Cascades.
Goldman's level-generation, multilevel categorization of action, and verb semantics

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1 Introduction

The paper takes up Goldman's theory of level-generation and act-trees (Goldman 1970) which forms the basis of his Theory of Human Action. Goldman's is a multilevel perspective on action, a view that observes that one doing by an agent can at the same time be considered to constitute many different types of action at the same time. His distinction of levels applies to the ways in which actions are categorized. Goldman's theory of leveled action was not to a great extent taken up in philosophy and linguistics. There are a few exceptions; the theory of "action ladders" in Clark (1995) is the only elaborate one. A handful of semantic publications applies a two-level perspective to specific classes of action verbs.

The discussion will start with an introduction of Goldman's notion of level-generation and act-trees, which we will dub "cascades" in order to have a more general term not confined to acts. The philosophical critics of Goldman's work are briefly reviewed arguing that they did not justice to his theory. We introduce the central term "c-constitution" – i.e. constitution under the given circumstances – for the relation resulting from level-generation, and provide an informal definition that avoids the criticism brought forward from the philosophical camp. The notion of c-constitution is then integrated into a frame approach to cognitive representation. It is proposed to consider c-constitution a relation between first-order action frames.

Locating the level distinction in cognition allows us to adopt the cascade perspective to the concepts that constitute the lexical meanings of action verbs. As it turns out, most action verbs do not denote single-level types of action. As classes of non-basic action verbs, we will briefly review "criterion predicates" for which Kearns (2003) and Sæbø (2008, 2016) proposed two-level analyses. In addition, various verb-semantic phenomena will be presented that display explicit or implicit level-generation. Two related examples will be introduced in detail: Austin's classical multilevel account of speech acts and the cascade of action involved with writing. The writing cascade is used as a case study for developing the semantic consequences of the cascade approach for decomposition and for the theory of composition and reference. As a major point, it is observed that the composition of a non-basic action verb with its argument specifications or verb modifiers necessarily involves the selection of a cascade level; this predicts the availability of multiple readings without lexical or syntactic ambiguity, a consequence which is theoretically welcome.

It is shown that the relation of c-constitution is not restricted to the acts as such, but is paralleled for the agents involved and other act participants across levels, such as the product of writing. This finding suggests that level-generation and c-constitution may be conceptual phenomena of much more general application in cognition. A brief outlook in this direction is given in the conclusion section.

2 Goldman's level-generation

2.1 Goldman's theory of act-levels

2.1.1 The multilayered view on human action

If someone does something, for example if Amy turns on the TV, what she does can be described in different ways:

(1) a. Amy presses the power button on the TV remote control
b. Amy turns on the TV
c. Amy turns on the evening news
d. Amy starts her daily evening TV ritual
e. Amy breaks off the on-going conversation
f. Amy annoys her friend
etc.

Amy may do all these things in one. And each of the alternative descriptions may be a contextually adequate or inadequate description of what is done. The six variants in (1) represent her doing as six different types of act: pressing a button on a remote control is not the same as turning on a TV – an act of the first type need not result in an act of the second type as one may as well turn the TV off by the same action, or nothing may happen at all upon pressing the button. Conversely, turning on the TV can often be accomplished without using a remote control. Similarly, the other sentences in (1) each describe a different type of act. However, under circumstances, these six things to do may coalesce in a single doing. The coalescence is contingent on certain regularities such as the normal interaction of the TV set with the remote control; the fact that news programs can be watched on TV in the evening; the personal habits of the agent; expectable emotional reactions to someone breaking off a conversation.

The six actions in (1) are listed in a particular order: each one comes about by executing the previous one; the friend is annoyed *by* Amy breaking off the on-going conversation; the conversation is broken off *by* Amy starting her daily evening TV ritual; the ritual is started *by* Amy turning on the evening news, whereby she breaks of the on-going conversation, and annoys her friend. Each of these steps depends on supporting circumstances: The TV can be turned on by pressing the power button of the remote control only if the two devices have sufficient power supply, connect to each other, and function properly; the TV set must be in standby mode; the remote control must be directed at the TV set, etc. In a similar way, each further step requires its own circumstantial conditions. Often, the circumstantial requirements are very complex; they would be hard to spell out completely. Yet this does not seem to matter much for the categorization of human action in everyday life. Hardly any user of a TV remote control knows much about the technical side of what they make happen if they press the button of a working remote control connected to a working TV set. A two-year old child is able to learn that pressing the red button on the remote control means turning the TV on or off; in other words: she learns the coalescence of these two types of act (and with them further acts: making a program appear on the TV screen, and probably more).

In his theory of human action (Goldman 1970), Goldman's point of departure is this observation: agents, when they act, may do several distinct things in one. They produce a coalescence (not Goldman's term) of tokens of different types of act in one doing, and therefore they produce as many act-tokens. Applied to the example in (1), Amy enacts a token of pressing the power button on the TV control, a token of turning on the TV, a token of turning on the evening news, and so on.

Goldman emphasizes that these act-tokens are distinct "because", he argues, "the *properties* picked out […] are distinct properties" [1] (Goldman 1970: his italics) – pressing the button on the remote control does not exemplify the same property as turning on the TV etc. One crucial difference of the properties distinguished concerns the respective causal relationships of the types of action: pressing the power button of the TV remote control may cause the TV to go on, but turning the TV on does not cause the power button of the remote control to be pressed. Thus, acts by the same agent at the same time which relate to each other like those in the example cannot be identical as they have different properties. Goldman presents this argument against the proponents of what he calls the "identity thesis" put forward by Anscombe (1963) and Davidson (1963), among others he mentions [p. 2]. According to Goldman, there is one doing by the agent that constitutes a combination of distinct act-tokens of distinct act-types. Goldman's criterion of identity for act-tokens is this: "Two act-tokens are identical if and only if they involve the same agent, the same property, and the same type" [p. 10]. "Each act-token is a token of one and only one type (property)." he says [p. 11]. There cannot be an act-token a that exemplifies two different act-types. An act-token is not just what Goldman calls a "doing", rather it is an act-as-a-token-of-a-particular-act-type. This can best be considered a pair "a/A" of a token a and its type A. There is only one way in which this distinction makes sense: Goldman is referring to acts *as they are categorized*. We will come back to this point later.

2.1.2 Act levels and level-generation

In Goldman's theory of action, the act-tokens enacted with a single doing are ordered in levels. The example in (1) displays the levels in ascending order from (1a) to (1f). Act-tokens at lower levels "level-generate" other, higher-level, act-tokens of the same agent at the same time. If an act-token A by agent S level-generates an act-token A', then S does A' "by" or sometimes "in" doing A [p. 20f]. There are different types of level-generation. Also level-generation can be a many-to-one, one-to-one, or one-to-many relationship. I will use original examples from Goldman (1970) in order to introduce and illustrate Goldman's types of level-generation and possible constellations.

Goldman distinguishes four types of level-generation. The definitions are given in (2), along with original examples[2]; for the sake of convenience, we use the symbol ↥ for level-generation:

(2) Four types of level-generation

1. **Causal generation**
   "Act-token a of agent S causally generates act-token a' of agent S only if
   (a) a causes e, and
   (b) a' consists in S's causing e." [p. 23]

   Examples [p.23]:
   'S flips the switch' ↥ 'S turns on the light'
   'S shoots the gun' ↥ 'S kills George'
   'S closes the door' ↥ 'S prevents a fly from entering the house'

2. **Conventional generation**
   "Act-token a of agent S conventionally generates act-token a' of agent S only if
   the performance of A in circumstances C (possibly null), together with a rule R saying that
   a done in C counts as a', guarantees the performance of a'." [p. 26]

[1] In Goldman's terminology, the sentences in (1) each express a "property" of the agent.

[2] Here and below, when quoting from Goldman (1970), we change the original notation as follows: we replace the form "*S*'s [doing …]" by "S [does …]"; we also replace lower-case for upper-case letters for act-tokens and events because we want to reserve capitals for act-types below; we also enclose the act-type description in single quotes.

Examples [p.25]:

'S moves his queen to king-knight-seven'	↥	'S checkmates his opponent'
'S breaks his promise'	↥	'S does what he ought not to do'
'S extends his arm out the car window'	↥	'S signals for a turn'

3. **Simple generation**
   "In simple generation the existence of certain circumstances, conjoined with the performance of a , ensures that the agent has performed a'." [p. 26]

   Examples [p.27]

'S jumps 6 feet 3 inches'	↥	'S outjumps George'
'S comes home after 12:00'	↥	'S breaks his promise'
'S asserts that p'	↥	's lies'

4. **Augmentation generation**
   "The generated act is formed by "augmenting" the generating act with some relevant fact or circumstance." [p. 28]

   Special case: Compound generation
   "The augmenting circumstance is a co-temporal[3] act of the agent." [p. 28]

Examples for augmentation generation will be discussed in 3.1.

The distinction of generation types reflects that level-generation may draw on different types of connection between actions: on causal connections, on convention, or just on the constellation of facts (simple generation). Augmentation will be illustrated and discussed in more detail in 3.1. We will argue there that augmentation should be distinguished from level-generation proper.

It is important to observe that causal generation is not a relation between an action and an event caused by that action. Let us assume that Amy turns on the light and thereby wakes up her baby. Under these circumstances, there is a causation relationship between Amy's act of turning on the light and the event of the baby awakening. By contrast, the causal-generation relationship arising from this connection between the two events is the relation between Amy's turning on the light and Amy's waking up the baby, that is, between two acts of Amy's, done in one. The causal relationship between the generating action a and the event e caused by a invites the notion that e temporally follows the causing event; similarly, if Bill's shooting at George causes George to die, his death will not be simultaneous with Bill's shooting. While there is no doubt that this is so, or at least can be the case, Bill's shooting the gun constitutes the act by which he killed George if he did so. If Bill killed George by shooting him, there is no delay between his shooting and his killing – they coincide in one doing. There will be, however, a delay between Bill's shooting-at-and-thereby-killing-George and George dying. Goldman uses "act-tree" diagrams for complex level-generational act structures; the trees are to be read bottom-up.

[3] Goldman uses the term "co-temporal" in the sense that two acts are co-temporal if one is done while also doing the other. Act-tokens that coincide due to level-generation have the same temporal extension, but they are not, in his sense, co-temporal.

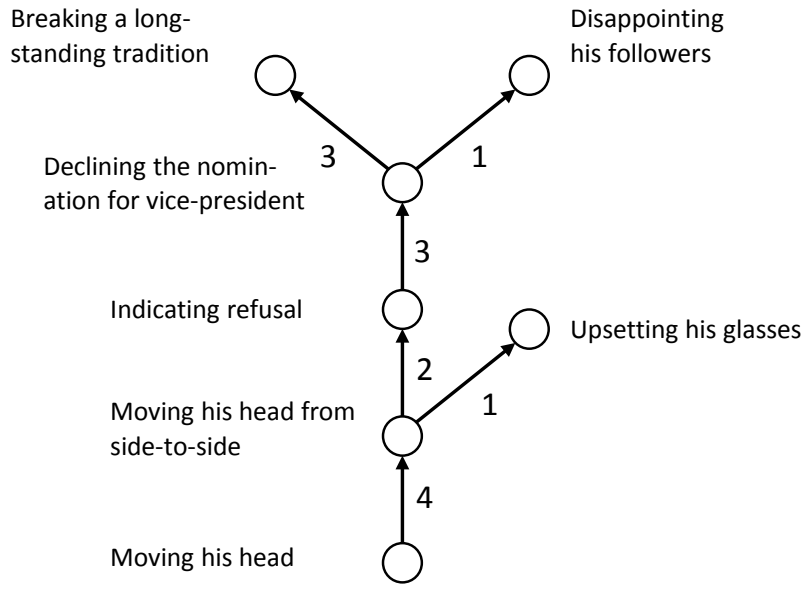

Fig. 1 Goldman's act-tree for declining the nomination for vice-president

The act-tree in Fig. 1 contains instances of all four types of level-generation.[4] The diagram displays seven nodes that stand for act-tokens of different types as labeled. They are connected by arrows that lead from the generating act to a generated act. The numbers that annotate the arrows indicate the four subtypes of level-generation as numbered in (2). The tree contains two act-nodes with upward branching generation. Moving the agent's head not only conventionally generates indicating a refusal, but also causally generates upsetting the agent's glasses. The agent's declining the nomination causally generates his disappointing his followers; it also generates in simple generation breaking a long-standing tradition. The latter constitutes simple generation because it comes about by the mere circumstances of such a tradition having obtained for a long time up to the moment where the agent does what he does. If an act-token generates two or more others which do not generate each other, then the generated acts are at a higher level, but the levels are independent of each other; in particular, they are not the same level. According to Goldman [p. 31], two acts are "at the same level" if only if they are distinct but generated by the same act and generating the same acts. His examples include 'hitting the tallest man in the room' and 'hitting the wealthiest man in the room' where in the given circumstances the tallest man in the room is at the same time the wealthiest one.

Goldman gives the following general definition of level-generation [p. 43, italics omitted; Arabic numbering replaced by Roman].

(3) "Act-token a level-generates act-token a' if and only if
- (i) a and a' are distinct act-tokens of the same agent that are not on the same level;
- (ii) neither a nor a' is subsequent to the other; neither a nor a' is a temporal part of the other; and a and a' are not co-temporal;
- (iii) there is a set of conditions C* such that
  - (a) the conjunction of a and C* entails a', but neither a nor C* alone entails a';
  - (b) if the agent had not done a, then he would not have done a';
  - (c) if C* had not obtained, then even though S did a, he would not have done a'."

[4] The diagram is adapted from Goldman (1970, p. 34), with dots replaced by circles and lines by upwards arrows.

2.1.3 Basic vs. non-basic act-types

The notion of level-generation immediately raises the question whether there is something like a basic level of action. Goldman (1970) answers the question to the positive. His examples of basic act-types include the following [p. 18]:

(4) extending one's arm
moving one's finger
bending one's knee
shrugging one's shoulder
opening one's eyes
turning one's head
puckering one's lips
wrinkling one's nose

Intuitively, a type of action is basic if it does not require a generating act of a different type in order to come about. A convenient test for non-basic act-types is to check if there are different types of act for implementing it. For example, an electric light may be turned on by doing various more basic things, like flipping a light switch, triggering a motion detector, using a smart phone touch display, or giving a voice command to an electronic device that controls the light.

According to Goldman, all action is caused by a current *want* to act correspondently. Essentially, he defines basic act-types as things an agent would do if they had the want to do so and were in standard condition with respect to this type of act, and if the act can be brought about without level-generation.[5,6] Basicness is primarily defined for act-types; the question of basicness of act-tokens will not be relevant in the following. It may suffice to say that "every basic act-token must be a token […] of a basic act-type." [p. 70]. Due to Goldman's definition, basic acts are necessarily intentional – although they may level-generate acts that are not intended.

2.2 Critics of Goldman's theory

Goldman's theory was criticized in Castañeda (1979), Bennett (1988), and McCann (1982), among others. A central point of criticism by these authors is Goldman's formal definition of level-generation quoted in (3). The critics show by counterexamples that the definition applies to cases of act pairs that are obviously not intended to be included.

Goldman's definition in (3) is essentially in terms of logical conditions on statements to the extent that *S does a* and *S does a'* where S's doing a level-generates S's doing a'. The only (probably) non-logical condition is the restriction in clause (ii) that a and a' be not co-temporal; but this weak constraint is far from capturing the basically non-logical notion of level-generation. Level-generation, as introduced by Goldman, is not a logical relation, but a genuinely conceptual relation. In his reply to Castañeda (1979), Goldman explicitly locates level-generation in the realm of psychology:

[5] "Property a is a basic act-type for S at t if and only if: (a) If S were in standard condition with respect to a at t, then if S wanted to exemplify a at t, S's exemplifying a at t would result from his want; and (b) the fact expressed by (a) does not depend on S's level-generational knowledge nor on S's cause-and-effect knowledge, except possibly the knowledge that his exemplifying a would be caused by his want." [Goldman 1970: p. 67]

[6] Goldman discusses, and rejects, a definition of basic action given in Danto (1963). "In Arthur Danto's article "What We Can Do" […] there is a confusion between causation and causal generation that results in an inadequate definition of the notion of a basic action" [Goldman 1970: p. 24].

"[…] insofar as philosophical theorizing is an attempt to lay bare the fundamental features of our conceptual scheme [i.e. level-generation, the author], it should not rest content with a "string" of explicit definitions. Our conceptual scheme is a *psychological structure, or a manifestation of a psychological structure*, and it is not the analysis of concepts alone that will facilitate our understanding of this structure."
[Goldman 1979: 269, my italics]

Being a conceptual relation, level-generation has logical consequences; however, its description is not exhausted by describing logical conditions. The logical supervenes the conceptual; however, supervenience is but a weak correspondence relation.[7] Given that, Goldman's own formal analysis fails to capture the real nature of the notion of level-generation – in fact no definition in terms of logical relations can. A definition like the one intended in (3) can only provide necessary logical conditions to be met by level-generation. The critics mentioned are right in pointing out that Goldman's attempt at a [logical] analysis of the relation does not provide a sufficient condition, but that does not invalidate the underlying intuitive notion of level-generation that Goldman's attempt at an analysis was aimed at.

"[…T]he idea of level-generation, I think, is an intuitive or pre-analytic idea, implicit within our common-sense framework. […T]he idea of level-generation is implicit in our use of the phrase, "S did … *by* doing ---," and in our use of the phrase, "S did … *in* doing ---." That it is an intuitive notion is reflected in the fact that once a few examples of it are given, any ordinary speaker can readily identify numerous other cases that fall under the same concept. […] Since there is a prior notion to be analyzed, we do not want to provide merely a *stipulative* definition. We want to provide a definition that captures our antecedent notion (while also capturing the amplifications of the notion – e.g., augmentation generation – which I have introduced). But providing analyses of interesting concepts is always a difficult enterprise. What must be remembered, therefore, is that the tenability of the intuitive concept should not depend on the success of any particular analysis." [Goldman 1970: p. 38]

In this paper, the notion of level-generation is taken as applying at the level of conceptual representation, or categorization, of actions. One doing of an agent S can be conceptualized in multiple, in fact indefinitely many[8], ways. These conceptualizations are related by the notion of level-generation. Level-generation not only relates two act-representations, but organizes an open number of them in the complex Goldmanian tree structure. As noted above, the distinction of acts in one doing can only be drawn at the conceptual level. It is where "properties", or act-types for that matter, are defined.

Realizing that Goldman's theory of human action addresses the conceptual level reconciles the points of view of the two camps dubbed "unifiers"[9] vs. "multipliers" (Goldman 1979: p. 261), who assume that in cases like the one described in (1) there is just one action, vs. as many as are distinguished in the act-tree, respectively. Yes, there is one doing out there in the world, but we may conceptualize this one doing with a concept that has the structure of a complex act-tree in terms of all the act-types involved. Comparing the multipliers' view to the unifiers', Goldman explains:

[7] McLaughlin & Bennett (2014) give the following definition: A set of properties A supervenes upon another set B just in case no two things can differ with respect to A-properties without also differing with respect to their B-properties.
[8] McCann (1982) in his review of Goldman (1970) considers the infinite potential of level-generation out of a single doing as a problem with the theory. It is not, if we apply a psychologically realistic view. Level-generation is a cognitive means of organizing complex representations of acts that connect under different, co-occurring aspects to other things; as such it constitutes a means for organizing world knowledge in one's mind. It is this potential, and its application, that matters. Cognitive subjects will never bother to attempt to build up an act-tree for a single doing with very many levels: the structure would soon grow too complex to operate with.
[9] Davidson (1963) or Anscombe (1958), among many others.

> A conceptual representation will tend to unify and segregate elements in terms of properties, aspects, features, or attributes of the representational field. Thus, John's waving his hand will be regarded as distinct from John's catching George's attention and distinct from his disturbing Oscar's concentration. These are all different features of what takes place. This sort of "conceptual" segregation into elements is what underlies the multiplier's conception of an action or event. [Goldman (1979): p. 267]

It appears uncontroversial to consider the rich analysis of doings like the one indicated in example (1) as "real" in the sense that if one agent acts in a particular situation and we consider a multi-level conceptualization adequate, then all the act-types, to us, are "really" enacted in his one doing. Thus, Goldman's theory of human action can be considered a contribution to ontology, and metaphysics, of the world *as it is perceived and conceived by human cognitive agents*, i.e. of what is *real for us*.

This point of view raises the question of the individuation of what Goldman calls 'properties'. As he points out, there may be different, but equivalent, descriptions of the same property, such as 'being an unmarried man' and 'being a bachelor' (p.12ff.). Similarly, different concepts may amount to equivalent categorizations. But note that equivalence is to be related not to the extension, but to the intensional level, to the general case to be conceptualized. Of course, there is not only one way to mentally represent a particular property, or category in general. Different individuals may form different concepts to mentally represent the same category, and we form different concepts in different situations for representing the same.[10]

The cognitive approach to level-generation will enable us below to apply the notion directly in cognitive semantics. This opens a new way of decomposing verb meanings. There have been first proposals in semantics to apply multi-level analysis to certain subclasses of verbs (see the work by Kearns, Sæbø, and Engelberg mentioned below), but the full potential of Goldman's theory has not been realized yet.

3 Cascades

In the following, the notation "a/A" stands for an act-token-a-of-the-act-type-A. We first want to set apart augmentation from the other types of level-generation.

3.1 Level-generation and augmentation generation

Goldman (1970: p. 28ff) gives three types of example for augmentation generation. They can be characterized as follows:

(5) **Subtypes of augmentation generation**

a. **Compound generation**
Two or more acts by the same agent and at the same time ("co-temporal" acts) jointly generate an act of doing all these things at the same time.
Ex. 'S jumps', 'S shoots' *generates* 'x jump-shoots' [p. 28]

b. **Manner augmentation** [our term]
An act generates doing this act in a particular manner.
Exx.: 'S says "hello" ' *generates* 'S says "hello" loudly'
'S runs' *generates* 'S runs at 8 m.p.h.' [p. 28f]

c. **Argument augmentation** [our term]
An act generates another act distinguished by the specification of an additional argument:

[10] Barsalou keeps emphasizing the aspect of situatedness of concept formation; see for example Barsalou (2016).

Exx.: 'S extends his arm' *generates* 'S extends his arm out the car window'
'S moves his queen' *generates* 'S moves his queen to king-knight-seven' [p. 34]

Goldman himself was not entirely convinced that augmentation generation is of the same kind as the other types of level-generation he distinguished (cf. his discussion in [1970: 28ff]). Related to the conceptual level, augmentation in all varieties mentioned is enrichment of a given act-type concept: the original concept is maintained and information added such as to form a concept that is more specific. Crucially, the extension of the augmented concept must be narrower. If a concept H is an enriched version of a concept L, then H logically entails L unilaterally, i.e. the extension of H is a proper subset of the extension of L. This is one point in which augmentation differs from the three other types of level-generation. With those, the relation necessarily obtains between two logically independent act concepts since level-generation is not automatic, but dependent on the circumstances. If, under circumstances c, an act a/A level-generates an act a'/A', there might as well be different circumstances c' where this is not the case; conversely, there might be circumstances c' such that an act a'/A' is generated by some act a"/A" with A" different from A.

The entailment condition for augmentation-related act-types has a second consequence. If a/A and a+/A+ are related by augmentation, the question does not arise whether a and a+ are different events or coincide. If A+ is exemplified, the act-type A is, too, just by entailment. The debate between unifiers and multipliers would not have arisen if it were only for augmentation.

A third distinction concerns the context-dependence. The relation between a/A and a+/A+ is just a logical relation; it is not contingent on the given circumstances.

However, there are also crucial points of commonality. First, concepts for act-types are concepts that model an act-token in general form. These concepts will have an event-type act component and specify for it an agent and an act-time. If we add any condition to such a concept, the specification of the agent and the act-time will be preserved. Thus pairs a/A and a+/A+ related by augmentation automatically fulfil the constraint for level-generated act pairs that they have the same agent and the same temporal extension.

Second, if a/A and a+/A+ are related by augmentation, A and A+ are concepts for different types of action, and the conditions added to the concept may be crucial for the causation of certain other things. Thus a/A and a+/A+ have different causal properties. Since one aim of the theory of level-generation is to capture the causal relations of an act-token as categorized in this way or another, augmentation is a relevant mechanism.

We will therefore integrate augmentation into act-tree structures (which we will call "cascades"), but as a relation of its own kind, set apart from level-generation in the narrower sense.

Augmentation is a very general concept relation that obtains between two concepts whenever one constitutes an enrichment of the other, or if the latter "subsumes" the former. The definition in (6a) defines the general notion as a relation between concepts in general,; it applies to act-types in particular. The definition is generalized in (6b) as to cover Goldman's compound generation. (6c) defines the derived notion of an act a+/A+ being more specific than an act a/A; in the case of compound generation, the relation holds between each component act and the compound act.

(6) **Augmentation**

a. A concept A+ is an augmentation of concept A,
$A \sqsubset A+$
iff A+ is A with a condition added such that the extension of A+ is a subset of the extension of A.

b. For n>1, the concept A+ is an augmentation of the concepts $A_1, \ldots, A_n$,
$A_1, \ldots, A_n \sqsubset A+$
iff A+ is an augmentation of each act concept $A_1, \ldots, A_n$.

c. An act a+/A+ is **more specific** than an act a/A,
a/A ⊳ a+/A+
iff A ⊏ A+.

3.2 The cascade relations

We define "cascades" basically as Goldmanian act trees. This term is preferred because we want to maintain the option to extend the notion to representations of things other than acts.

(7) **Act cascades**
An act cascade is a structured concept that consists of single act concepts related by level-generation in the narrower sense and possibly augmentation.

We proceed to give a working definition of level-generation that employs the more intuitive notions introduced by Goldman. Since level-generation is a relation between two act-tokens *qua* the act-types they exemplify, level-generation is based essentially on a concomitant conceptual relation between the act-types exemplified. We will therefore define the crucial relations as obtaining between entities of the form a/A.

3.2.1 Relational properties of level-generation and augmentation

The relation of "level-generation is intended to be asymmetric, irreflexive, and transitive" (Goldman 1970: p.22). Since it is irreflexive, no act generates itself. Asymmetry prevents two acts from generating each other. Due to transitivity, if l/L generates h1/H1 and h1/H1 generates h2/H2, then l/L generates h2/H2.[11] Consequently, level-generation may result in chains, and due to irreflexivity and asymmetry the chains cannot be cycles. As another consequence of transitivity, several steps of generation can be taken to form one bigger step. Conversely, it may be possible that a given step be broken down into several smaller steps.

Asymmetry, irreflexivity, and transitivity hold for generalized level-generation comprising the causative, conventional, and simple type. It also holds for augmentation as defined in (6) (note that the condition of genuine augmentation leads to irreflexivity). It is these logical properties of level generation and augmentation that gives rise to tree structures of the type encountered with cascades.

3.2.2 The relations **c-by** and **c-in**

Goldman mentions that there are the two options of paraphrasing the downward relationship between h/H and l/L, using a *by* or an *in* paraphrase: 'Agent does h/H *by* doing l/L' or 'Agent does h/H *in* doing l/L.' Goldman does not elaborate on the question as to when one or the other type of paraphrase is adequate. Kearns (2003) discusses *in* vs. *by* paraphrases in connection with certain action predicate types, to be discussed in more detail in 4.2 on "criterion predicates". These predicates involve level-generation[12] inherent to their conceptualization; she refers to the generator as "host" and the generated as "parasite". According to Kearns, an *in* paraphrase expresses that "the host simply realizes the parasite" [p. 602]; while a *by* paraphrase expresses that "the causative parasite is not realized simply in the occurrence of the one action performed, but requires also a consequential upshot" [p. 615]. It is not clear from her discussion when which of the two paraphrases applies. Still, Kearns' observation that the *in* paraphrase applies when the generating act *simply realizes* the generated act seems to be a valid generalization. We would say, for example, in the case of (8) that the casting of the speaker *is* the mistake.

[11] From here on I will use 'L', 'L1', 'L2', … for (relatively) lower cascades levels, and 'H', 'H1', 'H2', … for higher levels. The capital letters are also used for the act-types exemplified at the respective levels, while lower-case letters are used for act-tokens.
[12] Kearns does not use the term 'level-generation' and does not refer to Goldman's work.

(8) *All through The Graduate Nichols thought he'd made a mistake in casting me.* [BNC C9U 495]

By contrast, cases of generation where a *by* paraphrase is adequate seem to not allow for the equation, in this sense, of generating and generated act:

(9) *Our aim is to reduce the number of new HIV infections by giving young people the facts about AIDS and by encouraging them to think about their future.* [BNC A01 532]

Clearly, giving young people the facts about AIDS *is* not, in itself, a reduction of the number of HIV infections, rather it is a possible *means* of achieving that.

We conclude that there are two distinct inverse cascade relations that can be described by "h/H is done in doing l/L", and by "h/H is done by doing l/L", respectively. These are alternative inverses of the relation of level-generation. We index the relations with the subscript 'c' for the given circumstances since these relation only hold under circumstances, like the relation of level-generation.

(10) The downward relation **c-in**

h/H **c-in** l/L , iff

Under the given circumstances c,

- the agent, **in** doing l/L, exemplifies an act h of type H;
- doing h/H **consists in** exemplifying an act l of type L;
- the agent's doing l/L **counts as** / **amounts to** / **means** exemplifying an act h of type H.

(11) The downward relation **c-by**

h/H **c-by** l/L, iff

Under the given circumstances,

- the agent, **by** doing l/L, exemplifies an act h of type H;
- doing h/H **is effected by** exemplifying an act l of type L

A simple intuitive description of the relation between the generating act l/L and the generated act h/H derives from these definitions: Under the given circumstances, doing L is a way, or a *method*, for doing H. Sæbø (2016) uses the term 'method' in this connection, and we adopt his terminology. Thus, if under circumstances doing A is a method to do A' – either by causality, convention, or simply circumstances – then acts a/A and a'/A' are in the cascade relation of c-constitution.

3.2.3 The relation of c-constitution

Rather than striving for a general sufficient formal definition of level-generation, we will apply the notion to the more concrete variants listed above. We will also introduce a different term: the notion of level-generation emphasizes the dynamics of creating additional categorizations for a given act-token. In the following we will focus rather on the conceptual relation between the act-types related by level-generation, and speak of "c-constitution". Under the given circumstances c, an act l/L c-constitutes an act h of type H if and only if l/L level-generates an act of type H. Thus, the following definition of c-constitution can *mutatis mutandis* be taken as a definition of level-generation:

(12) **The relation c-const**

Let l/L and h/H be two acts such that

(i) l and h are acts by the same agent that occupy the same time, but l and h are not co-temporal

(ii) l and h are not on the same level

Under given circumstances c, an act l/L **c-constitutes** h/H

l/L **c-const** h/H, or l/L ↥ h/H

iff one of the following two relations holds:

h/H **c-in** l/L – In doing l/L, the agent exemplifies an act h of type H, or

h/H **c-by** l/L – By doing l/L, the agent exemplifies an act h of type H.

3.2.4 The two sides of the notion of level-generation

Goldman's notion of level-generation is of a double nature. It can be considered a relation between act-tokens *and* a relation between act-types. When we define level-generation and augmentation as relations between act-tokens-of-a-type l/L and h/H, there is a concomitant relation between exemplified act-types: between the act-type L exemplified with l, and the act-type H exemplified with h. Using the notation 'A\a' for an "act-type A exemplified by a token a", we can alternatively define the cascade relations between exemplified act-types L\l and H\h. These obtain iff the "ingredients" l, L, h, and H fulfil the conditions that define the relations between l/L and h/H. In the following, we will keep to the token-mode when relating to cascades, using the definitions introduced above. We will adhere to the token-centered view in the following.

In addition to the token-type duality, level-generation can be taken either as a cognitive process or as the resulting relation between two act-types. Again, these are two sides of the same coin. Goldman's terms 'level-generation' and 'augmentation' relate to the process side of the coin, while his definition in (3) defines level-generation in terms of relations between the act-tokens. We chose to define c-constitution and subsumption as relations rather than processes.

3.2.5 The cognitive status of the cascade relations

We follow Goldman in assuming that level-generation is an intuitive psychological notion. In fact, we consider c-constituency a basic – and in this sense primitive – relation between concepts in our cognitive system. We will assume that this mechanisms does not simply produce several concepts of categorization dependent on each other; rather it produces concepts with a cascade structure that categorize simultaneously at multiple levels. We will adopt this approach in the sections on verb semantics below, arguing that very many verb meanings have a multi-layered cascade structure. So far, c-constitution is only introduced for act concepts. It appears, however, that the notion can be extended to other types of concept; we will take a first glimpse at this possibility in the section 5.6.

Clearly, conceptual subsumption is of an equally basic nature in cognition and extends to all sorts of concepts.

Thus, Goldman's notion of level-generation (subsuming c-constitution and augmentation) when applied to cognitive representation opens a new dimension for a theory of representations, categorization, and concepts. If concepts are conceived of as two-dimensional networks (as they are in the frame approach), level-generation adds an orthogonal third dimension.

3.3 Cascades and frames

3.3.1 Barsalou frames

We adopt Barsalou's Frame Hypothesis, according to which Barsalou frames constitute the universal format of concept representation in human cognition. We assume that lexical meanings are concepts stored in long-term memory and that compositional meanings are concepts formed as the result of syntactic and semantic processing, essentially by unification.

According to Löbner's (2017) theory of Barsalou frames, a frame structure is a network of nodes, related by functional attributes. The nodes represent individuals in a global universe of discourse. The attributes are functions that for individuals of an appropriate type return another individual as value. For example, the attribute SIZE returns the individual size for all individuals that have size; the attribute MOTHER returns the mother for every animal with parents; the attribute HEAD returns the head for those things that have a head. The values of attributes may carry their own attributes; thus frame structures are in principle recursive. In a frame, type restrictions may be imposed on the nodes, i.e. conditions that what they stand for belong to a certain subset of the universe. The frame structures defined in Löbner (2017) are first-order in that the underlying ontology provides a universe of discourse; the set of all individuals. The universe does not contain second-order entities such as properties, relations, attributes, or frames. The only attributes admissible are such that they assign individuals to individuals. Frame structures can be translated into an appropriate first-order predicate logic language.

Frames are usually represented by frame diagrams (see examples below), or else by attribute value matrices. We use the former format. There is always a distinguished central node that represents the individual described by the whole frame. Frames have the same double nature as Goldmanian act-tokens-of-a-type. A frame can be read as a description of the individual for which the central node stands and to which the frame structure applies. This is the token-of-a-type view on frames. Alternatively, we can read a frame as a complex description of a type *qua* description of a potential token of the type – the type-of-a-token view.

In the context of the present paper, we exclusively deal with frames for actions. Actions are a particular type of individuals in the universe, a subtype of events. All events have an attribute τ for the time they occupy; therefore every action frame has this attribute on the central act node. Actions have an agent whence the act node in an action frames carries an attribute AGENT. For the current discussion in the context of a theory of human action, we will assume that agents are persons. An action frame may contain more attributes of the act, corresponding to more semantic roles such as THEME, PATIENT, INSTRUMENT, GOAL etc.[13]

3.3.2 Cascades in frame theory

The question arises if cascades are another variant of frames. Löbner (2017) admits only for first-order attributes in frames. The cascade relations c-constitution, c-in, c-by, and subsumption, however, are essentially and irreducibly second-order, because they relate types, i.e. whole first-order frames. Apart from that, the upward relations are not functions, as we saw in 3.2. Due to transitivity, a level-generating act-token does not project to a uniquely defined token it generates in addition, level-generation may branch upwards. Thus the cascade relations cannot figure as attributes *within* first-order frames. We will therefore integrate them into frame theory as second-order relations between first-order frames.

Let us consider a simple two-level cascade for illustrating the interplay of frame representation and c-constitution:

(13) 'Bill turns on the light' **c-const** 'Bill wakes up the baby'

The two cascade diagrams in Fig. 2 each contain the frames for 'Bill wakes up the baby' and for 'Bill turns on the light' at the upper and the lower level, respectively. The two frames are parallel in structure. They have a central act node that represents an act of the type indicated by the type label. In both frames, the action node carries the attributes AGENT and τ. We assume that the two attributes have the same value in both frames; thereby the two acts fulfil the formal precondition for level-generation. Both frames have a THEME attribute on the central node, of different nature. The frames are grossly incomplete, but the content indicated suffices for the current purpose.

[13] For more elaborate verb frames, see for example Kallmeyer & Osswald (2013), Naumann (2013), Gamerschlag et al. (2014), Löbner (2017).

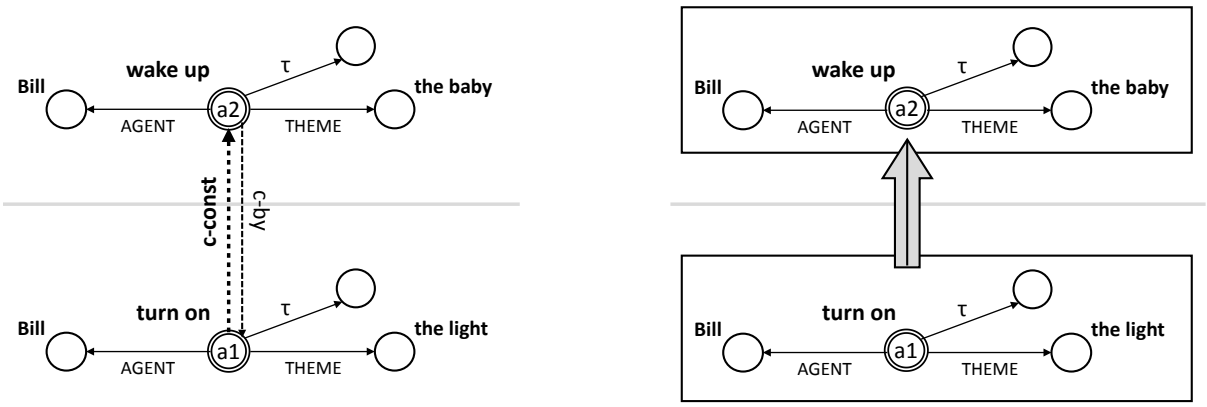

Fig. 2 Cascade formed by the two frames

The left cascade diagram adopts the token view on level-generation. The two frames are read as representations of a1/'Bill turns on the light', and a2/'Bill wakes up the baby'. The dashed upward arrow stands for the relation of c-constitution between the two acts, the downward arrow for the c-by relation.[14] In the right diagram, the type view is adopted. The frames are enclosed in rectangles to mark them as conceptual units. They are to be read as representations of the exemplified act-types 'Bill turns on the light'\a1 and 'Bill wakes up the baby'\a2. A different type of arrow connects the two frames, not their central nodes. Both depictions are equivalent; they highlight two different aspects of cascade formation. In the following we will use the left type of diagram.

4 Cascades and verb classes

4.1 Verbs of basic and non-basic action

The meaning of a verb describes a type of situation; for action verbs, it describes a type of act. The distinction between basic and non-basic act-types (2.1.3) therefore immediately carries over to verbs. If one takes a look at corpus and dictionary data, it turns out that non-basicness of action verbs is the rule rather than the exception. Table 1 displays the most frequent 100 English action verbs, among the 156 most frequent verbs in all. The table was obtained by checking the entries in the online Oxford Dictionary of English[15] (ODE) for the most frequent English verbs in the online British National Corpus. A verb was counted as an action verb if the first sense in the dictionary entry has an agentive, non-stative description. It was classified as non-basic if the definition was in terms of multiple synchronous or sequential action, if the method was left open, or if a cascade-like definition is given ("do --- by doing …"). In addition, we marked verbs of social action with italics. Social action is necessarily non-basic, as its social character derives from social rules. For any type of social action, a generating physical act is required that under circumstances will count as that type of social action.[16] We classified verbs as social if the sense description mentions interaction with other persons; verbs of social action are written in italics.

[14] In the following cascade diagrams we will omit the downward arrows and the labeling of the upward arrows with "c-const".

[15] Oxford Dictionary of English: https://en.oxforddictionaries.com/

[16] See, for example, Searle (1995) on the distinction of what he calls "brute facts" and "institutional facts". The latter form our social reality. They are what they are by social agreement. Constitutive rules of the form "X counts as Y in context C" [p.28] create the social reality, including social action. This concept closely resembles Goldman's notion of conventional level-generation, but Searle does not refer to Goldman's work.

01	*say*	go	make	take	come	*give*	look	use	*tell*	put
11	work	leave	*show*	*ask*	try	*call*	*provide*	keep	hold	turn
21	bring	begin	follow	*help*	write	run	set	move	play	*pay*
31	*meet*	*lead*	*allow*	carry	produce	*talk*	*offer*	consider	*suggest*	let
41	sit	continue	add	change	*buy*	*speak*	*send*	decide	*win*	*describe*
51	*agree*	build	read	reach	open	*spend*	return	draw	create	*sell*
61	cause	walk	accept	wait	pass	lie	apply	base	raise	increase
71	*report*	watch	learn	cover	*explain*	*claim*	break	support	form	cut
81	reduce	establish	join	bear	achieve	seek	deal	choose	fail	*serve*
91	*represent*	kill	drive	*discuss*	place	*argue*	*prove*	*introduce*	pick	enjoy

Table 1: 100 most frequent English action verbs (verbs of social action are written in italics)

Among the one-hundred action verbs, there is not a single example of a clearly basic act verb. One verb might be a candidate: The ODE describes the first sense of the verb *stay* as 'remain in the same place'[17]; however, if *stay* is an action verb at all (rather than stative), it is a borderline case, and the fact that it seems basic may just be due to it not involving doing anything. As a result, it appears that there are no basic-act verbs at all among the 100 most frequent English verbs. Thus, the question arises: Are there any basic-act verbs in English? Verbs that invariantly denote basic action rather than what is achieved by some type(s) of more basic action in one or more steps of level-generation? The verbs in Goldman's basic action examples in (4) – *extend*, *move*, *bend*, *shrug*, *open*, *turn*, *pucker*, *wrinkle* – are not in themselves verbs of basic action. In Goldman's examples, they are all transitive verbs and their basicness depends on the choice of a particular body-part as the object argument. For types of object other than one's own body-parts, there would be different methods of enactment possible. Some of the verbs have intransitive action uses – *move*, *bend*, *shrug*, and *turn*; among them, *shrug* is a candidate for a basic-action verb because to shrug is the same as to shrug one's shoulder; maybe *bend* is another one.

It is not surprising that there are so few verbs that denote basic acts. The vocabulary of natural language serves communication in, and about, our reality, and this is to a large part social reality. Verbs of action are used in order to describe what people do. If we were restricted to verbs of basic action, it would be extremely hard, in fact probably impossible, to describe what people are really doing. Quite generally, it seems, we communicate about what people do on considerably advanced levels of cascading. Verbs like *help* supply a good illustration of the 'abstractness' of action concepts. Ranking 24 in the above list, it is central vocabulary. According to the analysis in Engelberg (2005), the verb means essentially 'do something for somebody that improves their situation'. The concept of helping leaves open what the generating action would be concretely; in fact an action of almost any type may constitute help in one situation, and the contrary in another, and the very same act-token may constitute help for one person and a big problem for another. In social life, improving others' situation is of utmost importance; it applies to all kinds of situation in our complex lives; we *need* general verbs like this.

For another source on basicness or nonbasicness, one may take a look at Levin's (1993) *English Verb Classes and Alternations*, where a comprehensive collection of semantic verb classes is compiled and described. There are 49 major classes distinguished, almost all of them action verbs – not a single class is basic-action.

[17] https://en.oxforddictionaries.com/definition/stay, accessed Jan 15 2018.

4.2 Criterion predicates

Goldman's theory of action was not really taken up in semantic theories of verb meaning.[18] There is, though, a small thread of discussion on the semantic analysis of *by* gerunds where a two-level view on the meaning of selected types of action verb is adopted. The discussion starts out with Kearns (2003). Kearns distinguishes two special classes of action predicates which she dubs "causative upshots" and "criterion predicates". Causative upshots are transitive predicates like *cure the patient* or *convince s.o.* [p. 599]; they denote the achievement of some sort of change by doing something more concrete, e.g. curing someone by administering a certain treatment, or convincing someone by presenting evidence. Criterion predicates are often intransitive and not inherently causative; this class includes predicates such as *make a mistake*, *break the law*, *score a goal*, or *prove the theorem*. The predicate requires that something be done that fulfils a given criterion, but it is left open what is actually done. For both types, in Kearns' terms, there is a "host" and a "parasite" [p. 600f]. The "more abstract" parasite, the causative upshot or criterion predicate, is implemented by the "more concrete" host. For example, the parasite is 'breaking-the-law' and the host a theft; the parasite is 'curing-the-patient' and the host administering the treatment. Clearly, Kearns' host level-generates the parasite. Kearns does not mention Goldman's work, though. Her analyses are confined to two levels, and to two special classes of non-basic act-types.

The two classes of verbs are taken up in Sæbø (2008, 2016). He chooses different terms for Kearns' causative upshots ("manner-neutral causatives" in 2008, "method-neutral causatives" in 2016); hosts and parasites he calls concrete and abstract.

4.3 Means of explicit level-generation

There are numerous lexical and grammatical mechanisms operating on verbs and their lexical meanings to the effect of generating further cascade levels. Some of them involve word formation, for example affixation, or conversion from a different word class, others employ certain grammatical constructions or adverbials. The examples in the following are chosen for the sake of illustration; they do not provide a systematic survey, but represent just the tip of an iceberg. Almost all the cases described make involve augmentation along with level-generation.

4.3.1 Adding an level of social interaction

Many lexical and grammatical processes add a further argument[19] to a given action concept. This amounts to augmentation of the underlying concept, but in addition c-constitution is involved, on top of the augmentation. We will discuss the addition of a person-type argument; this will inevitably have the effect of cascading to a level of social interaction. Many basic types of bodily action are used as non-verbal signals for communication. For example, the verbs *smile*, *frown*, *raise one's brows*, *wink*, *nod*, *shrug*, *bow*, *kneel down*, *fold one's hands*, *scratch one's head*, *wave one's hand*, and others can also denote communicative action. They do so invariantly if they are used with a prepositional phrase that adds an addressee: 'smile/wink/wave/ frown *at someone*'. German has verb prefixes such as in *zu-zwinkern* ('wink at') or *an-lächeln* ('smile at')

[18] The theory was taken up and developed further in Clark's (1996) theory of communication. However, he did not apply the notion of level-generation to verb semantics.

[19] It is not relevant in this context to distinguish syntactically between complements and adjuncts; we will talk of 'arguments' in both cases.

which have the same effect of adding an argument for a person addressed.[20] Using a "flat" notation for cascades, the concept of *zuwinkern* has the informal cascade structure in (14). (15) is an example that attests the social-level relevance of *zuzwinkern*.

(14) 'zuzwinkern': 'zwinkern' ⊏ 'zwinkern' + *addressee* ↥ 'zuzwinkern'

(15) *Mein Lieber, wenn du nicht verheiratet wärst, dann könnte ich dir jetzt zuzwinkern.* [DWDS]
'My dear, if you were not married, I could now wink at you.'

The two German prefixes can also be used as prepositions marking an additional addressee argument for verbs of communication: *schreiben an* + accusative NP 'write to' or *sprechen zu* + dative NP 'speak to'.

Similar to these cases are applicative constructions (van Valin & LaPolla 1997). Japanese has several such constructions consisting of two verbs; the first verb is in the gerund *-te* form and the second a verb of possession transfer, such as *ageru* 'give upward' and *kureru* 'give downward'; the direction component is metaphorically used for expressing 'give to superior' or 'give to inferior'. A speaker will always treat the addressee as socially superior, whence the beneficiary in the *-te ageru* construction will typically be the other, and the agent typically the self or someone related to the self. The social relation is inverted if one replaces *ageru* by *kureru*. The complex expression is used to describe doing a favor.[21]

(16) a. Japanese
mado o ake- te age- ta
window ACCUSATIVE open- GERUND give- PAST
"I opened the window for you"

b. Cascade:
'open the window' ⊏ 'open the window' + *superior addressee* ↥ 'do addressee a favor'

Thus, the construction has the structure of a criterion predicate, with the method specified. A similar construction in Mandarin is discussed in Tsai (2012).

(17) a. Mandarin (Tsai 2012, p. 5) [22]
gei wo gui- xia!
AFF me kneel- down
'Kneel down for my sake!'

The verb *gěi* 给 'give' is also used as a standard verb of giving.[23]

Van Valin & LaPolla (1997, p. 384) describe beneficiary constructions in Lakhota with essentially the same semantics. German has a special use of the dative in such cases:[24]

(18) German
Er hat ihr die Tür aufgehalten
he has *her*.DATIVE the door kept open
'he [has] kept the door open for her'

As witnessed by the translation, English has a *for*-complement construction with the same function.

[20] See Stiebels (1996, p. 163f) on the prefix *an-*.
[21] Martin (1975, pp. 597ff)
[22] Tone diacritics are not given in the source.
[23] Chang (Ed., 2016: p. 251f)
[24] Wegener (1985, pp. 94ff) on dativus commodi.

4.3.2 Adding a level of achieving a result

Predicate expressions such as *hammer flat* or *drink empty* consist of a verb of action and a predicative adjective that denotes a resulting state of the object acted upon. Resultatives of this type denote an action that is generated by an act of the type of the base verb; for example, *hammer flat* denotes a cascade of the structure 'hammer … ↥ flatten', and *drink empty* a cascade 'drink … ↥ $\text{empty}_{\text{verb}}$'. However, the cascade first requires an augmentation that adds the affected object. Thus, the analysis requires two cascade steps:

(19) a. 'hammer' ⊏ 'hammer' + *on x* ↥ 'flatten x'
b. 'drink' ⊏ 'drink' + from x ↥ 'empty x'

Dowty (1979), and since then many others, analyzed this type of construction as causative in the sense that, for example, *drink the glass empty* means 'drink from the glass and [thereby] cause the glass to become empty' (Dowty 1979, p. 93). This is reflected by the analysis in (19) if ↥ is taken as representing the causal type of level-generation. German has a lot of particle verbs with a resultative particle such as *tot-* 'dead' in *totschießen* 'shoot to death', *klein-* 'small, little' in *kleinschneiden* 'cut into small pieces, chip' or *an-* in *anknipsen* 'to flick on'; these can be analysed analogously.

Van Valin & LaPolla (1997: 90) mention verbs of killing in Lakhota; they have the form of compounds with the first part indicating the method of killing, and the second a verb *t'a* that means 'dead / to die', for example *ka-t'a* 'strike to death' (*ka-* 'by striking'), *ya-t'a* 'bite to death' (*ya-* 'with the teeth'), *yu-t'a* 'strangle' (*yu-* 'with the hands'). English can generally use the addition *to death* for level-generating a predicate of killing. German has a series of verbs of killing with the prefix *er-* that does not have much of a lexical meaning on its own, but rather constructional meaning in this type of verb formation: *erschießen* ('shoot to death'), *erschlagen* ('beat to death'), *erwürgen* ('choke to death'), *erhängen* ('hang'), *erdrücken* ('crush to death'), and several more.[25] – The generating act-type fails to be specified in cases of conversion of adjectives to verbs; the adjective denotes the resulting state of the object of an unspecified action: *empty*, *fill*, *smooth*, etc. These verbs are method-neutral predicates in the sense of Sæbø (2016).

4.3.3 Adding an evaluative level

A further type of cascade extension adds an evaluating aspect to the action-verb concept. German has a productive word formation pattern that derives from almost arbitrary verbs of action a verb used to express this action and failing to produce the intended result; these verbs have been dubbed 'erratic' verbs (see Fleischhauer 2016: 293). One variant of the derivation adds the prefix *ver-* to a transitive verb and yields another transitiveverb (*die Hecke verschneiden*, 'cut the hedge in the wrong way' [26]); a second type adds the same prefix and the verb is reflexivized as to form an intransitive predication (*sich verschneiden* 'cut in the wrong way'). This derivation adds an evaluation of the doing as a failure: 'cut' ↥ 'fail'. Thus, this is another mechanism that produces criterion predicates. English has some erratic verbs with the prefix *mis-*: *misunderstand, misdirect, mishear*, but the pattern is far less productive than the German one.[27]

Other constructions across languages serve the generation of a level of 'doing too much': cf. English *overcook*, *overheat*, *overpay* etc. Russian uses the prefix *pere-* in a similar way (*pere-gret'* 'overheat').[28] Japanese has verb compounds with the second verb *-sugi-ru* 'exceed', for example *nomi-*('drink')*-sugi-ru* 'drink too

[25] Stiebels (1996, p. 232 ff.)
[26] Stiebels' example in her discussion of this derivation (1996, p. 143–148).
[27] Goldman (1970: p. 17) mentions erratic misspeak, miscalculate, and miscount as examples of act-types that "preclude intentionality".
[28] See Zinova (2016: 146ff) on a frame analysis of the meanings of *pere-*.

much'.[29] A two-verb construction in Mandarin with the second verb 'play' *wán* 玩 can be used to express the level-generation of acting for fun:

(20) a. Mandarin (Liu Fan, from the BCC corpus)
Xiánzhe méishì zuò kāfēi <u>wán</u>
be.idle have.nothing.to.do make coffee play
'[I am] idle and make coffee for fun.'

b. *Wǒ xiàwǔ chūqù hé péngyǒu guàngjiē wán ne*
I afternoon go.out with friend go.shopping play PRT
'I go out to shopping with my friend for fun.'

In German there is a very productive adverb formation that adds *-weise* to an adjective or a present participle. This type of adverb is used for evaluating an act, or more generally an event or a state. Examples include *dummerweise* 'stupidly', *erstaunlicherweise* 'surprisingly', *unnötigerweise* ('unnecessarily'), *glücklicherweise* ('luckily'), and hundreds more. Unlike their English translations, they cannot be used as manner adverbials; rather they correspond to English adverbs in sentence-initial use.

(21) German (DWDS corpus)
<u>Dummerweise</u> hatten wir keine Schneemäntel angezogen.
'Stupidly, we hadn't put on snow coats.'

This type of adverb projects the verb to a criterion-predication level. For example, adding *dummerweise* to a verb V, has the effect of [V] ↥ 'do something stupid'.

4.4 Implicit level-generation

It may be worthwhile considering cases of "integrated" augmentation generation of the types discussed above as they provide a glimpse into the decompositional structure of certain types of action concept.

Evaluation. One group with an integrated specific evaluation is constituted by verbs of forbidden action, e.g. *lie*, *steal*, *trespass*, *rob*, *rape*, *murder*, and many others. These add to the concept of a particular type of action a level 'do something forbidden/illegal'. Thus, there is a cascade relationship between 'kill' and 'murder'. 'Murder' can project further to 'assassinate' if the victim is an important person, giving rise to elaborate cascades such as 'shoot' ↥ 'shoot at y' ↥ 'kill y' ↥ 'murder y' ↥ 'assassinate y'.

Result. Van Valin & LaPolla (1997) distinguish causative and active accomplishments, and achievements. Causative accomplishments are verbs like *kill*: the agent does something that causes somebody to die. The authors apply the following general half-formal analysis to this type of action verb [p. 188ff.].[30]

(22) [**do** x, [**predicate**$_1$(x, (y))] CAUSE [BECOME **predicate**$_2$(x) or (y)]].

This reads essentially as follows: The agent x does something of the type **predicate**$_1$ which causes x or y to change into the condition denoted by **predicate**$_2$. The first part of the analysis – **do** x, [**predicate**$_1$(x, (y))] – describes an action by the agent x (that possibly involves another participant y); according to the second part – CAUSE [BECOME **predicate**$_2$(x) or (y)] – x's doing causes x or y to enter the condition described by the second predicate. The whole formula describes the constitutive condition for causal generation:

(23) **do** x, [**predicate**$_1$(x, (y))] ↥ [x CAUSE [BECOME **predicate**$_2$(x) or (y)]]

[29] Martin (1975: 434–438) on the "excessive" construction.
[30] The analysis goes back to Dowty (1979), who relates to McCawley (1968) for the structure of the analysis.

Causative achievement and accomplishment verbs with an agent argument are abundant in natural languages. Typically, the generating level of the more basic action is not specified.

Generating a level of signaling. As mentioned above, some action verbs of basic or near-basic level can be used to denote a social-level act of signaling (*smile*, *frown*, *harrumph*, *nod*, *shrug*, and others). If used in this sense, they incorporate generation of a social level. As social agents, equipped with the "sense-making machines" our minds are, we usually try to come up with a construal of the acts of others as meaningful beyond the mere act. The verbs mentioned reflect this tendency by incorporating a higher cascade level in lexicalized meaning variants.

5 The writing cascade

We will have a brief look at Austin's (1962) speech act theory. There is a double reason for doing that: first, Austin's analysis anticipated Goldman's multi-level theory of action; Goldman mentions it as such in his introduction [p. 8]. Second, it serves as a preparation of the discussion of the writing cascade in the section following.

5.1 Austin's speech act cascade

Austin's (1962) analysis of speech acts constitutes a classical example of a cascade. Austin's analysis distinguishes five levels of action in an ordinary verbal utterance (Fig. 3). The "locutionary" level consists in saying something with a particular sense and reference in the given context of utterance. Within the locutionary act, Austin makes a finer distinction into three levels: with the "phonetic act", the speaker produces speech sounds; the "phatic act" is "the uttering of certain vocables or words, that is, noises of certain types, belonging to and as belonging to, a certain vocabulary, conforming to and as conforming to a certain grammar." (Austin 1962: p. 95); the "rhetic act" is "the performance of an act of using those vocables with a certain more-or-less definite sense and reference." [p. 95]. The phonetic act generates the phatic act, and this in turn the rhetic act. Austin continues [p. 98], "To perform a locutionary act is in general, we may say, also and *eo ipso* to perform an *illocutionar*y act". Austin calls this level the *il*locutionary act in order to emphasize that it is done *in* performing the locutionary act. He thus explicitly assumes a c-in relation between illocution and locution. The achievement of the illocutionary act – a promise, an answer to a question, etc. – only succeeds if complex "felicity conditions" [p. 25–38] are fulfilled. Austin discussed these conditions in detail, thereby offering an elaborate case study of the "circumstances" involved in these cases of level-generation.

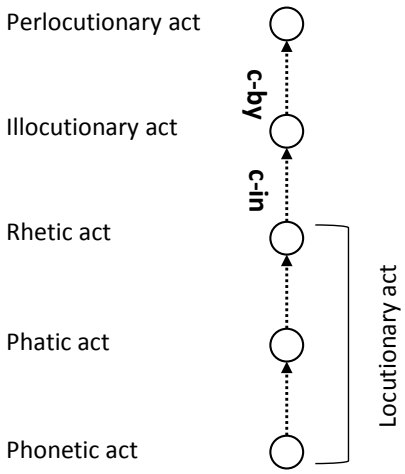

Fig. 3 Austin's speech act cascade

Finally, *by* performing an illocutionary act, the speaker may execute a "perlocutionary act" that consists in causing a particular effect, for example, convincing, offending, or delighting the addressee. Austin calls it *per*locution because it is done *by* performing the illocution [p. 108]. "[T]he perlocutionary act always includes some consequences" [p. 107]. Unlike the lower four levels of a speech act, the perlocutionary act may or may not be intended. The nature of the four level-generations is a combination of conventional and simple for

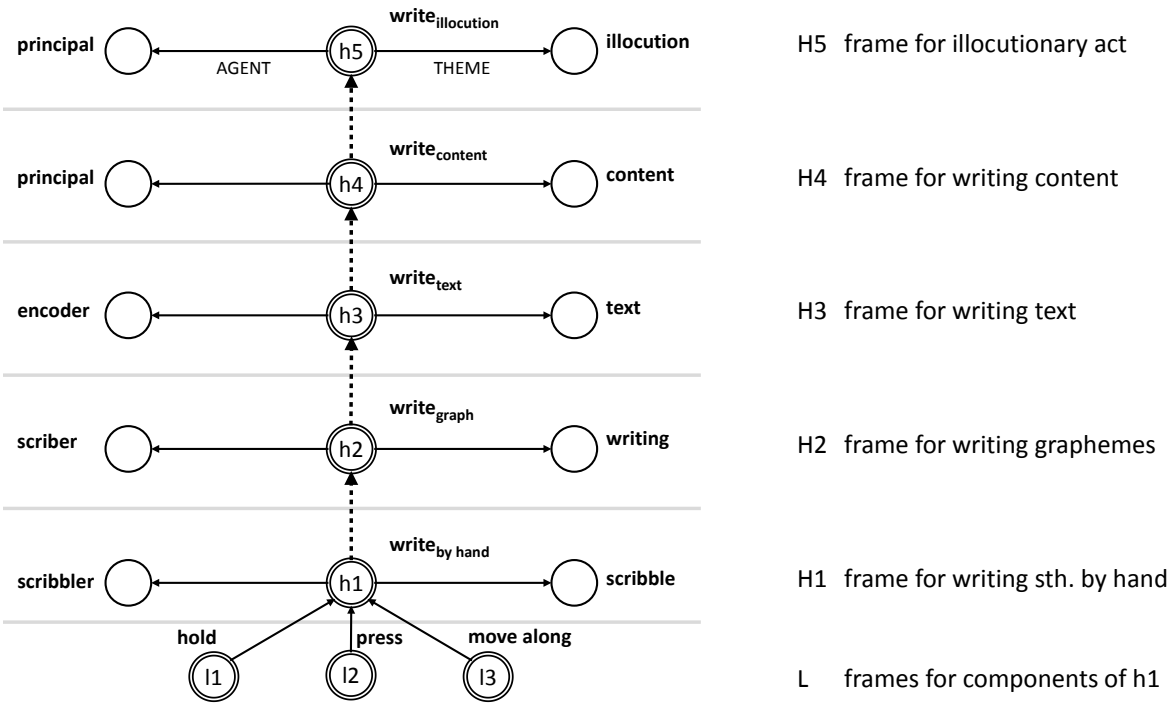

Fig. 4 The cascade for writing by hand

phatic, rhetic, and illocutionary act; the level-generation of the perlocutionary act from the illocutionary act is causal; it does not involve convention [p. 121].

5.2 The cascade structure of writing by hand

We will now proceed to an example that is suitable to illustrate and discuss central aspects of applying the cascade approach to lexical concepts of action verbs. Fig. 4 displays a cascade for the concept of writing by hand. It is roughly analogous to Austin's cascade, but we will elaborate it more, commenting on the single-level frames and their relationships. The writing cascade has a lowest level of three co-temporal acts; they compound-generate the first level that can be called writing, Level H1 “writing by hand” in the sense of producing visible lines and shapes. The agent holds a writing implement in their hand, presses its writing part on some surface, and moves it along leaving a visible trace. For reasons of space, the three frames for the acts of holding, pressing, and moving along are only represented by their central act nodes. In fact, they share the agent among them and the action time with the higher-level frames; they also have the same theme argument (i.e. the pen or other writing implement; the acts of pressing and moving share the surface as a third argument.[31]

The higher Levels H1 to H5 consist of action frames each with an agent and a product attribute. If Level H1 produces perceptible forms of writing on the surface, it generates Level H2 “$write_{graph}$” of producing graphemes. Graphemes, in turn, may or may not constitute linguistic text: under circumstances, Level H2 generates Level H3 “$write_{text}$”. Again under circumstances, writing text constitutes a fourth Level H4 “$write_{content}$”. Writing verbal content corresponds to the locutionary level in Austin's cascade. To this level adds an illocutionary

[31] Actually, the process of handwriting is more complex; usually, the pen will not be in continuous contact with the surface since writing certain graphemes, words, or sequences of words may require to lift the implement and move it to a different position on the surface.

level H5 "write$_{illocution}$", for example, an application, an excuse, a reply, a request, etc. The type labels for the agents will be explained in 5.4.

At each cascade level, the act is embedded in a different context, and each context comes with different requirements. For the writing cascade, the context of Level H1 is the same as, for example, the context of drawing. The agent needs a surface such as a sheet of paper, a poster, or a canvas, and they need pens, brushes, or other implements, along with ink, paint, etc. The agent needs to be able to hold the implement and move it along on the surface at some level of motor control. The product at Level H1 can be copied or scanned; if properly processed, it can be stored on an electronic device; the agent determines readability in terms of the size of writing, the visibility of the writing material on the surface, the durability of the product; they may be concerned with highlighting parts of the writing by different color or style. At Level H2, the agent bothers about a writing system and a writing style. They need to command the skill of writing. The Level 3 agent is concerned with choosing a language, with orthography and grammar; they need be in command of the language. At Level H4, the agent produces content, whereby the author potentially relates to other content and its authors; for larger texts, the author is concerned with aspects such as coherence and structure which are crucial for comprehensibility. Obviously, producing text involves more abilities than just knowing the language. It is at the illocutionary level that the agent enters interaction with a reader addressee, possibly initiating or continuing a sequential exchange; the agent at this level will choose an appropriate type of text, a style and a tone of expression, which requires the relevant social competence. At each level, different criteria of successful action obtain. And each level is motivated and informed by what it serves to level-generate.

5.3 Types of products and levels of manner modification

At each level, the writing activity produces different types of product, for example, lines, letters and characters, words, coherent texts, illocutions, etc. This amounts to different selectional restrictions for each level. Correspondingly, if the verb *write* is complemented with a direct object such as *whorls, e's*, *"mama", "I'm to the cafeteria"*, *a receipt*, an appropriate level within the cascade will be selected for application. If one were to describe the selectional restrictions for the theme argument of *write* in a single-level approach, one would run into a heterogeneous type assignment for the product argument.[32]

The level-distinction is equally relevant for the analysis of manner modification. (24) lists manner modifiers of *write* that are level-specific; others like *slowly* or *beautifully* may apply at more than one level.

(24) Manner modifiers of *write* and the cascade-levels they relate to
- H1 *swiftly*, *shakily*
- H2 *small*, *illegibly*
- H3 *ungrammatically*, *coherently*, *in Dutch*
- H4 *incomprehensibly*, *redundantly*, *laconically*
- H5 *urgently*

[32] One approach to this problem is the assumption of "dot objects" (see for example Pustejovsky 2009, Asher 2011). Dot objects are of a composite type, such as *physical_object•information* for 'book'. There is a vague connection between this approach and cascade theory, if the notion of cascade is extended to objects (see below), but the relationship is too unclear to be addressed here. The dot-objects approach raises many questions: What is the ontological character of dot objects – are they one object or more? Which types can be combined to form dot types? Which relationships obtain between the elements of a dot object? What is the relationship of the elements to the whole?

Without requiring disambiguation or coercion, the verb combines with any-level modifiers or product specifications. Simultaneous relation to different levels is possible. The following example constitutes a case of what is called “copredication”:

(25) *She used to write her private letters* [H4] *very slowly* [H1] *on her typewriter* [H1].

5.4 Agencies at cascade levels

In Goldman’s theory, the agents of the acts in a cascade are presupposed to be the same. But even so, they are in different *roles*, a fact we blurred by the use the same generalized attribute AGENT at all levels, instead of the more specific role attributes that actually apply. In the case of writing by hand, these are:

(26)

Level	Agent’s role
L	the one who holds the writing implement in hand
	the one who presses its writing part on the surface
	the one who moves it along on the surface
H1	the scribbler
H2	the scriber
H3	the encoder of the text
H4	the author of the content
H5	the performer of a written illocutionary act

Goffman (1979) introduced the notion of “footing” in order to distinguish different roles that the participants of a verbal communication can take in. There are producer footings and recipient footings. On the producer’s side, Goffman distinguishes the roles of “principal”, “author”, and “animator”. The principal is the one on whose behalf an utterance is made, the one responsible. The author chooses the words, the animator produces the verbal signals. In everyday communication, the three roles are usually enacted by the same person, but in institutional settings, like press conferences, public speeches, court trials, examinations, and countless others, the producer footings may be distributed among more than one person; ghostwriters choose the words they don't utter themselves, attorneys speak on behalf of their clients, a typist types words not their own. Agentship can in principle be delegated down the cascade if the higher-level agent is in the position to do so. A lower-level agent is responsible to one of the higher-level delegators; ultimately, the principal will be held responsible for the performance of all the agents involved at the lower levels. These considerations may lead to a generalization of level-generation that allows for delegation of agency down the cascade, instead of strict identity of agents.

If agency does not split, there is a relation between the agent roles at the different levels – if these agents are not considered just persons but persons-in-a-particular-role. Let us assume that Erica holds a pen and moves it along a piece of paper. As such she is already in three roles, implementing the penholder, the one who presses the pen upon the paper, and the one who moves it along on the paper. If she produces script, she thereby implements a ‘writer-by-hand’. The implementation cascades upwards if Erica is successful in writing graphemes, thereby producing text, content, an illocution. The agent at a given generator level implements the agent at the generated higher level. Like the relation of c-constitution, the implementation is successful only under circumstances. We will therefore talk of “c-implementation”.

The implementation relation is asymmetric: the writer-of-text implements a writer-of-content, but not vice versa, since text need not have content. It is also irreflexive: no role implements itself. And implementation is transitive. Thus, the c-implementation relation has essentially the same properties as c-constitution, except for the fact that it is a relation between persons and the roles they implement, rather than between acts.

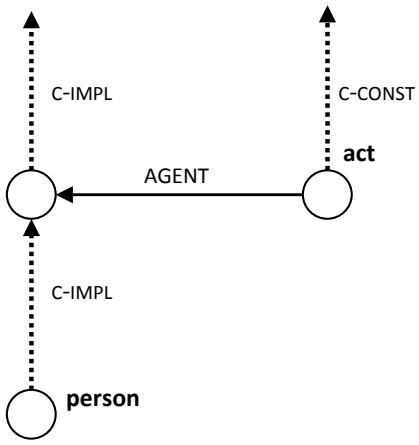

Fig. 5 The two levels of implementing an agent role

C-implementation shares with c-constitution the question of grounding. Although c-implementation goes hand in hand with c-constitution of acts, the grounding of c-implementation is not just derivative from the grounding of c-constitution. Rather, for any level of action, including the basic level, taking the agent role means implementing it, for the person who acts. Hence, if B is the basic act in a cascade to perform, the c-implementation chain starts with an additional prior step, taking the form in (27a), while the act-cascade is as in (27b):

(27)	a.	Person x	**c-impl**	agent at level L	**c-impl**	agent at Level H1	**c-impl**	…
	b.			act at level L	**c-const**	act at Level H1	**c-const**	…

Fig. 5 displays the two levels involved with agency: the person who implements the agent and the implemented agent, that is, the person in the agent role for a specific act. The act level may cascade further upwards.

We may assume that a person is implemented by a human animal, the human animal by human biomass, and so on. This assumption would be in a line with theories that model social entities such as persons as supervenient on biological entities, and these on chemical entities, and ultimately matter. Thus, the problem of grounding persons in an implementation cascade is an ontological problem of its own that extends down below the basic level of act-cascades.

This mismatch notwithstanding, we may consider to generalize the term *c-constitution* as to also cover the c-implementation relation. It makes sense to extend the use of the term in this way: the writer-by-hand under circumstances *constitutes* a writer of graphemes, who in turn may *constitute* a writer of text, etc. In both applications of the term, to acts and to their agents, the notion of c-constitution captures the phenomenon of multi-level categorization.

5.5 Objects at cascade levels

Goldman does not impose conditions on arguments other than agents involved in the acts at different levels. In view of the writing cascade, we are certainly reluctant to assume identity of the products because they exemplify ontologically different types of object. Extracting the product track from the cascade yields a multilevel conceptual description of the product on its own. The product is something of a quality that originates at Level H1, it is also something of a quality that originates at Level H2, and so on. Again, there is a relation of constituency: under circumstances, the graphemes constitute text, the text constitutes content, the content an illocution.

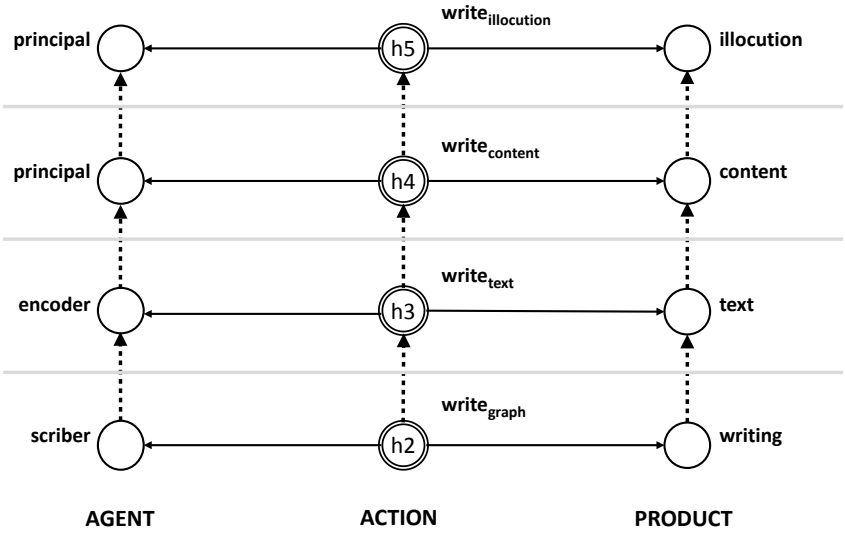

Fig. 6 Three tracks of c-constituency in a cascade

The difference of description that applies to the product of writing at the levels distinguished is particularly conspicuous. This will always be the case for object arguments in action cascades of creating, destroying, or changing things, like *bake*, *break*, or *repair*. However, objects in other cascades, even if they may not change, come about, or cease to exist, will be in different roles, too, analogous to the agents in a cascade. Let us have a second look at the initial TV example. The TV has different roles at each level:

(28) L The TV is a remote-controllable device tuned to the particular remote control.
H1 The TV is in the role of being turned on by the telecommand. It matters whether or not the TV is in the state 'on', 'off', or 'standby'; it changes this state upon receiving the telecommand.
H2 The TV is in state such that it receives TV broadcast programs; in particular, it is a device that delivers the evening news. It is a device of mass media communication.
H3 The TV is in the role of the device that enables Amy to have her daily evening TV ritual. It serves Amy's habits in a particular way.
H4 The TV and its program, when watched by Amy, make continuing her conversation impossible. To Amy, the TV and its program is something that at this moment is more important than continuing her conversation.
H5 The TV and its program are a disruptive element to Amy's friend.

5.6 C-constitution generalized

We argued above that the cascade relations are second-order because they are relations between act-types. We now see that there is a much stronger argument for the second-order view: c-constitution between acts necessarily comes along with c-constitution of agencies and potentially further arguments of the act if they are shared across levels. These other tracks of c-constitution are conceptualized as roles of the arguments involved. Hence, c-constitution is a *multitrack* condition. Fig. 6 displays a three-track sub-configuration cascade that would apply to the writing and TV examples. Notably, the tracks in an action cascade intrinsically harmonize. To each of them the same circumstances – the "c" parameter of c-constitution – are relevant, and with them the level-specific contexts. While the diagram highlights the multitude of c-const relations, the three tracks can alternatively be considered the components of the one complex inter-level relation of c-constitution as depicted in the right diagram in Fig. 2.

6 Reference and composition

The assumption that action-verb meanings are concepts with a cascade structure has far-reaching consequences not only for a theory of cognitive representation and decomposition, but also for the theory of reference and of composition.

6.1 Meaning and reference of the verb *write*

We call activities at all Levels H1 to H5 of the writing cascade "writing", regardless if the higher levels are actually achieved. If we refer to a level higher than H1, a choice of alternative methods at Levels L and H1 is available, such as writing with a typewriter, or by using a computer with a keyboard, a smart phone with a touch screen etc. Thus, for present-day English, it is not to be assumed that the cascade in Fig. 4 represents the lexical meaning of the verb, as the lexical entry must not fix the method of writing. That does not mean that the level of the writing method is absent from the concept; it cannot be absent because it is required for logical reasons (no higher-level acts without appropriate generating lower-level acts). The method of writing is present in the lexical concept, but it is not specified.

What we are dealing with here is not polysemy, that is, different senses on a par with each other. Rather, it is a case of different, but systematically interdependent, simultaneous categorizations of one doing, or: one sense with a complex internal cascade structure. Of course, this does not mean to say that action verbs with a cascade structure meaning cannot be polysemous in addition.

When the verb *write* is used referentially, it refers to a cascade of actions of the a/A type. The cascade need not be implemented completely. The completion can be confined to any level from H1 to H5 if some of the higher levels do not come about due to circumstances or because the agent did not intend to achieve them.

6.2 Cascades and composition

If we consider semantic meanings to be concepts, for example frame cascades for verbs of action, and if we are provided with explicit models of these concepts, we are in a position to ground a theory of semantic composition on the given decomposition. Semantic composition can then be modeled in more detail and more precisely. Also, if we know more about the meanings of words, we can start to model the interaction of semantic information with context knowledge. Using the example of the verb *write*, we will illustrate some of the general perspectives of semantic composition that emerge from the cascade model.

Let us assume we are to interpret a simple sentence with the verb *write* in finite use, with a subject and a direct object.

(29) *Martha wrote the statement.*

The lexical meaning of the name *Martha*, when taken as a person name, is a very simple frame: There is a central referential node typed as 'person' with one attribute, NAME, that carries the value 'Martha', basically an English sound and written form; we may add a GENDER attribute to the central node with the value 'female' if we consider it adequate to constitute part of the meaning of the name *Martha*. The subject DP in (30) specifies the agent argument of the verb. Now, there are five agent nodes in the writing cascade that belong to an act typed as some level of writing. The frame for *Martha* can be unified any one of them. What about the remaining four agent nodes? They will essentially be taken care of by the c-constitution requirements. In the simpler case of one-party agency, Martha is the agent at all levels, i.e. the scribbler, the scriber, the

encoder, and the principal at the same time. If we allow for footing splits, the conditions are more involved: the level-agent is either Martha herself, or somebody who delegates this level to Martha or to whom Martha delegates this level.

In addition to the full five-level readings of *write*, there is the possibility that the writing cascade may be implemented only up to a lower level than H5. Thus, there are three degrees of freedom given for the composition of verb and subject: (i) choice of the overall expansion of the writing cascade up to a level less than or equal H5; (ii) selection of a level for the agent; (iii) selection of the agent's role in a footing structure. This amounts to a vast number of readings on this part alone.

Dealing with the direct object in (30) is less complex because in most cases the specification will select a particular level of the cascade. In the given case, the product is Level H5, an illocution. In order to be able to select the appropriate level for unifying the product node with the frame for *the statement*, we need to know that statements are illocutions, that is, we need an according frame representation of the noun *statement*. As to the remaining four object nodes in the cascade, again the c-const relation will take care; for any product at a Level n+1, the product at Level n must support the higher-level product type. We may, however, also have product specifications that leave the type open, such as *it* or *that*. Depending on how the reference of the pronoun is determined in the given context, it might result in selecting a different level than was chosen for the agent. Therefore, the number of readings due to handling the agent argument possibly multiplies with the number of levels on account of level-selection for the object specification.

As is natural when one works with frames, we assume that the basic mechanism of semantic composition is unification.[33] Unification is restricted by the conditions that the type information on the nodes unified be compatible. In the case of level-specific object specifications or modifiers, this condition accounts for how these "find" their level to apply to. If there is more than one pair of nodes that fit, there may be more than one way of unification. We therefore have to accept that semantic composition is not deterministic. Although this is a bitter pill to swallow for some theoretical orientations in semantics, this consequence is after all welcome. All the readings possible are potentially "real". If there are several readings to a sentence without it containing ambiguous lexical items, the compositional theory must account for them accordingly.

Bitter pill or not, one should realize that the classical model of semantic composition is not a psychologically realistic model (and never was meant to be). In a realistic approach to semantic processing, the semantic agent will draw on contextual knowledge *during* the process of composition, not only after it is finished. Aiming not at abstract sentence meaning, but at utterance meaning, that is, meaning plus reference in the given context, the composing subject will merge the semantic information as early as possible with contextual information about the referents. For example, when faced with the sentence *Martha wrote the statement*, in a context where they know who Martha is, what statement is at issue, and which writing footing Martha can have, they may come up with one possible reading only. It is in this connection, where the dependence of c-constitution on the circumstances comes to bear crucially. The c-parameter in every cascade link *calls for* the inclusion of contextual knowledge in the compositional process; knowledge of the circumstances is necessary in order to decide which cascade levels are actually accomplished.

[33] According to the formal semantics view of composition, predicate expressions have open argument slots in their meaning to be "saturated" with the arguments. If we apply this view to the cascade approach, one level will be selected for the agent argument to saturate and a possibly different level for the product argument. The other agent slots and product slots are existentially saturated and imposed type conditions emanating from the c-const relations obtaining to the saturated nodes.

7 Conclusion: Cascades in cognition, semantics, life, and metaphysics

We started out recalling Goldman's theory of level-generation and act-trees. Taken as the psychological notion Goldman intended, level-generation provides the ground for a theory of the cognitive representation of action concepts. According to this approach, we conceptualize tokens and types of human action in multilevel cascade structures (the occasional basic acts notwithstanding). Cascade concepts of action applied to single tokens of acts are complex structures that categorize an act simultaneously as different types of action, organized into a hierarchy of levels. These are not levels of generality, but of constituency: lower-level acts constitute higher-level acts, where constituency is generally dependent on supportive circumstances.

In a second step, Goldman's theory was applied to action *verb* concepts in natural language. Almost all action verbs denote non-basic action and therefore cascades of action. Some examples of everyday activities such as writing call for cascaded concepts of as much as six or more levels. Thus, the repertoire of natural language verb meanings provides ample evidence for Goldman's multilevel view on action categorization. As a theory of the structure of semantic verb concepts, the cascade approach has far-reaching consequences for a theory of decomposition of verb meanings and for the theory of semantic composition.

A closer look at the participants in the acts within a cascade reveals that there are analogous constituency relationships between the respective participants at different levels. There is a track of stepwise upwards implementation of agency in terms of the finer-grained level-specific agent roles. A parallel track obtains for other participants involved through cascade levels. This finding suggests that human action induces cascades not only for action itself, but also for agents and objects involved. Relating c-constitution to the theory of Barsalou frames showed that this is a relation between frames for the single levels; c-constitution organizes the single-level frames into a hyperframe of levels or representation.

A radical induction from these findings might be this: All human categorization is, at least potentially, multilevel in the sense of cascade theory. Whatever we categorize, we categorize at potentially more than one level. This is owed to the fact that the bits and pieces of reality, or to be precise: of what is reality to us as human cognitive individuals, always matters in many different contexts. The brief glimpse at upward cascading mechanisms in the verbal lexicon (S. 2.3) gave an impression of where cascading expands to: in many cases it is a projection into the realm of social action and interaction; in others, cascading conquers the realm of evaluated action (with respect to personal or socially shared values). This might be taken as an indication that there may be macrolevels across specific action types. Acquiring a vocabulary of verbs for human action with cascade structure meanings will help the members of a language community to synchronize their cascade level distinctions for single types of action as well as for overarching macrolevels. Clark's (1996) theory of language use is a detailed study of how conversational interactants synchronize their multilevel views of the interaction they are engaged in.

In his introduction to Goldman (1970), Goldman relates his theory of action to the ontological debate about the question whether, say, flipping a switch and thereby turning on the light is one act or two. The problem dissolves, if one applies the psychological perspective Goldman made more explicit later. There is no doubt that, if somebody does something – one doing – they potentially (if not necessarily) enact in one a whole cascade of doings. All the acts in a cascade *really* are enacted; they *really* are as what they are categorized at all cascade levels. This is reality *to us* as we cognitively construe the world. For psychology and in particular for the analysis of verbal communication – and thereby for linguistics – this is the relevant notion of reality.

The higher levels of an action cascade can be considered as corresponding to as many respects in which the doing has *meaning*. Likewise, persons in roles matter at the level of action that defines this role, and so do objects involved in action. Conversely, acts, persons, and objects can be viewed as lacking meaning to us as long as they, for us, do not c-constitute anything at a higher level. Of course, what carries meaning to a

subject is first of all a personal issue. There are, however, socially established ways of c-constitution that will be anticipated by persons in social interaction.

Linking the cascade theory of action to observations on the meanings of action verbs is not only an application of the theory; these observations conversely provide support for the psychological theory. To the extent that the analysis of semantic concepts can provide evidence for the cascade theory, it can be regarded as a contribution to the philosophical program of natural language metaphysics and ontology: the approach to ground a theory of the world and the things there are in semantic analysis.

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Online corpora

BCC Beijing Language and Culture University Chinese Corpus. http://bcc.blcu.edu.cn/lang/en
BNC BNCweb. British National Corpus online. http://bncweb.lancs.ac.uk/.
DWDS Das Wortauskunftssystem zur deutschen Sprache in Geschichte und Gegenwart. https://www.dwds.de/