representing a multiple bilateral operationalization of the subordinate concepts *constative* and *performative*.[17] Case 2 is given by the frame of Fig. 8 adding the operationalizations of the frames of Figs. 3, 4, 5 and 6 to the basic definitions of constative and performative utterances shown in Fig. 1.

Case 1: The operationalizations replace the definitions of the subordinate concepts *constative* and *performative* Recall that the definitions of the subordinate concepts *constative* and *performative* tell us what constatives and performative *are*. They are contentually closed because they are linguistic conventions. Contrary to this, operationalizations do not tell us what constatives and performatives are, but they are a kind of tool to detect whether a certain utterance is constative or performative. That is, the operationalizations of the concepts *constative* and *performative* are contentually open because they do not define constative and performative utterances, but they entail empirical statements concerning both kinds of utterances. How do they do that? Assume that the attribute *test doubt* assigns the value *no* to a certain natural language utterance x. According to Fig. 7, x is then classified to be performative because in a bilateral operationalization frame each determination link says that the value connected to a subordinate concept is sufficient for that concept. Further, each single value connected to a subordinate concept by a determination link is necessary for that concept. Therefore, if utterance x is classified to be performative due to the value no of attribute test doubt, it follows that all other value of the remaining attributes that are linked to the subordinate concept performative are assigned to x. This means that the

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[16] If the utterances are presupposed to be performative in an intuitive and pre-theoretical way, the operationalizations would be the only way to determine the concepts *constative* and *performative* as in the first case.

[17] Note that a multiple bilateral operationalization taxonomy frame is of the same frame type as a (single) bilateral operationalization taxonomy frame because there is no difference in how the determination links work.
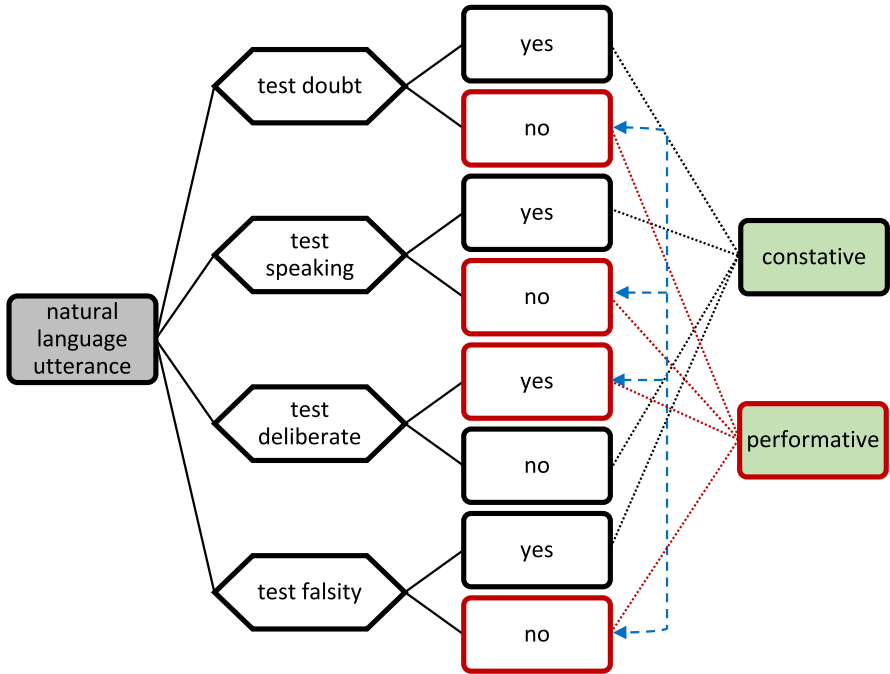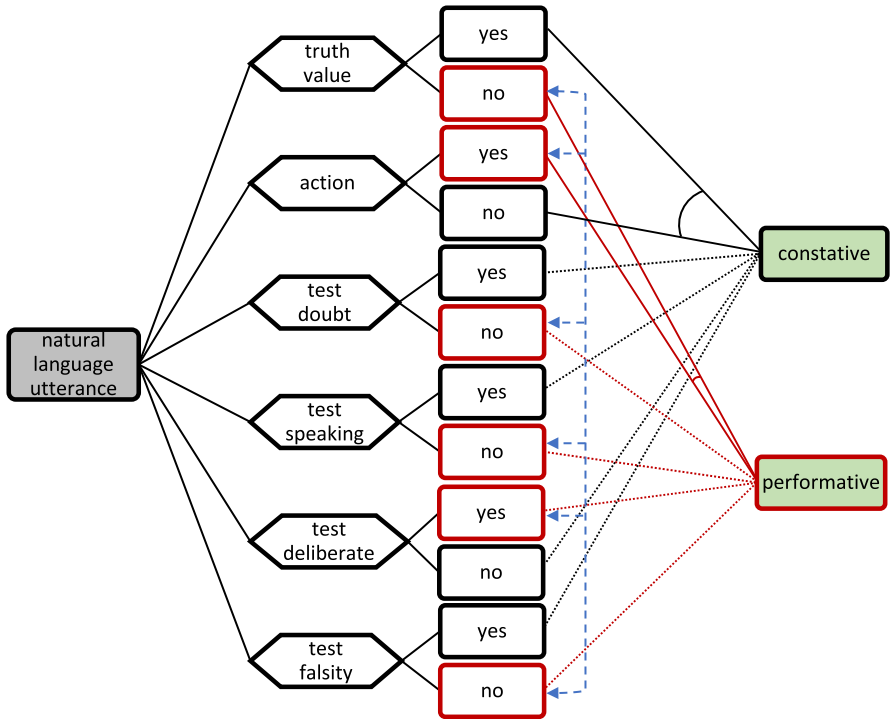
Fig. 7 Multiple bilateral operationalization taxonomy frame for the subordinate concepts *constative* and *performative* replacing definitions (Case1). The determination links are dotted lines indicating that they represent empirical relations. For clarity, the determination links for *performative* are highlighted in red. The blue dashed arrows are constraints between values. The constraints are entailed by the determination of the subordinate concept performative. The constraints for the concept *constative* are neglected. (Color figure online)

multiple operationalization of the subordinate concept performative entails empirical consequences which, in a frame analysis, can easily be represented by constraints (the blue dashed arrows in Fig. 7). In sum, Fig. 7 shows that a multiple operationalization of the subordinate concepts makes theory building and concept determination indistinguishable (Stegmüller, 1970, pp. 228–230). I call such a fusion of theory building and concept determination a *concept/theory-merging*.[18] To repeat, there would not be a definite answer to the questions of what constative and performative utterances are. All we would know about both kinds of utterances would be that they unify the empirical phenomena specified by the operationalizations. Hence, the concepts *constative* and *performative* can be considered theoretical concepts introduced by what Schurz (2008) calls a *hypothetical cause abduction*—an abductive inference of one single

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[18] Readers might wonder what theory I am talking about. The frame of Fig. 7 represents a theory in its minimal form. The paths of edges and nodes beginning at the superordinate concept and ending at a subordinate concept are the laws of the theory containing the theoretical concepts *constative* and *performative* and that entail empirical statements (constraints). However, I do not have the space to elaborate this point in more detail here (but see Kornmesser & Schurz, 2020).

Fig. 8 Dual frame containing a multiple bilateral operationalization taxonomy frame for the subordinate concepts *constative* and *performative* (dotted determination links) in addition to definitions (solid determination links) (Case 2). For clarity, the determination links for *performative* are highlighted in red. The blue dashed arrows are constraints between values of the subordinate concept *performative*. The constraints for the concept *constative* are neglected. A curved arc connecting two determination links means that the values determining the linked subordinate concept are necessary and jointly sufficient for the subordinate concept. (Color figure online)

cause for several empirical nomological relations as represented by the constraints of the frame.

Case 2: The operationalizations are an addition to the definitions of the subordinate concepts constative and performative

If the operationalizations are an addition to the definitions of *constative* and *performative*, this leads to the frame type of a *dual concept* as given in Fig. 8. A dual concept is a special case of a mixed concept, in which *one and the same* extension is supposed to be determined in two different ways.[19]

Dual taxonomy frame A frame is a *dual taxonomy frame* if and only if it contains at least two frame types for one and the same subordinate concept.

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[19] To my knowledge, the idea of a dual concept was first proposed by Smith and Medin (1981). However, as opposed to the case discussed here, the identifying procedure introduce by Smith and Medin was based of prototypical properties. Hence, for Smith and Medin, a dual concept contains a definitional core and a prototype based identifying procedure.

In Case 2, there would be an intra-conceptual structure change from the frame of Fig. 1 to the Frame of Fig. 8 due to the added operationalizations. However, there is no conceptual content change. Why does the extension of the frame of Fig. 1 to the frame of Fig. 8 does not satisfy the definition of conceptual content change despite the additional attribute-values in Fig. 8 that are linked to the concepts *constative* and *performative*? The reason is that the multiple bilateral operationalization frames added in Fig. 8 do not change the contentually closed definitions, but add empirical nomological information to both concepts (see above). The concepts *constative* and *performative* are still determined by their definitions based on the attributes *truth value* and *action*. Hence, their conceptual content remains the same. As a consequence, in contrast to Case 1 the concepts *constative* and *performative* are still defined and, hence, contentually closed. The additional operationalizations would lead to dual concepts containing a *definitional core* and an *identifying procedure* given by the added operationalization. That is, the tests provided by the operationalizations can be used as a tool in order to identify whether a given utterance is constative or performative. Due to the bilateral structure of the operationalizations of the concepts *constative* and *performative* empirical information concerning constative and performative utterances are entailed. However, the operationalizations do not change the analytical content of both concepts.

I call the extension of a contentually closed concept by empirical information that do not change the conceptual content of that concept *conceptual enrichment*. I define conceptual enrichment as follows.[20]

Conceptual enrichment A concept A of a frame φ is *conceptually enriched* if and only if A is contentually closed and φ is extended to a dual taxonomy frame ψ by additional attributes and values linked to A that are contentually open.

Hence, the extension of the frame of Fig. 1 to the frame of Fig. 8 is a conceptual enrichment of the concepts *constative* and *performative*.

5 Speech acts

As it is well known, Austin (1962, pp. 91–93) finally rejects the distinction between constative and performative utterances and replaces the distinction by an analysis of *speech acts*. That is, the conceptual basis to investigate how one does something in saying something changes. From the eighth lecture on, Austin does not try anymore to discriminate between two kinds of utterances, with one kind of which an action is performed, but he presupposes that with *every* utterance certain kinds of actions (speech acts) are performed. Hence, he intends to distinguish between linguistic actions and not between utterances since every utterance is an action and, therefore, a performative utterance. Consequently, in a frame representation, the superordinate concept

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[20] I am indebted to an anonymous reviewer who recommended (a) to state explicitly that there is no conceptual content change and (b) to introduce the notion of conceptual enrichment. If the addition of empirical information would be classified as conceptual content change, this would lead to meaning holism because every information concerning the elements of the extension of that concept would change the content of that concept (see, for example, Schurz, 2013, pp. 142–143).

changes from *utterance* to *linguistic action*. The subordinate concepts are the distinct linguistic actions performed with an utterance. That is, the subordinate concepts are the distinct speech acts: the *locutionary*, the *illocutionary*, and the *perlocutionary* act. The attribute-value structure contains the properties and/or criteria to discriminate the speech acts. As a consequence, the conceptual shift to speech acts cannot be adequately described as an intra-conceptual change because the speech act concepts do not have the same or at least a similar extension as the concepts *constative* and *performative*. Rather, it is a new conceptual framework. This is why I will call the relation between the constative/performative-distinction and the speech act concepts an *inter-conceptual change*. Inter-conceptual change is based on *extensionally divergent concepts*. For example, the concepts of both frameworks contain entirely different kinds of entities: the elements of the extensions of *constative* and *performative* are utterances and the elements of the extensions of the speech act concepts are linguistic actions. More precisely, I define extensionally divergent concepts as follows:

Extensionally divergent concepts Two concepts A and A* or two sets of concepts $\mathfrak{A}$ and $\mathfrak{A}$* are *extensionally divergent* if and only if the extension of *A* or the extensions of the concepts of $\mathfrak{A}$ do not contain the same kinds of entities or do not have approximately the same scope as *A** or the concepts of $\mathfrak{A}$*.

It goes without saying that there would be any number of trivial examples of extensionally divergent concepts. Assume, for example, the relation between the physical concept *mass* and the biological concept *bird* which would be extensionally divergent. *Mass* is a function assigning real numbers to entities. Thus, its extension is a set of ordered pairs whereas the extension of *bird* is the set of birds. However, it would be misleading to call the relation between the extensionally divergent concepts *mass* and *bird* an *inter-conceptual change* because a change from A to B implies that B somehow results from A. This is surely not the case for the relation between *mass* and *bird*, but it is the case for the relation between *constative* and *performative* on the one hand and the speech act concepts on the other hand. The concepts of both frameworks are used to answer the same research question and to contribute to the same philosophical issues. As Austin ([1962], p. 91) points out at the end of Lecture VII, where he abandons the constative/performative-distinction and starts to introduce speech acts: "It is time to make a fresh start on the problem. We want to reconsider more generally the senses in which to say something may be to do something, or in saying something we do something […] Perhaps some clarification and definition here may help us out of our tangle."

That is, he wants to shed new light on the problem that led to the distinction between constative and performative utterances by developing the theory of speech acts. In other words, Austin still works within the same research program[21], but recognizing that intra-conceptual change of the constative/performative-distinction does not lead to the desired objectives, he proposes an inter-conceptual change, imposing a new structure of concepts on the issue of linguistic actions.

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[21] For the sake of brevity, I will not elaborate on the notion of research programs in this article. I use it in a rather vague way to indicate that the concept change occurs in the same scientific discipline to address the same research questions.

Inter-conceptual change A conceptual change within a research program from a concept *A* (or a set of concepts 𝔄) of a frame φ to a concept A* (or a set of concepts 𝔄*) of a frame ψ is an *inter-conceptual change* if and only if the determination of A (or 𝔄) by the attribute-values φ of is different from the determination of A* (or 𝔄*) by the attribute-values of ψ and A (or 𝔄) and A* (or 𝔄*) are extensionally divergent. Usually, different linguistic expressions are used to name the extensions of A (or 𝔄) and A* (or 𝔄*).

The frame of Fig. 9 represents the conceptual structure of Austin's (1962) speech act theory. I will not analyze the development of his speech act theory although Austin introduces several criteria and tests to classify speech acts that would be worth analyzing by frames. The purpose of the frame of Fig. 9 is to show that the same research program can be addressed by an extensionally divergent structure of concepts and, thus, to exemplify what I call *inter-conceptual change*.[22]

Austin (1962, pp. 91 ff.) distinguishes between different kinds of speech acts: First, the act of saying something (locutionary act) that is further classified into the phonetic, phatic and rhetic act, second, the act of doing something in saying something (illocutionary act) that is performed with the utterances itself (e.g., promising or betting), and, third, the act of doing something by saying something (perlocutionary act), i.e., the act of causing a certain effect (e.g., convincing or annoying someone). The subordinate concepts *phonetic act*, *phatic act*, *rhetic act*, *illocutionary act*, as well as *perlocutionary act* are each defined by a value of one specific attribute. If and only if an act consists of a phonetic, a phatic, and a rhetic act, it is a locutionary act. In sum, the frame of Fig. 9 is a conjunctional defining frame.

According to Austin (1962, p. 98), there is a certain relation between locutionary and illocutionary acts: "To perform a locutionary act is in general, we may say, also and *eo ipso* to perform an *illocutionary act*, as I propose to call it." The relation of *eo ipso* is an empirical nomological relation: If a locutionary act is performed, then an illocutionary act is (also) performed. Consequently, in Fig. 9 the relation of *eo ipso* is represented by a constraint between the values *yes* of the first four attributes (dashed blue arrow). Presumably, this constraint represents Austin's strongest argument against

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[22] I am indebted to an anonymous reviewer for relating the approach of conceptual change discussed in this article to the *problem of changing the subject* that arises for conceptual engineering. Strawson (1963, p. 505) introduces the problem with respect to Rudolf Carnap's (1950) notion of *explication* (see footnote 11). According to Strawson, an explication of a concept changes the subject and, hence, the question or problem one was talking about using the unexplicated concept.Contrary to Strawson, Cappelen (2018) introduces the idea of *topic continuity*: Conceptual engineering does not necessarily lead to a change of the subject because subjects (topics) "are more coarse-grained than extensions and intensions, and so expressions that differ with respect to extensions and intensions can be about the same topic." (Cappelen, 2018, p. 101) I agree to this reviewer that the distinction between intra- and inter-conceptual change could contribute to this controversy and could be used to further specify conceptual engineering as well as the notion of topic continuity. For example, the notion of intra- and inter-conceptual change could be used to distinguish between *topic continuity in a narrow sense* due to intra-conceptual change that leads to a change of the intension, but keeps the extension approximately constant and *topic continuity in a wide sense* due to inter-conceptual change which leads to a new conceptual framework that, however, is used to explore the same subject (i.e., topic or research program). The change of the concepts *constative* and *performative* from Fig. 1 to Fig. 2 could be an example of conceptual engineering with *topic continuity in a narrow sense* and the change of concepts from Fig. 1 to Fig. 9 an example of conceptual engineering with *topic continuity in the wide sense*. However, this line of thought is beyond the scope of this article and should be elaborated in future work.
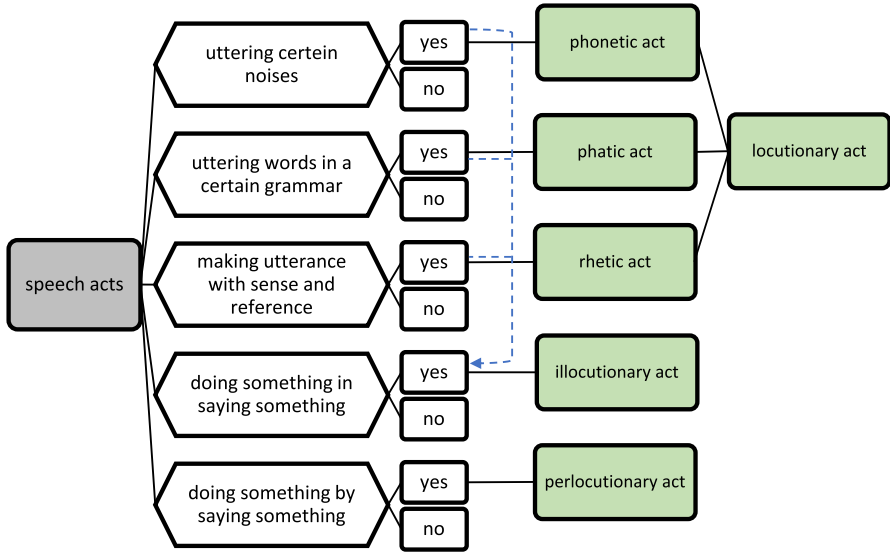
Fig. 9 Conjunctive defining taxonomy frame for speech acts with constraints (dashed blue arrow). (Color figure online)

the constative/performative-distinction because there is no such thing like just saying something true or false with a constative utterance. That is, one cannot exclusively perform a locutionary act (which would be a constative utterance). *Every* utterance is the doing of an action: "to state is every bit as much to perform an illocutionary act as, say, to warn […] 'stating' is put absolutely on a level with arguing, betting, and warning." (Austin, 1962, p. 133) In other words: The utterances that Austin called "constatives" in his initial lectures always also have illocutionary forces and, thus, are performatives. Consequently, Black (1963, p. 225) points out that we then "seem to be back to the old difficulty of being unable to make the performative-constative distinction or anything that will replace it" because all utterances are performative. Austin (1962, p. 103, fn. 1) draws the same conclusion when he asks "in all senses relevant […] won't all utterances be performative?" In sum, Austin's claim that to perform a locutionary act is eo ipso to perform an illocutionary act leads a rejection of the constative/performative-distinction. The frame of Fig. 9 represents Austin's structure of speech acts containing the momentous constraint of the *eo ipso* as discussed above.

How does the frame of Fig. 9 relate to the distinction between conceptual structure change and conceptual content change? With respect to the frames of Figs. 1, 2, 3, 4, 5, 6, 7 and 8, the frame of Fig. 9 introduces extensionally divergent subordinate concepts. Hence, it leads to an inter-conceptual content change. Whether there is a conceptual structure change depends of the frames that are related to the frame of Fig. 9. For example, there is no conceptual structure change with respect to the frame of Fig. 1 because both frames are conjunctive defining frames, but there is a conceptual

structure change with respect to the frame of Fig. 8 because the frame of Fig. 9 is of a distinct frame type.

6 Conclusion

In this article, I investigated conceptual change exemplified by John L. Austin's distinction between constative and performative utterances. To this end I used the frame model to analyze the structure of concepts. I found different types of conceptual change: inter-conceptual change versus intra-conceptual change on the one hand (Aim 1) and conceptual structure change versus conceptual content change on the other hand (Aim 2). Further, I found a case of conceptual enrichment as opposed to conceptual change (Aim 3). Frames proved very useful to analyze the content and the structure of concepts. I provided frame representations of the intra-conceptual change of the concepts *constative* and *performative* by conjunctive, disjunctive as well as bilateral operationalizing frames and showed how contentually closed concepts became contentually open operationalized concepts that entail empirical relations and, thus, lead to concept/theory-merging (Aim 4). However, intra-conceptual change always leads to what I called extensionally convergent concepts. In contrast to intra-conceptual change, inter-conceptual change leads to extensionally divergent concepts that are intended to be used to answer (almost) the same research questions—as exemplified by the inter-conceptual change from the constative/performative-distinction to the speech act concepts. Throughout the investigation, I applied and improved the frame model (Aim 5). For example, I defined different kinds of concept change and different frame types. In sum, the frame model has proven to be a highly useful tool to analyze scientific concepts and conceptual change due to the attribute-value structure of frames and the easily accessible graphical representation of conceptual structures.

The investigation of inter- and intra-conceptual change is anything but completed by the case studies of this article. There are still many future tasks considering conceptual change, of which I would like to hint at just two here. First, there might be a lot of further structures of concepts not mentioned in this article that could be analyzed by appropriate frame types. Consequently, there would be further specifications of intra-conceptual change. Second, the distinction between inter- and intra-conceptual change might provide more detailed analyses within diachronic approaches of scientific development in general.

Declarations

Conflict of interest The author has no conflicts of interest to declare that are relevant to the content of this article.

References

Andersen, H., Barker, P., & Chen, X. (1996). Kuhn's mature philosophy of science and cognitive psychology. *Philosophical Psychology,9*, 347–363.

Andersen, H., Barker, P., & Chen, X. (2006). *The cognitive structure of scientific revolutions*. University Press.

Austin, J. L. (1962). *How to do things with words*. Clarendon Press.

Bach, K. (1965). Performatives are statements too. *Philosophical Studies, 28*(4), 229–236.

Barsalou, L. W. (1992). Frames, concepts, and conceptual fields. In A. Lehrer & E. F. Kittay (Eds.), *Frames, fields, and contrasts* (pp. 21–74). Lawrence Erlbaum Associates.

Barsalou, L. W., & Hale, C. R. (1993). Components of conceptual representation: From feature lists to recursive frames. In V. I. Mechelen, J. Hampton, R. S. Michalski, & P. Theuns (Eds.), *Categories and concepts: Theoretical views and inductive data analysis* (pp. 97–144). Academic Press.

Black, M. (1963). Austin on performatives. *Philosophy, 38*(145), 217–226.

Cappelen, H. (2018). *Fixing language: An essay on conceptual engineering*. Oxford University Press.

Carnap, R. (1936). Testability and meaning. *Philosophy of Science,3*, 419–471.

Carnap, R. (1950). *Logical foundations of probability*. University of Chicago Press.

Graham, K. (1977). *J. L. Austin: A Critique of Ordinary Language Philosophy*. Hassocks: The Harvester Press.

Grewendorf, G. (1976). Fortschritte der sprechakttheorie. In E. Savigny (Ed.), *Probleme der sprachlichen bedeutung* (pp. 101–123). Scriptor.

Heal, J. (1974). Explicit performative utterances and statements. *The Philosophical Quarterly, 24*(95), 106–121.

Hommen, D. (2019). Ontological commitments of frame-based knowledge representations. *Synthese,196*, 4155–4183.

Hornsby, J. (2006). Speech acts and performatives. In E. Lenore & B. C. Smith (Eds.), *The Oxford Handbook of Philosophy of Language* (pp. 893–909). Oxford University Press.

Hommen, D. (2020). Determinables in frames. *Acta Analytica,36*, 291–310.

Kornmesser, S. (2016). A frame-based approach for theoretical concepts. *Synthese,193*, 145–166.

Kornmesser, S. (2017). A frame-based approach for operationalized concepts. In M. Massimi, J. W. Romeijn, & G. Schurz (Eds.), *EPSA 15 selected papers: the 5th conference of the European philosophy of science association in Düsseldorf* (pp. 205–220). Springer.

Kornmesser, S. (2018). Frames and concepts in the philosophy of science. *European Journal for Philosophy of Science,8*, 225–251.

Kornmesser, S., & Schurz, G. (2020). Analyzing theories in the frame model. *Erkenntnis,85*, 1313–1346.

Lemmon, E. J. (1962). On sentences verifiable by their use. *Analysis, 22*(4), 86–89.

Petersen, W. (2007). Representation of concepts as frames. In J. Skilters, F. Toccafondi, and G. Stemberg (Eds.), Complex cognition and qualitative science. The Baltic International Yearbook of Cognition, Logic and Communication, Vol. 2 (pp. 151–170). University of Latvia.

Quine, W. V. O. (1981). *Theories and things*. Cambridge, Mass./London: The Belknap Press of Harvard University Press.

Schurz, G. (2008). Patterns of abduction. *Synthese,164*, 201–234.

Schurz, G. (2013). *Philosophy of science: a unified approach*. Routledge.

Searle, J. R. (1989). How performatives work. *Linguistics and Philosophy, 12*, 535–558.

Smith, E., & Medin, D. (1981). *Categories and concepts*. Harvard University Press.

Soames, S. (2003). *Philosophical Analysis in the Twentieth Century, Volume 2: The Age of Meaning*. Princeton: Princeton University Press.

Stegmüller, W. (1970). *Probleme und Resultate der Wissenschaftstheorie und Analytischen Philosophie*. Band II. Theorie und Erfahrung. Springer-Verlag.

Strawson, P. F. (1963). Carnap's view on conceptual systems versus natural languages in analytic philosophy. In P. A. Schilpp (Ed.), *The philosophy of Rudolf Carnap* (pp. 503–518). Open Court.

Tsohatzidis, S. L. (2018). Performativity and the 'true/false fetish.' In S. L. Tsohatzidis (Ed.), *Interpreting J. L. Austin* (pp. 96–118). Cambridge University Press.

Votsis, I., & Schurz, G. (2012). A frame-theoretic analysis of two rival conceptions of heat. *Studies in History and Philosophy of Science,43*(1), 105–114.

Votsis, I., & Schurz, G. (2014). Reconstructing scientific theory change by means of frames. In T. Gamerschlag, D. Gerland, R. Osswald, & W. Petersen (Eds.), *Concept types and frames: Application in language, cognition, and science* (pp. 93–110). Springer.