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Modeling locative prefix semantics. A formal account of the English verbal prefix *out*-

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Abstract
The English verbal prefix *out*- gives rise to at least two semantic categories: comparative forms as in *to outplay someone* and locative forms as in *to outstream from somewhere*. While most available studies on the comparative sense rely on insufficient databases, systematic studies on the actual behavior of locative verbal *out*-forms are lacking altogether. Building on a set of more than 1,500 tokens culled from corpora, this study is the first to systematically analyze, formalize, and contrast the two senses. The formal analysis will be couched in frame semantics and model both individual attested examples as well as lexeme-formation rules based on generalizations. Formalizations of the two prefixes, and their implications, are shown to speak against an analysis of one underlying, underspecified prefix. Locative *out*- essentially functions as a morphologically bound, and highly restricted, version of *out*- as a particle, while comparative *out*- is a highly specialized, idiosyncratic construction.

Keywords Derivational semantics · English locative prefixes · Frame semantics · Polysemy · Complex verbs

1 Introduction

Across languages, locative prefixes and particles frequently give rise to diverse semantic categories and patterns of polysemy (see Rainer 2014 for an overview). This paper sets out to describe, formalize, and compare the semantics of English verbs prefixed with *out*-. Examples of the two commonly acknowledged categories are provided in (1-a) and (1-b) (from COCA and iWeb; see Davies 2008, 2018; and OED 2018):

(1) a. LOCATIVE *out*-VERBS
to outsource something, to outgas, to outstream, to outpour etc.

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b. COMPARATIVE *out*-VERBS
to outrun someone, to outfly someone, to outsmart someone, to outlast someone etc.

c. LOCATIVE *out*-NOUNS AND PARTICIPIAL ADJECTIVES
an outhouse, out-hanging

In fact, *out*- also gives rise to nouns and participial adjectives, as in (1-c). I will remain non-committal in this paper regarding such forms and focus on verbal structures. The examples in (2) illustrate the verbal prefix senses in (1-a,b) with some more context, and also show that they can be found with the same base forms:

(2) a. [...] the men believe it has been pretty clear from the amount of nuts on the ground and in the trailers headed to the huller, where **huge dunes of processed nuts** wait **to be outshipped** [...] (COCA)

b. Should Nintendo actually ship the reported units, **the Switch would outship the Wii U** in its first 13 months of sale [...] (iWeb)

As in (2-a), *out*- can make reference to spatial information: nuts await shipment away from their current location at the huller. In contrast, the general interpretation of the case in (2-b) is strikingly different: roughly, the attestation describes a (hypothetical) competition between two game console models, in which the Switch prevails by virtue of being shipped more frequently than the Wii U. Regarding terminology, I will call spatial cases as in (2-a) LOCATIVE *out*- and cases such as (2-b) COMPARATIVE *out*-. I will treat both these categories as cases of prefixation and formalize them in the general spirit of word-based morphology (see e.g. Aronoff 1976, Blevins 2006). These commitments, including the argument that comparison is merely one facet of meaning in comparative *out*-, will be critically discussed in the respective analysis sections and, in particular, in Sect. 5.

The two processes are under-researched to different degrees. The studies that investigate comparative *out*- (e.g., Kotowski 2021, Ahn 2022, Kotowski and Schäfer 2023, Tolskaya 2014, Irube 1984, McIntyre 2003, Talmy 2000) propose highly divergent analyses, and no satisfactory formal account is available as of yet. In contrast, the by far less productive locative *out*-verbs are recognized by major reference works (see Bauer et al. 2013:ch.16, Marchand 1969:55; on the productivity of *out*-verbs, see Schröder 2011), but have, to the best of my knowledge, not been investigated in any depth thus far. This paper's objective is the formal modeling of the two categories in Barsalou frame semantics (see Barsalou 1992, Löbner 2014, Kallmeyer and Osswald 2013, Petersen 2007), building on a corpus-based analysis of their semantic properties.

Formalizing the two categories will also allow for addressing the question of how closely related the two categories at hand actually are. The few authors commenting on the historical relationship between the two prefixes argue for a stepwise development. First, the locative sense gave rise to a by now obsolete completive-resultative meaning category, as in *to outbake something* 'to bake something thoroughly'. Second, this completive-resultative semantics then gradually developed into the comparative category at hand (see Brinton 1988, Nagano 2011). Yet, this subsequent development to a sense that includes comparison of two events remains largely obscure.

While some authors speculate on a metaphorical shift from path semantics to scalar semantics (see e.g. Talmy 2000, Tolskaya 2014), the question of synchronic polysemy of *out*-verbs has not yet been addressed, and is summed up by Bauer et al. (2013:347) as follows:

> On the one hand, the semantic uniformity and robust productivity of the [comparative; S.K.] version of the prefix might be taken as evidence that *out*- has evolved into two distinct homophonous affixes. On the other hand, the existence of an overlap between the two meanings in forms derived from verbs might argue for a polysemy analysis.

The analyses will build on corpus data, culled from mostly COCA and iWeb. The database includes more than 500 comparative verb types and 57 locative verb types, and more than 1,500 tokens in total. Overall, the analyses and the frame formalizations will show that the differences between the two forms in question clearly outweigh their commonalities. Besides obvious discrepancies regarding productivity, these differences concern possible base forms, stress assignment, subcategorization frames and argument linking, semantic and syntactic uniformity, induced argument structural and event structural changes, and the existence of semantically equivalent, homophonous forms. Based on these considerations, I will propose distinct lexeme formation rules capturing generalizations in the lexicon (see e.g. Riehemann 1998, Koenig 1999, Bonami and Crysmann 2016) and formalize these as frames (see e.g. Plag et al. 2018, Kawaletz 2021, Andreou 2017 for frame-based lexeme formation rules).

The paper is structured as follows: Sect. 2 briefly introduces frames as the assumed framework. Section 3 for locative *out*- and Sect. 4 for comparative *out*- introduce the respective analyses. Section 5 juxtaposes the findings of the preceding questions and discusses implications both for questions of polysemy or semantic relatedness and for the nature of the morphological processes at hand. Section 6 concludes.

2 The framework

The framework used for modeling in the following is frames in the sense of Barsalou (1992) and frame semantics as their adaptation to semantics (see Löbner 2014, Kallmeyer and Osswald 2013, Petersen 2007). Barsalou-style frames differ in several ways from Fillmore frames as made use of in FrameNet (see e.g. Fillmore and Baker 2009 as well as Sect. 3.3). They are modeled as recursive typed feature structures (see e.g. Carpenter 1992) that offer a general format of knowledge representation, including linguistic knowledge, and they allow for decomposing semantic structure and for representing constraints derived from contextual information or world knowledge in a unified format.

I will represent frame semantic structures as attribute-value-matrices (AVMs). Figure 1, for example, depicts an AVM-representation of the frame semantic structure of the sentence *The boy is lying on the sofa*.

Typed feature structures include a finite set of types represented in italics (e.g. the eventuality type *locative_state*) and a finite set of attributes represented in small caps

Fig. 1 Frame representation as AVM for *The boy is lying on the sofa*

$$\begin{bmatrix} \textit{locative\_state} \wedge \textit{posture\_state} \\ \textsc{theme}\ \boxed{1}\ \texttt{boy} \\ \textsc{location}\ \boxed{2}\ \textit{spatial region} \\ \textsc{posture}\ \textit{lying} \\ \textsc{ground}\ \begin{bmatrix} \texttt{sofa} \\ \textsc{onregion}\ \boxed{3}\ \textit{spatial region} \end{bmatrix} \\ \boxed{2} \subset \boxed{3} \end{bmatrix}$$

(e.g. the semantic role THEME). For the sake of simplicity, I sometimes use linguistic material from an attestation as a placeholder for a more general type, and I will represent such placeholders in typewriter font (see e.g. `boy` in Fig. 1). Attributes are partial functions from type node to type node, i.e. they return unique values for attributes that are unique to their holder. Types can also be connected via non-functional relations (non-functional in the sense that they constitute one-to-many mappings, i.e. do not return unique values).

Figure 1 represents an eventuality of the complex type *locative_state* $\wedge$ *posture_state*, which shows a node can have more than one type as long as types are compatible. Event participants are attributes of the event type, here THEME and LOCATION. Further event attributes include the GROUND and the specification of the POSTURE. Frame structures are potentially recursive, as values are types themselves that can take further attributes, as in the functional chain [*locative_state* $\wedge$ *posture_state* $\longrightarrow$ GROUND : *sofa* $\longrightarrow$ ONREGION : *spatial region*]. Non-functional relations between types, such as the mereological part-of relation $\boxed{2}\subset\boxed{3}$ that connects the *spatial region* types accessed via the LOCATION and GROUND attributes, respectively, are indicated at the bottom of the AVM. Finally, frames allow for structure sharing, and type nodes can be accessed via more than one attribute or relation. Structure sharing in AVMs is indicated by coindexation via boxed numerals. In Fig. 1, for example, the *spatial region* $\boxed{3}$ is accessed via both the attribute ONREGION of the type *sofa* and its $\subset$-relation with *spatial region* $\boxed{2}$.

The configuration of admissible type-attribute clusters gives rise to a type signature, a taxonomy formally constraining frames. In particular, the type signature restricts the set of admissible frames, orders types hierarchically, and states appropriateness conditions on possible attributes for a type and possible values for a given attribute (see Petersen 2007 for details). Figure 1, for example, instantiates the broader constraints that every *state* has a THEME and that both *locative_state* and *posture_state* are subtypes of *state*. Also, relations can be defined in the type signature as type sensitive, i.e. relations are restricted to elements of particular types. In the *locative_state* depicted in Fig. 1, this constraint is instantiated by $\boxed{2}\subset\boxed{3}$ that relates elements of the type *spatial region* (see also Kallmeyer and Osswald 2013).

Frame semantics as understood here has given rise to a number of different analyses of derivational semantics. The nature of the framework is in essence independent of grander morphological issues, and both morpheme-based as well as word-based models (see e.g. Aronoff 1976, Blevins 2006) can be formalized as frames. For example, Zinova (2016) uses frames in morpheme-based fashion for modeling the polysemy of Russian verbal prefixes as unification processes of prefix, base verb, and argument semantics. In contrast, Plag et al. (2018), Kawaletz (2021), Kawaletz and Plag (2015), and Schulzek (2019) take a word-based stance, as they all make use of referential shifts on the base forms' frame structures for their modeling of derivational phenomena. In similar spirit, Andreou (2017) models negation phenomena as lexical rules that manipulate values of certain attributes provided by the input.

In the next section, we turn to locative *out*-verbs, their properties, and how these can be captured in frame formalizations. This is followed by the discussion and frame formalization of comparative out-verbs in Sect. 4.

3 Locative *out*-verbs

This section analyzes the semantics of locative *out*-verbs. Regarding spatial language, I will follow common assumptions: spatial relations are linguisticallly encoded against the backdrop of the spatial primitives FIGURE, GROUND, PLACE, and PATH (see among many others Talmy 2000, Jackendoff 1983:ch.9, Landau and Jackendoff 1993, Dirven 2010, Zwarts 2008). Figures are understood as entities that move or are located relative to some other entity, the ground. The path is conceived of as the figure's trajectory or followed course relative to the ground, while place refers to the figure's stative location relative to the ground. Similar assumptions are also uncontroversial regarding analyses of derived words with locative semantics, and have found their way into reference works (see e.g., Bauer et al. 2013:ch.16).

The next subsection illustrates general properties of locative *out*-verbs and the semantic patterns the construction occurs in. Section 3.2 models affix-base-interaction, while Sect. 3.3 generalizes over the findings and formulates lexeme formation rules.

3.1 General properties and semantic patterns of locative *out-*

THE DATA BASE

Locative *out-* is an only marginally productive word-formation process, at least with respect to the number of different lexemes it has given rise to, and the analysis here is based on a mere 70 tokens from 57 types. This data set was compiled as follows. First, I searched both COCA and the BNC (see Davies 2004) via the query string in (3) on their respective web interfaces (available under https://www.english-corpora.org/). This string returns all forms that are tagged as verbs and that start with the characters <out> followed by any number of characters (up to the following space or punctuation):

(3) out*_v*

The 2447 word forms that the search in (3) returned were then cleansed manually, and clearly different senses as well as clear corpus corruptions were discarded. This systematic procedure led to a data set of a total of 32 types, which allows for the conclusion that, synchronically, type frequency is indeed relatively low. The remaining 25 types were added as a result of unsystematically searching iWeb and the OED. Additional tokens were only added to the data set if two tokens of the same type showed some diverging semantic properties (see below).[1] All numbers below are based on the complete data set, i.e. on the 70 tokens.

SYNTACTIC AND SEMANTIC PATTERNS

Locative *out*-verbs occur both intransitively, as in (4), and transitively, as in (5).Transitives make up around two thirds of the data (65%), intransitives roughly one third (35%).

(4) A majority of the town's younger populace **out-migrates** after completing high school... (COCA)

(5) Federally endangered **dry forest species to be outplanted** in the Kaupulehu preserve. (COCA)

The attestations in (4) and (5) are representative of a clearly dominant semantic pattern in the data. Roughly 75% of all locative *out*-verbs in my data occur in directed motion structures (see e.g. Goldberg and Jackendoff 2004, Los et al. 2012:ch.5), for which I will use the term TRANSLOCATION in the following (see Kallmeyer and Osswald 2013:299f.). In all of these attestations, a figure-argument undergoes translocation along a path. Semantically, this argument is a THEME (or PATIENT or FORCE RECIPIENT, depending on one's preferred analysis), and is realized syntactically as subject in intransitives, as in (4), and as object in transitives (or subject in passives), as in (5). All transitive cases denote caused translocation, and they constitute the by far most frequent pattern with more than 60% of all locative *out*-verbs.

The locative *out*-forms in my data are not category-changing, i.e. we only find verbal bases.[2] In nearly all cases, the prefix is non-applicative, i.e. the morphological process does not add additional object arguments to the bases' argument structures (see Haspelmath and Sims 2013:ch.11 on morphology and argument structure).[3] This is illustrated in (6-a) and (6-b) with non-prefixed counterparts to the examples (4) and (5), respectively.

(6) a. ...the poor and excluded [...] are increasingly forced **to migrate** in find of work... (COCA)
    b. Some 30,000 students will **plant trees** in Mexico City... (COCA)

[1] I only included examples from the OED when they clearly showed locative semantics and were not flagged as 'obsolete'. In general, many of the types in my data base have low token frequency or are hapaxes in the respective corpora. While such forms may strike listeners or readers as odd, low frequency forms provide a good means of testing the potential of productive word formation processes (see Plag 1999). As suggested by one reviewer, the apparent oddness of some of the locative *out*-examples may be down to dialectal variation and the unselective inclusion of data from corpora that comprise different English varieties (or possibly even non-native material in the case of iWeb). Investigations into possible dialectal variation are beyond the scope of this paper. Wherever possible, examples from iWeb have been checked for how likely they were produced by native speakers.

[2] Possible candidates for nominal bases would be *outshore*, *outramp*, and *outsource*. However, there are verbal counterparts compatible with the respective derivatives' semantics in the OED for such cases, which makes it more likely that they are converted from verbs (see also Bauer et al. 2013:353).

[3] Here and throughout, I am using the term 'applicative' in a rather broad sense for operations that either create fully new argument slots of a verb (and their realizations as direct object), create direct objects out of non-objects, or change the semantic type of the arguments licensed in direct object position.

In a few cases, the prefix does have weakly applicative potential, namely in the form of particle incorporation (see Wunderlich 2012, McIntyre 2007). For example, as in (7-a), *to blast* does not license a direct object, while *out* can license direct objects, both as a prefix, as in (7-b), and as a particle, as in (7-c).

(7) a. ??The repellent will **blast scent**.
b. Mosquito repellent will **outblast scent**. (OED)
c. Jasmine 'Clotted Cream' [...] **blasts out scent**.[4]

Outside of straightforward translocation interpretations, we find a smaller number of slightly diverging, but related readings. First, a few cases denote metaphorical rather than literal motion, such as *outprocess* (8-a), which refers to the administrative act of signing out from an army base. Second, at least the attestation in (8-b) is directional rather than translocational, and it is not entirely clear which element would correspond to a figure argument. Third, the eventive nature of some forms is not entirely clear. For example, (8-c) refers to a geological formation and thus suggests a stative rather than a dynamic interpretation (see Goldberg and Jackendoff 2004:543f. on the possibility of resultative analyses for similar stative example).

(8) a. The MTL told me once **I outprocess** from Keesler I am off of their books [...] (iWeb)
b. Oscar De La Hoya [...] has gone on record this week stating two things that have made many people **outlash** at him (iWeb)
c. The graphite-rich rock is **outcropping** in a north easterly direction for approximately 3.75 kilometres before descending beneath cover (iWeb)

Finally, as in the examples (9), we find a sub-pattern of locative *out*-verbs, in which the locative source-domain SPATIAL REGION is semantically shifted to the target-domain POPULATION. Unlike the example in (8-a), these items do not denote translocation. Rather, they locate the mating-events denoted by the respective base verbs to the exterior of, for example, an ethnic group in (9-a) or a genus of grass in (9-b), and thus give rise to interpretations of mating with non-members of the own group.

(9) a. By the third generation, Hispanics as well as Asians are **out-marrying** by something like 60%. I mean, they marry somebody other than a Latino. (COCA)
b. Included in that list is wheat, which [...] can **outcross** with bearded goat-grass, a problem weed in the western United States. (COCA)

The obvious question from a morphological vantage point concerns the contribution of the prefix to the semantics of the complex forms. Therefore, we will model prefix–base interaction for the main semantic patterns introduced above. As we will see, these patterns largely arise via the combination of a mereological constraint introduced by the prefix, the (path) semantics of the base verb, and partly additional locative arguments introduced via PPs.

[4] https://www.themiddlesizedgarden.co.uk/12-creative-tips-for-a-stunning-urban-garden [Accessed: June 05, 2022].

$$\left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{causation}} \\
\text{CAUSER} & \boxed{1} \\
\text{UNDERGOER} & \boxed{2} \\
\text{GOAL} & \left[\begin{array}{ll}\multicolumn{2}{l}{\textit{spatial_region}} \\ \text{INREGION} & \boxed{3}\end{array}\right] \\
\text{CAUSE} & \left[\begin{array}{ll}\multicolumn{2}{l}{\textit{activity}} \\ \text{AGENT} & \boxed{1}\end{array}\right] \\
\text{EFFECT} & \left[\begin{array}{ll}\multicolumn{2}{l}{\textit{translocation}} \\ \text{THEME} & \boxed{2} \\ \text{PATH} & \left[\begin{array}{ll}\multicolumn{2}{l}{\textit{goal_path}} \\ \text{INIT} & \boxed{4} \\ \text{END} & \boxed{5}\end{array}\right]\end{array}\right] \\
\multicolumn{2}{l}{\boxed{5} \subset \boxed{3} \wedge \boxed{4} \not\subset \boxed{3}}
\end{array}\right]$$

Fig. 2 Generalized event frame for POCKET-verbs. (Abbr.: INIT = INITIAL-POINT; END = ENDPOINT)

3.2 Prefix-base interaction in locative *out*-forms

In this section, I will show that the meaning component shared by all locative *out*-formations is a figure's or an event's NON-CONTAINMENT in some bounded ground. Bounded grounds are understood as multi-dimensional regions that have an interior and an exterior (see Tyler and Evans 2003:ch.7). Let us begin the analysis with the major semantic pattern of locative *out*-, i.e. caused translocation, and introduce minor patterns, including non-caused translocation and population readings, as we go along.

CAUSED TRANSLOCATION

The prefix's contribution to locative *out*-verbs can be illustrated best by comparing an example of base verb semantics with its corresponding derivative semantics. Consider the attestations of *to house* and *to outhouse* in (10).

(10) a. The city funded the four large display cases and agreed **to house the collection at the Convention Center**. (iWeb)
b. They tried taking their son and daughter-in-law with them for the last year, **outhousing them at the hotel** [...] (COCA)

Verbs such as *to house* in (10-a) belong the pocket-verb subtype of putting-verbs (see Rohde 2001:ch.6, Carrier and Randall 1992:177, Dixon 2005:106f. for putting verbs). These are derived via N→V-conversion, and refer to putting an entity at a location that is of the type denoted by the verb's nominal base (see Levin 1993:121f.). They are thus lexical causatives that inherently include an AGENT who causes the GOAL-oriented translocation of a THEME.

Figure 2 provides a generalized frame for pocket-verbs (see Kawaletz 2021 on generalized verb frames). The frame depicts an event of type *causation* with attribute-value descriptions for both roles and sub-events (see Kallmeyer and Osswald 2013, Osswald and van Valin 2014, Plag et al. 2018; see Rappaport Hovav and Levin 1998, van Valin and LaPolla 1997 for the event structure of causative verbs in general).

Fig. 3 Frame for the event description of the *outhouse*-example in (10-b). (Abbr.: INIT = INITIAL-POINT; END = ENDPOINT)

$$\left[\begin{array}{ll}
\textit{causation} & \\
\text{CAUSER} & \boxed{1}\ \texttt{They} \\
\text{UNDERGOER} & \boxed{2}\ \texttt{son and daughter-in-law} \\
\text{GOAL} & \left[\begin{array}{l} \texttt{hotel} \\ \text{INREGION}\ \boxed{3} \end{array}\right] \\
\text{GROUND} & \left[\begin{array}{l} \textit{bounded_spatial_region} \\ \text{OUTREGION}\ \boxed{4} \end{array}\right] \\
\text{CAUSE} & \left[\begin{array}{l} \textit{activity} \\ \text{AGENT}\ \boxed{1} \end{array}\right] \\
\text{EFFECT} & \left[\begin{array}{ll} \textit{translocation} & \\ \text{THEME} & \boxed{2} \\ \text{PATH} & \left[\begin{array}{l} \textit{goal_path} \\ \text{INIT}\ \boxed{5} \\ \text{END}\ \boxed{6} \end{array}\right] \end{array}\right] \\
\boxed{3}\subset\boxed{4} \wedge \boxed{6}\subset\boxed{3} \wedge \boxed{5}\not\subset\boxed{3} &
\end{array}\right]$$

For pocket-verbs, the core participants in macro roles are CAUSER, UNDERGOER, and GOAL. The complex event splits up into two sub-events. The first sub-event is the CAUSE, an underspecified *activity* on behalf of the CAUSER in the more fine-grained role AGENT (CAUSER and AGENT are co-referential and therefore co-indexed as $\boxed{1}$). The CAUSE brings about the second sub-event, the EFFECT, which is of type *translocation* and constitutes the locus of motion. The *translocation*-event's THEME, co-referential with the macro-event's UNDERGOER, undergoes movement along a PATH typed as *goal_path* by default. Finally, the generalized frame in Fig. 2 connects PATH and GOAL: the two mereological constraints at the bottom of the frame state that the path's initial stage (INIT) is located outside the goal, i.e., $\boxed{4}\not\subset\boxed{3}$, while its final stage (END) is located inside the goal, i.e. $\boxed{5}\subset\boxed{3}$.[5]

Now, how does locative *out*- contribute to the semantics of a pocket-verb? The example in (10-b) can roughly be paraphrased as 'They put their son and daughter-in-law into the hotel, outside some other location'. Figure 3 is the instantiated frame for the example (10-b) and the pertinent attribute-type pairs from the generalized frame in Fig. 2 are adjusted accordingly: *They* as CAUSER and the son and his wife as UNDERGOER of the macro-event, the *hotel* as GOAL etc.

While we may infer that the location that the hotel is contrasted with is likely the home of the subject-argument, there is no indication that it serves as the translocation event's source. Rather, *out*- integrates a bounded GROUND into the topological structure of the event denoted by the base *to house*. Capturing the assumption that something cannot be located outside of one-dimensional structures (see Tyler and Evans 2003:ch.7), I assume the type of ground that features in locative *out*-events to

[5] A general caveat to the frames illustrated here and in the following concerns stativity and dynamicity. The majority of *out*-formations discussed in this section in fact denote dynamic events, while the frame representations depict changes as successions of states. Nothing hinges on this distinction for the analyses of the morphological processes discussed hre (see Löbner 2017 for a dynamic frame proposal, though).

be constrained as in the attribute-type chain in (11). Grounds have a demarcated interior and exterior, and are typed *bounded_spatial_region* with attributes INREGION and OUTREGION of type *spatial_region*:

(11) a. *bounded_spatial_region* $\longrightarrow$ INREGION : *spatial_region*
b. *bounded_spatial_region* $\longrightarrow$ OUTREGION : *spatial_region*

For the example in (10-b), the GROUND introduced by the prefix is spatially distinct from the GOAL and not directly attached to the PATH in Fig. 3. (12) provides the prose for the mereological relations stated at the bottom of the frame:

(12) a. path's initial point is outside goal: $\boxed{5} \not\subset \boxed{3}$
b. path's endpoint is inside goal: $\boxed{6} \subset \boxed{3}$
c. goal is outside ground: $\boxed{3} \subset \boxed{4}$

The following examples shows that the linguistic context may well lead to interpretations of *out*- upon which grounds are identical with sources. In (13), world knowledge at least suggests that the books in question were located at the museum prior to outhousing them, while (13-b) introduces a source-goal path via the *into*- and *from*-PPs, respectively.

(13) a. We are assured [...] by the Museum that care has been taken [...] **to outhouse only books** which are thought to be less frequently consulted. (OED)
b. The next morning, we **out-loaded the compostable materials** into the truck from the big window.

In all these cases, *out*- does not introduce a new sub-event, but expresses that the respective endpoints of the path are not contained in some bounded ground. The sole structural difference between them concerns the question of whether this ground functions as source (as in (13)) or not (as in (10-b)).

In summary, the event structures of the causative putting-verbs themselves remains untouched by the morphological process, and (lexicalized) goal components provide a natural attachment site for the prefix's contribution. More generally, it is the base verbs' lexical semantics that contributes motion, i.e. a path, which can be illustrated by a closer look at the very limited range of typical base verbs. Making use of VerbNet's macro-classes (see Kipper et al. 2008), (14) provides examples from the most frequent base classes:

(14) a. PUTTING-VERBS: flood, pour, plant, load, station etc.
b. EMISSION-VERBS: puff, stream, dribble, pop, radiate etc.
c. SENDING AND CARRYING-VERBS: ship, drag, heave, thrust, haul etc.

Typically, bases in the caused translocation pattern are from the classes in (14). These bases inherently include motion components in their semantics and, in their transitive variants, denote causation (cf. Levin and Rappaport Hovav 2019, Dixon 2005:ch.4, Levin 1993).

Fig. 4 Frame representation for the *out-stream*-example in (15). (Abbr.: INIT = INITIAL-POINT; INTER = INTERMEDIATE-STAGE)

$$\left[\begin{array}{l} \textit{translocation} \wedge \textit{substance\_emission} \\ \textsc{emittee}\ \boxed{1}\ \texttt{gas} \\ \textsc{ground}\ \boxed{5} \\ \textsc{manner}\ \textit{stream} \\ \textsc{source}\ \boxed{5} \left[\begin{array}{l} \texttt{the young stars} \\ \textsc{inregion}\ \boxed{2} \end{array}\right] \\ \textsc{path} \left[\begin{array}{l} \textit{source\_path} \\ \textsc{init}\ \boxed{3} \\ \textsc{inter}\ \boxed{4} \end{array}\right] \\ \boxed{3} \subset \boxed{2} \wedge \boxed{4} \not\subset \boxed{2} \end{array}\right]$$

NON-CAUSATIVE TRANSLOCATION

For illustration of an intransitive item of a locative *out*-derivative with translocation semantics, consider the example *out-streaming* in (15). This form is based on a substance-emission verb,[6] and in the attestation, gas is emitted from within a source (the stars) to their outside.

(15) In turn, **gas out-streaming** from the young stars in the clusters can feed and energise the black hole. (iWeb)

I follow non-causative analyses for intransitive motion constructions (see e.g. McIntyre 2004, Rappaport Hovav and Levin 2001). This reasoning is based on the assumption that such events are not complex, and that their presumable sub-events are indistinguishable. For example, in (15) the gas's traversal of a path and its streaming are spatially indistinct and occur at the same time, and thus constitute the same event. In the frame in Fig. 4, this is captured by the complex event type *translocation* ∧ *substance_emission* and the lack of a cause-effect structure. The specific type of emission is captured via a MANNER-attribute typed *stream*.

The event has two participants, the EMITTEE *gas* and the SOURCE *the young stars*. Accordingly, the PATH is typed *source_path*. Most generally, the integration of *out-* into the structure works in identical fashion to the causative frame in Fig. 3: the contribution of the prefix is again modeled as non-containment. For the case at hand, however, the SOURCE and the introduced GROUND are identical, and therefore co-indexed as $\boxed{5}$, and it is the path's intermediate stage (INTER; on the assumption that this is not necessarily its endpoint, see Zwarts 2008) that is set apart from the source via the relation $\boxed{4}\not\subset\boxed{2}$.

Regarding the attestation in (15), we have just argued for the unification of the ground (introduced by the morphological process) with the source (provided via the *from*-PP). However, a more general feature of intransitives can be illustrated by the *out-migrate*-example in (16). Unlike for some transitive items (see e.g. (10-b)), sources are either explicitly given or can be at least be inferred for all intransitive examples in the data. In (16), for instance, the source is not realized as a PP, but can readily be inferred contextually as Ethiopia.

[6]Like other emission verbs (see *to blast* above), the example in (15) shows particle or preposition incorporation, cf. ??*Gas is streaming from the stars*.

Fig. 5 Frame representation for the *outbreed*-example in (17). (Abbr.: INIT = INITIAL-POINT; INTER = INTERMEDIATE-STAGE)

$$\begin{bmatrix} \textit{breeding\_activity} \\ \text{ACTOR } \boxed{1} \begin{bmatrix} \texttt{naked mole rats} \\ \text{COLONY } \boxed{2} \end{bmatrix} \\ \text{CO-ACTOR } \boxed{3} \begin{bmatrix} \texttt{naked mole rats} \\ \text{COLONY } \boxed{4} \end{bmatrix} \\ \text{GROUND } \boxed{2} \\ \text{EVENT\_LOCATION } \boxed{4} \\ \boxed{4} \not\subset \boxed{2} \end{bmatrix}$$

(16) Many brave Ethiopian Moslems [...] **were forced to out-migrate** to safe heavens [sic] such as Eritrea and Sudan. (iWeb)

POPULATION INTERPRETATIONS

Finally, let us look at the one pattern that is not (trans)locational in nature. The item in (17) is another example of the semantic shift 'population-as-spatial region' (see also the examples in (9) above). Here, *outbreed* refers to breeding with specimens from a different rat colony. This shows that in *out*-verbs of this type, the spatial meaning introduced by the prefix is responsible for the shift, that it is populations (or similar groups such as a genus) that are reconceptualized as grounds, and that the events denoted by the base are not semantically shifted as such. This pattern does not include any path-semantics, and the contribution of locative *out*- to the semantics of the base verb is best described as locating the entire event to the outside of the ground.

(17) Naked mole rats breed readily enough with close kin. Although their preference is to **outbreed**, Faulkes says [...] (COCA)

The formalization for (17) is provided by the frame in Fig. 5. The frame describes a breeding activity with naked mole rats as (co-)actors. Crucially, these rats are from distinct colonies, tagged $\boxed{2}$ and $\boxed{4}$, respectively. The frame captures the non-containment relation introduced by *out*- as follows: the metaphorical location of the breeding activity is identical with the co-actor's colony, and thus co-indexed $\boxed{4}$. In turn, the introduced ground is analyzed as identical with the actor's colony (co-indexed $\boxed{2}$), while the relation $\boxed{4}\not\subset\boxed{2}$ determines that the ground and the event location (and thus the two colonies) are spatially distinct.

Let us wrap up the main points of the preceding analyses:

- Locative *out*- introduces a mereological non-containment relation between (metaphorical) spatial regions (or places).
- Typically, it is base verbs that introduce the motion component of translocation semantics, and one of the spatial regions includes the path's end- or intermediate point, which is set apart from a contextually specified ground.
- The specific nature of the path, as for example goal- or source-goal-path, is contextually determined (but all intransitive items have sources)
- Whenever sources or goals are realized, they form part of the introduced non-containment relation.

Fig. 6 Lexeme formation rule with abstraction over locative *out*-'s semantics

$$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{lexeme}} \\ \text{PHON} & \textit{óut-}\boxed{\text{x}} \vee \textit{out-}\boxed{\acute{\text{x}}} \\ \text{CAT} & \text{V} \\ \text{SEM } \boxed{0}! & \left[\begin{array}{l} \textit{eventuality} \\ \text{GROUND } \boxed{1}\ \textit{bounded\_spatial\_region} \\ \text{LOCATION } \boxed{2} \\ \boxed{2} \not\subset \boxed{1} \end{array}\right] \\ \text{M-BASE} & \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{lexeme}} \\ \text{PHON} & \boxed{\text{x}} \\ \text{CAT} & \text{V} \\ \text{SEM } \boxed{0} & \left[\begin{array}{l} \textit{eventuality} \\ \text{PARTICIPANT} \end{array}\right] \end{array}\right] \end{array}\right]$$

The following section provides a generalization over these findings by providing lexeme formation rules.

3.3 Generalization: lexeme formation rules for locative *out*-

Let us begin the generalization over locative *out*-'s properties by designing a preliminary lexeme formation rule. Lexeme formation rules (lfr), as made use of by authors in constraint-based formalisms such as HPSG (see Riehemann 1998, Koenig 1999, Müller 2002, Bonami and Crysmann 2016) and Sign-based Construction Grammar (SBCG) (see Sag 2012), are underspecified lexical entries that establish relations between some input, e.g. morphological base(s), and some output, e.g. a complex lexeme. They are derived via generalizations over attested examples and, by extension, over the lexicon. A note of caution is in place regarding the compatibility of the analyses presented here and by proponents of SBCG, respectively. SBCG (see e.g. Sag 2012, Michaelis 2004, 2015) makes use of an HPSG-style grammar architecture, while it represents the semantics component as an underspecified, non-decompositional reference to semantic categories from FrameNet (see e.g. Fillmore and Baker 2009). In contrast, the following semantic analyses will make use of Barsalou frames (see Sect. 2) instead of Fillmore frames. I will use Barsalou frames, and their representation as typed feature structures, for both the semantics proper and for the grammatical architecture as such.

The rule in Fig. 6 builds on the frame-based formalizations by Plag et al. (2018), Kawaletz (2021), and Andreou (2017), and makes use of typed-feature structures for the description of both a lexeme's semantic and its non-semantic properties. This rule is applicable to all locative *out*-lexemes in the data. Being morphologically complex, these lexemes come with an attribute for their morphological base (M-BASE), whose value is another lexeme. The derivative's phonology attribute (PHON) is typed *óut*-$\boxed{\text{x}}$ $\vee$ *out*-$\boxed{\acute{\text{x}}}$, i.e. the complex form adds the prefix *out*- to the base's phonology, while primary stress is variable and can fall on either the prefix or on the same syllable of the base that it falls on if the base is not prefixed with *out*-.[7] Base and derivative are both typed V for their syntactic category (CAT), i.e. the rule derives verbs from verbal bases. With respect to the base's semantics (SEM $\boxed{0}$), the rule states that these lexemes denote eventualities.

For the discussion at hand, the essential claim of the frame in Fig. 6 is that the copy-and-override-mechanism $\boxed{0}$! captures *out*-'s meaning contribution. The $\boxed{0}$!-tag indicates that the derivative semantics inherits the entire base semantics and adds the elements specified in the !-structure, which override elements from the base if the respective types are incompatible (see Sag 2012:119f., Andreou 2017:12f.).

As shown above, locative *out*- is a non-applicative process with derivatives inheriting most features of their respective bases. Most importantly, the rule in Fig. 6 does not add any sub-events to the base, and base and derivative semantics (i.e. $\boxed{0}$ and $\boxed{0}$!) do not differ in semantic type. In turn, the introduced structure can unify with elements of appropriate types provided by the base or contextual information. Reconsider the different *outhouse*-tokens discussed above: for both examples, the goal provided by the base verb's lexical semantics unifies with a LOCATION $\boxed{2}$ in Fig. 6, while the GROUND $\boxed{1}$ either remains unspecified (as in example (10-b)) or is identified with the path structure's source that is inferred from context (see example (13-a)).

The reader may have noticed that information on the semantics of the base verb is kept to a minimum in Fig. 6, merely stating that bases denote eventualities with at least one participant. For morphological processes in general, the question of how narrowly defined the base semantics should be is a rather vexed one. This holds, in particular, for an underspecified rule of a fairly unproductive word-formation process, which nevertheless gives rise to several semantic sub-patterns with fairly different types of bases. In fact, stipulations on selectional restrictions are not always straightforward, even for single sub-patterns of locative *out*-.

On the one hand, the bases in the caused translocation pattern are highly predictably causative verbs with a motion component (see the examples in (14)), with very few metaphorical cases. In contrast, the paucity and the diversity of intransitive items do not easily allow for formulating base restrictions. Consider the case of non-causative translocation. First, with *out-struggle* in (18), we do find at least one base verb in the described pattern that does not inherently involve motion.

(18) He dragged on the tree root and **out-struggled** from the river [...] (COCA)

Second, restricting the possible input to bases that do introduce path semantics appears to also over-generate. Notably, for example, we do not find locative *out*- on pure manner of motion verbs, such as *run* or *fly*, or on inherently directional motion verbs such as *exit* or *descend*.

[7] The OED provides phonological information for 30 out of the 57 locative *out*-verbs in my data and their primary stress distribution is as follows: 17 verbs (i.e. about 57%) bear primary stress on the base, e.g. *outflóod* and *outpóur*. 12 verbs (i.e. about 40%) are stressed on the prefix, e.g. *óuthouse* and *óutplant*. One item (*outmigrate*) is attested with both stress patterns. Out of the seven clearly locative *out*-verbs in the *Longman Pronunciation Dictionary* (cf. Wells 2007), five are listed with primary stress on the prefix (*óutcrop*, *óutput*, *óutreach*, *óutsource*, *óutstation*) and only two with primary stress on the base (*outpóur*, *outspréad*).

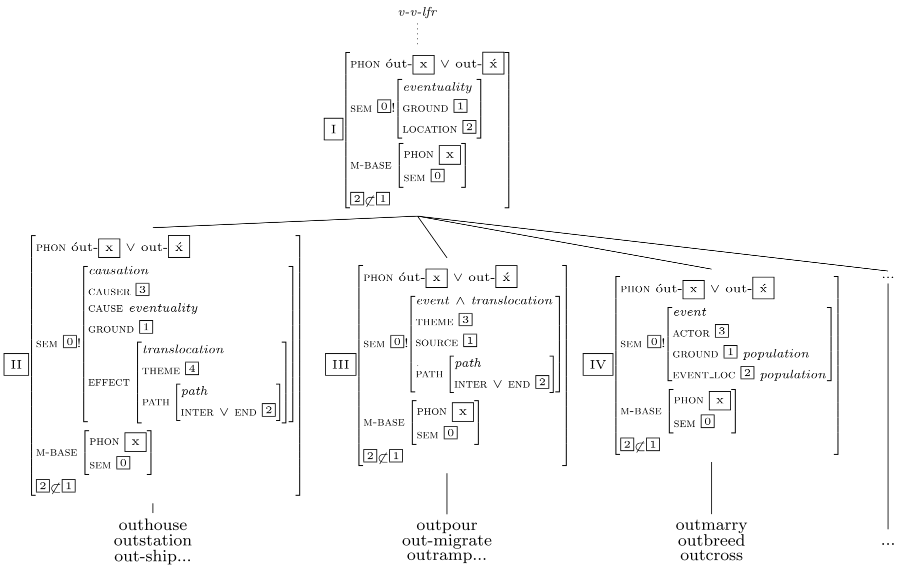

Fig. 7 Partial inheritance hierarchy for locative *out-*

In the following, I will suggest to not state semantic properties of the base in any rule at all, but to specify sub-constructions of the semantic pattern laid out in Fig. 6 and provide attestations of derivatives that instantiate these sub-constructions. Building on previous accounts of how sub-constructions are organized in the lexicon (see e.g. Riehemann 1998, Koenig 1999, Booij 2010, Bonami and Crysmann 2016, Kawaletz 2021, Plag et al. 2018), the inheritance hierarchy in Fig. 7 models locative *out-* as a process that derives verbs from verbs ('v-v-lfr'), and provides the common denominator of all sub-constructions as an abbreviation of the highly abstract rule in Fig. 6. This more general rule (tagged as construction $\boxed{\text{I}}$ for readability) then branches out into subpatterns, which both inherit parts of the structure provided by the supertype as well as specify other parts of that structure. In turn, the semantic subpatterns are linked to instantiations of *out*-derivatives provided at the bottom of the hierarchy.

For space reasons, Fig. 7 only includes three semantic patterns, while the three dots to the right-hand indicate that further sub-patterns may exist (as well as individual attestations not captured by the patterns modeled here). The patterns depicted here are the ones for which we have seen frame formalizations in Sect. 3.2: caused translocation (rule $\boxed{\text{II}}$ with *causation* semantics to the left), non-causative translocation (rule $\boxed{\text{III}}$ with *event* ∧ *translocation* semantics), and the population reading (rule $\boxed{\text{IV}}$ with *event* semantics to the right). All of these sub-patterns are instantiations of their supertype, inherit their supertype's phonology, and are compatible with their supertype's semantics typed *eventuality*. Most importantly, all subtypes inherit the supertype's mereological constraint ($\boxed{2}\not\subset\boxed{1}$), but specify this constraint in pattern-specific ways. Finally, at the bottom we find (partial) lists of complex *out*-verbs that instantiate the respective sub-pattens: for example, *outhouse* and *out-ship* for caused translocation, *outpour* and *out-migrate* for non-causative translocation, and *outmarry* and *outbreed* for the population pattern.

In summary, this section has modeled the word-formation process that gives rise to locative *out*-verbs as a hierarchy that connects a highly abstract lexeme formation rule to more specific lexeme formation rules, and connects these more specific rules to attested *out*-forms. All derivatives inherit the bulk of the semantic structure of their respective bases, and it is an underspecified mereological constraint that forms the semantic core that all derivatives share. Let us now turn to comparative *out*-verbs in the next section.

4 Comparative *out*-verbs

This section analyzes the semantics of comparative *out*-verbs. As will become obvious shortly, the name chosen for the construction in this study is a partial misnomer, and I will argue that comparison and scalarity only constitute one, albeit central facet of meaning at play. I will follow standard treatments and understand property scales as triples of information: i) a DIMENSION of measurement such as SPEED, TEMPERATURE, HEIGHT etc., ii) a set of DEGREES along said DIMENSION, and iii) an ORDERING RELATION among those DEGREES (see, among many others, Kennedy and McNally 2005, Kennedy 2007, Solt 2015).

Section 4.1 introduces pertinent data and general properties of the construction and largely draws on the in-depth descriptive analysis in Kotowski (2021). In Sect. 4.2, individual attestations of *out*-tokens are decomposed in frames, while Sect. 4.3 develops a lexeme formation rule.

4.1 Data and properties of comparative *out*-

THE DATA BASE

Compared to the data base for locative *out*-forms (see Sect. 3.1), the data base for comparative *out*-verbs has been compiled in less systematic fashion. It includes 543 types and more than 1,500 tokens, the majority of which are from iWeb and COCA, with fewer examples added from the BNC and Google searches. The primary reason for a relatively unsystematic compilation lies in the fact that comparative *out*- is a very productive process (see Schröder 2011) and that many further types could easily be found. At least in part, the database has a deliberate bias towards forms that are predicted to be ungrammatical in the literature, and thus answers back to theoretical predictions, both on the construction's general semantics and its selectional restrictions (see Lieber 2016:ch.2.2 for a similar approach to other morphological phenomena).

More specifically, virtually all claims on selectional restrictions argued for in the literature are wrong (see Ahn 2022 and, in particular, Kotowski 2021 for overviews). I will come back to this point in Sect. 4.3, but will briefly mention that comparative *out*- is regularly category-changing and allows for adjectival (e.g. *out-absurd*), nominal (e.g. *out-decibel*), and occasionally phrasal bases (e.g. *out-thank-you*; all examples from COCA).[8] Similarly, putative restrictions on the lexical aspect of base

[8]Given the ubiquity of conversion in English, one may want to know whether these bases are possibly also attested as verbs. My database lists 345 nominal, adjectival, or phrasal bases. Less than half of them are

verbs also prove far too restrictive. Although activity verbs and semelfactives feature most frequently as base (e.g., *outplay*, *outrun*, *outblink*, *outsneeze*), we find attestations with base verbs from all major aspectual classes. Examples include stative bases (e.g. *out-know*), achievements (e.g. *outspot*), causative result verbs (e.g. *out-terrorize*; all from COCA) as well as degree achievements (e.g. *out-dry*; iWeb).

BASIC SYNTACTIC AND SEMANTIC PATTERNS
Irrespective of the base, however, comparative *out*-verbs come with their own, rigid argument structure. Passive constructions aside, these verbs invariably occur in syntactic frames of the kind [NP$_{sub}$ *out*-V NP$_{obj}$]. If the morphological base is primarily intransitive, as *to run* in (19-a), an object-argument has to be added as in (19-b). Intransitive *out*-formations are odd across the board, e.g. (19-c).

(19) a. Camels can run.
b. Most camels can **outrun most horses**, but the fastest racehorse would probably outrun the fastest camel[...] (iWeb)
c. ??Most camels can **outrun**.

As shown in (20-a,b), the construction allows for object-arguments that are otherwise not licensed by transitive base verbs (i.e. *to drink* selects for drinkables as object). Objects compatible with base verbs are typically unacceptable when the verbs are prefixed with *out*-, as in (20-c).

(20) a. ??We try to drink our friends.
b. We try to **outdrink our friends** and end up as alcoholics. (COCA)
c. ??We try to **outdrink the beer**.

Comparative *out*- is thus syntactically rigid and robustly creates its own argument structure. The nature of this argument structure, however, is contested.

There is agreement in the literature that the construction includes some form of conflation structure of a macro-event and one or more sub-event(s) (see, e.g., Talmy 2000 on conflation). However, authors disagree on whether the construction is primarily scalar-comparative or primarily causative-resultative. In consequence, there is disagreement on how to analyze the role of the object-argument. For example, in (19-b) we are dealing with a macro-event that is, depending on the analysis, either SCALAR-COMPARATIVE ('we drink more/faster/more frequently than our friends') or CAUSATIVE ('our friends are defeated/beaten in a drinking contest'). The distinction is a fundamental one, and any attempt at formalizing the construction calls for explicitness in this regard.

Building on Kotowski (2021), the remainder of this section will defend the argument that the construction denotes COMPETITION. Neither a purely comparative approach (e.g., Ahn 2022, Tolskaya 2014, Williams 1992) nor a purely resultative approach (cf. McIntyre 2003) make correct predictions. Rather, the interpretations comparative *out*- allows for are located on a gradient along an axis of mere surpassment of the object-argument to predominantly causative-resultative semantics, with

also attested as verbs in the OED or occur tagged as verbs in COCA, and many of those that are indeed listed in the OED have clearly different interpretations than in the respective *out*-forms. It thus seems safe to assume that *out*- is in fact category-changing.

the better part of examples being compatible with both. Accordingly, a more suitable paraphrase for the natural interpretation of typical examples such as (19-b) is, roughly, 'in running-competitions, camels usually defeat horses by running faster/farther etc. than horses run'. Put more technically, I will defend an analysis upon which events denoted by comparative *out*-verbs are causative, have a comparative core, and come with three subevents.

First, a purely causative-resultative account, such as the one in (21) proposed by McIntyre (2003), does not predict that object-arguments are participants of subevents other than a result state.

(21) a. Fred outdrank Stan. [=ex.8b in McIntyre (2003)]
b. DO(FRED,DRINK) $\&_{\text{CAUSE}}$ OUTDONE(STAN)

However, in all *out*-attestations in my data both subject- and object-arguments participate in distinct sub-events. The example in (22-a), for example, gives rise to the clear inference of two distinct dancing-events that take the subject- and object-arguments as their respective participants. The same holds for a different *outdance*-token in (22-b).

(22) a. I'm not saying she did everything else perfectly, but in those few minutes, **she outdanced the rest of us**. (iWeb)
b. ...when **brides out-dance their last wedding guest**... (iWeb)

Second, analyses such as (21-b) suggest no comparative component to the construction's semantics. However, all examples in my data include comparison in the form of the subject-argument surpassing some threshold on a measure dimension of a scalar event property (see Solt 2015 for an overview on scalarity). As shown quantitatively by Kotowski and Schäfer (2023), classes of base verbs predict measure dimensions to substantial degrees. For example, Kotowski and Schäfer show in an iWeb study that 67% of lemma-dimension combinations of *out*-forms based on verbs from VerbNet's EXIST class refer to the DURATION dimension, while 51% of verbs based on RUN lemmas refer to the SPEED dimension. At the same time, the majority of *out*-'s bases do not come with lexicalized scales, and scalar dimensions remain underspecified and in need of contextual disambiguation. For example, the contexts in (22-a,b) show that *outdance* is at least attested with the dimensions QUALITY (inferrable on the basis of *perfectly*) and DURATION (inferrable on the basis of *last wedding guests*).

Third, the semantically thorniest issue concerns the question of whether *out*-formations are in fact causative and, in consequence, whether they include a result state. Typically, accomplishment structure is taken as a hallmark of resultative constructions. However, *out*-verbs do not allow for easy aspectual or event structural classification. Consider, for example, telicity tests, where (in)compatibility with temporal *in*- and *for*-adverbials is claimed to allow for testing for the distinction between processes and accomplishments (cf. Dowty 1979). However, we find attestations for an *out*-derivative such as *outclass* with both of these adverbials. The *in*-adverbial in (23-a) leads to an interpretation that a tennis match is lost, while the *for*-adverbial in (23-b) indicates that Boetsch had merely been dominated for ten minutes:

(23) a. The first all-Australian women's pairing to make the title match in Paris in 46 years, Dellacqua and Barty were **outclassed in 66 minutes**. (iWeb)
b. After being thoroughly **outclassed for ten straight minutes** by an opponent no one expected him to defeat, a battered and bruised Tim Boetsch trudged back to his corner [...] (iWeb)

There is further evidence that *out*-verbs are event structurally peculiar. Even on the assumption that they are causative-resultative, their event structure does not necessarily consist of an activity as causing subevent and a change-of-state subevent. As shown by *outspot* in (24), the causing subevent can also include an achievement as situation type (or other types, see above). Note that, while the typically obligatory object argument of the base (cf. *to spot something*) is surpressed, it is still entailed (and even explicitly mentioned in the following subclause).

(24) Not only was I able to quickly and easily undo the backlash in my friend's line, but I was also able to **outspot him** when it came to seeing fish at a distance.[9]

While the aspectual class of comparative *out*-verbs thus cannot easily be determined, the existence of a result state is denied in purely comparative approaches. For example, Tolskaya (2014) claims that (25-a) shows the lack of a result reading for *outdance*, as we presumably cannot deny the result without denying the process. Similarly, she claims that the test in (25-b) provides evidence for a lack of change in the object-argument.

(25) a. The girl did not outdance the giant, *though she danced the giant. [=ex.21c in Tolskaya (2014)]
b. The girl outdanced the giant, but nothing is different about him. [=ex.29a in Tolskaya (2014)]

However, the test in (25-a) is not a good one for determining event structure. If anything, it shows that *to dance* does not license object-arguments of the type *giant*, rather than that *out*-forms lack result states.[10] The problem in (25-b) is more intricate. Typically, resultativity is understood in terms of concrete, physical changes-of-state (or location) of an argument (cf. Rappaport Hovav and Levin 2001, Goldberg and Jackendoff 2004, Jackendoff 1997). In fact, in some attestations, such as (26), the respective argument does undergo physical change.

(26) [...] if you do **outsweat the jacket**, it has large pit zips to dump heat. (iWeb)

The example in (26) is plausibly interpreted as 'leaving the jacket overfull by sweating more than it is capable of absorbing/dispersing', i.e. the jacket is clearly acted

[9] Wright, Peter (Dec 1996). See-keeping. *Motor Boating & Sailing*, Vol. 178, No. 6, p.31. Retrieved from https://books.google.com.

[10] In fact, a more appropriate, although somewhat clumsy, reformulation of what Tolskaya claims to test does not fare too badly: *The girl did not outdance the giant, though she competed at dancing against the giant*.

upon and enters a result state of being OVERFULL. This is backed up by the *What-X-did-to-Y-* and *What-happened-to-X*-environments in (27) that test for resultativity and object-affectedness (cf. Jackendoff 1997, Rappaport Hovav and Levin 2001, Beavers 2011).

(27) a. What you did to the jacket was outsweat it.
b. What happened to the jacket was you outsweated it.

Importantly, the majority of *out*-attestations are compatible with such tests for object-affectedness. As shown in (28), this also holds for examples that do not suggest physical changes-of-state, such as the *outdance*-example in (22-a) above. Although typical *out*-examples thus do not encode physical changes-of-state, they do suggest notions of 'being defeated'.

(28) a. What she did to the rest of us was outdance us.
b. What happened to the rest of us was she outdanced us.

Finally, a further, albeit circumstantial piece of evidence speaks against comparison as the sole semantic ingredient of comparative *out*-. As shown by Kotowski and Schäfer (2023) in an investigation of nearly 1,000 tokens from 12 *out*-derivatives, the majority of attestations do in fact not explicitly spell out the scalar dimensions necessary for any comparison. Although many of these attestation allow for inferences based on the dimensions typically associated with the respective base verbs, this state of affairs would appear unexpected if the construction was merely comparative in nature.

In summary, comparative *out*- is best described as a hybrid construction that denotes COMPETITION and introduces its own rigid argument structure. Neither purely scalar-comparative nor purely resultative approaches make correct predictions, and verbs of this kind do not allow for easy aspectual classification as accomplishments or processes. Typically, we will arrive at full-fledged interpretations only via interaction with contextual information on possible scalar dimensions and the nature of the sub-events (see e.g. Lieber 2016 and Andreou 2017 for the necessity in any theory of derivational semantics to allow for contextual interaction with word-formation processes). The following section proposes frame formalizations for several attestations including such contextual information.

4.2 Modeling comparative *out*-

The strategy in this section will be as follows: I will present frame formalizations for selected attestations that allow us to capture both the invariable structure of comparative *out*- across examples as well as to reveal meaning components that show variability. Building on the discussion in the previous section, I will propose what we may call the constructional scaffold of the prefix, which includes:

- A complex event structure, i.e. a causative macro-event with two participants provided by the subject- and object-arguments.
- Three sub-events: first, a CAUSE sub-event with the subject-argument as participant; second, a correlated sub-event with the object-argument as participant; third,

Fig. 8 Frame representation for the *outswim*-example in (29) (Abbr.: DEG = DEGREE; MEASURE-DIM = MEASURE DIMENSION; *prop-scale* = *property scale*)

$$\begin{bmatrix} \textit{causation} & \\ \text{CAUSER} & \boxed{1}\ \texttt{dolphins} \\ \text{UNDERGOER} & \boxed{2}\ \texttt{predators} \\ \text{CAUSE} & \begin{bmatrix} \textit{swimming-activity} & \\ \text{AGENT} & \boxed{1} \\ \text{MEASURE-DIM} & \begin{bmatrix} \textit{prop-scale} \wedge \textit{speed} & \\ \text{DEG}\ \boxed{3} & \begin{bmatrix} \alpha \\ \copyright_{s,Rel}\ (\boxed{3},\boxed{4}) > \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{CORRELATE} & \begin{bmatrix} \textit{swimming-activity} & \\ \text{AGENT} & \boxed{2} \\ \text{MEASURE-DIM} & \begin{bmatrix} \textit{prop-scale} \wedge \textit{speed} \\ \text{DEG}\ \boxed{4}\ \beta \end{bmatrix} \end{bmatrix} \\ \text{EFFECT} & \begin{bmatrix} \textit{change-of-state} & \\ \text{RESULT-STATE} & \begin{bmatrix} \textit{defeated} \\ \text{UNDERGOER}\ \boxed{2} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

a contextually determined sub-event that includes the object-argument as participant of a RESULT STATE.

- A scalar-comparative component that is central to bringing about the RESULT STATE, and therefore has to form part of the CAUSE sub-event.

At the same time, the formalization of this invariable scaffold has to allow for variable elements that can be contextually specified (or remain underspecified). As we will see, these include the prominence of comparison, scale types and dimensions, the type of result state, and the similarity between the cause and the correlated sub-events.

Let us begin the discussion with what we may call a typical *out*-attestation in (29). Abstracting away from modality and negation, the relevant part can be paraphrased as 'in a chase, dolphins defeat predators by swimming faster'. The example suggests that both arguments engage in the same kind of activity, i.e. swimming, and via the underlined contextual clue, it specifies SPEED as the scalar dimension.

(29) [...] <u>at the fastest swimming speeds</u> they observed, **pregnant dolphins** would not have been able to **out-swim most predators**. (iWeb)

The frame in Fig. 8 represents the semantics of (29) as a causative macro-event with two participants, CAUSER and UNDERGOER, and three subevents CAUSE, CORRELATE, and EFFECT (see Sect. 3.2 for causation frames in general). The CAUSE sub-event inherits its type *swimming-activity* from the morphological base and takes the subject-argument *dolphins* as AGENT $\boxed{1}$ (co-referential with the macro-event's CAUSER). The object-argument *predators* is coerced into the AGENT (co-referential with the macro-event's UNDERGOER) of a CORRELATE-sub-event, which is inferred to also be of type *swimming-activity*. The EFFECT describes the outcome of the causation event, i.e. the object-argument losing out, as the UNDERGOER's attained RESULT STATE (typed *defeated*).

With respect to the comparative meaning component, the frame needs to capture two observations (see Sect. 4.1): first, we need to compare two distinct event properties and, second, the frame needs to reflect considerations of scope, as the comparative component has to be part of what brings about the EFFECT sub-event. The frame in Fig. 8 captures these properties in the following way: First, both the CAUSE and CORRELATE events are measured out via measure dimension attributes (MEASURE-DIM). These attributes return as values complex types that consist of the conjunct of a scale type and a dimension type (see Zinova 2016 for a similar frame formalization of property scales). Here, these complex types consist of the property *speed* mapped to its associated property scale (*prop-scale*) for both the CAUSE- and CORRELATE sub-events. These complex types take degree-attributes (DEG) that return the respective degree values α and β on the speed scale.

In order to compare α and β, we build on Löbner's (2017) use of COMPARATORS, introduced as the attribute '©s,Rel($\boxed{3}$,$\boxed{4}$)' of value α. Comparators are two-place (or more-place) attributes that compare the values of multiple attributes and output a comparison value. In the notation used here, '©' stands for 'comparator', 'Rel' for 'relation', and 's' for 'sort': thus, a comparator establishes a relation between appropriate elements of the same sort, where sorts are exclusive partitions of the universe such as colors, materials, heights, temperatures etc. In the example at hand, the appropriate elements are degree values that allow for comparisons along the lines of the very scale they map to, i.e. the SPEED-scale (see Löbner 2017 for details and a general motivation of more-place comparators as attribute types in frames). The values the comparators take as input are co-indexed and ensure that we compare α and β. Reflecting the key ingredient of surpassment in *out*-prefixation, the comparison value in the comparative *out*-construction is always '$>$', and indicates a higher value on a scale of ordered degrees.

More specifically, the locus of the comparator inside the CAUSE sub-event reflects scope. As argued above, it is the CAUSE's surpassment of a threshold that brings about the EFFECT, while typical *out*-attestations such as example (29) compare event properties provided by the CAUSE and CORRELATE, respectively. The comparator in the frame in Fig. 8 captures the necessary scopal relation by specifying the values to be compared, i.e. $\boxed{3}$ and $\boxed{4}$, respectively, and by specifying that value $\boxed{3}$ is part of the CAUSE sub-event, while the frame as a whole retains the conventional scope of cause-effect structures.

Let us now look at another example that provides evidence for semantic elements that allow for vagueness. In particular, neither the scalar dimensions that underlie comparison nor the sameness of the CAUSE and CORRELATE sub-events are fixed on the lexical level. In (30), we find another *outswim*-attestation that suggests a chase. In contrast to (29), however, the context clearly shows that the object-argument (a hippo) is engaged in a running-activity rather than in a swimming-activity. Moreover, the underlined part allows for the inference that the two sub-events are compared on the basis of their respective duration rather than speed.

Fig. 9 Frame representation for the *outswim*-example in (30). (Abbr.: DEG = DEGREE; MEASURE-DIM = MEASURE DIMENSION; *prop-scale* = *property scale*; RES-STATE = RESULT STATE)

$$\left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{causation}} \\
\multicolumn{2}{l}{\text{CAUSER } \boxed{1}\ \texttt{you}} \\
\multicolumn{2}{l}{\text{UNDERGOER } \boxed{2}\ \texttt{hippo}} \\
\text{CAUSE} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{swimming-activity}} \\
\multicolumn{2}{l}{\text{AGENT } \boxed{1}} \\
\text{MEASURE-DIM} & \left[\begin{array}{l}
\textit{prop-scale} \wedge \textit{duration} \\
\text{DEG } \boxed{3} \left[\begin{array}{l} \alpha \\ \copyright_{s,Rel}\ (\boxed{3},\boxed{4}) > \end{array}\right]
\end{array}\right]
\end{array}\right] \\
\text{CORRELATE} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{running-activity}} \\
\multicolumn{2}{l}{\text{AGENT } \boxed{2}} \\
\text{MEASURE-DIM} & \left[\begin{array}{l}
\textit{prop-scale} \wedge \textit{duration} \\
\text{DEG } \boxed{4}\ \beta
\end{array}\right]
\end{array}\right] \\
\text{EFFECT} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{change-of-state}} \\
\text{RES-STATE} & \left[\begin{array}{l}
\textit{defeated} \\
\text{UNDERGOER } \boxed{2}
\end{array}\right]
\end{array}\right]
\end{array}\right]$$

(30) Hippos cannot swim [...] they will basically run underwater [...] They also don't tire easy, so **you** <u>better have good cardio</u> to **outswim one**. (iWeb)

Now, the question arises as to how frame representations allow for such variability of the comparative component? Fig. 9 represents the frame for (30) as structurally equivalent to the one in Fig. 8, i.e. we find the same kind of causative macro-event with the same number and types of sub-events. The relevant differences between (29) and (30) are represented as type differences. First, in Fig. 9, the CAUSE and CORRELATE sub-events are typed differently as *swimming-activity* and *running-activity*, respectively. Second, the basis of comparison is not the dimension SPEED, but DURATION, as reflected in the respective types of the MEASURE-DIM-attributes of both sub-events. The formalizations of the respective comparative component in both Figs. 8 and 9 capture the possibility of comparing swimming activities to other activities along different dimensions via the attachment site of the comparator attributes. Formally, this is achieved by not comparing events as such (e.g. CAUSE and CORRELATE), but by attaching the comparator attribute to deeply embedded types, namely to the degree value of a property scale inside the sub-events.

This raises more general questions of what can be compared via comparative constructions and, concerning *out*-prefixation, which kinds of events allow for comparison along which kinds of dimension (see e.g. Doetjes 2010, Kennedy 1997 for discussions of incommensurability in adjectival comparisons; see Kotowski and Schäfer 2023 for base-driven preferences of dimensions in *out*-prefixation). In my *out*-data base, there are no comparisons across different dimensions. More technically, this suggests that dimension types, such as *speed*, *duration*, or *temperature*, constitute different sorts, and are incompatible with each other. If this generalization is correct, comparators as made use of in Figs. 8 and 9 above will only apply to equally typed MEASURE-DIM-attributes.

$$\left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{causation}}\\
\text{CAUSER} & \boxed{1}\ \texttt{Lil Kemp}\\
\text{UNDERGOER} & \boxed{2}\ \texttt{old boy}\\
\text{CAUSE} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{possession_state}}\\
\text{POSSESSOR} & \boxed{1}\ \textit{Lil Kemp}\\
\text{THEME} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\texttt{badge}}\\
\text{MEASURE-DIM} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{card-scale}}\\
\text{CARD}\ \boxed{3} & \left[\begin{array}{l}\alpha\\ C_{s,Rel}\ (\boxed{3},\boxed{4})\ >\end{array}\right]
\end{array}\right]
\end{array}\right]
\end{array}\right]\\
\text{CORRELATE} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{possession_state}}\\
\text{POSSESSOR} & \boxed{2}\ \texttt{old boy}\\
\text{THEME} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\texttt{badge}}\\
\text{MEASURE-DIM} & \left[\begin{array}{l}
\textit{card-scale}\\
\text{CARD}\ \boxed{4}\ \beta
\end{array}\right]
\end{array}\right]
\end{array}\right]\\
\text{EFFECT} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{change-of-state}}\\
\text{RES-STATE} & \left[\begin{array}{l}
\textit{defeated}\\
\text{UNDERGOER}\ \boxed{2}\ \textit{old boy}
\end{array}\right]
\end{array}\right]
\end{array}\right]$$

Fig. 10 Frame for *outbadge*-example in (31). (Abbr.: CARD = CARDINALITY; *card-scale* = *cardinality scale*; MEASURE-DIM = MEASURE DIMENSION; RES-STATE = RESULT STATE)

A similar restriction applies to scale type and the possibility of comparing degrees on property scales with cardinalities on cardinality scales. Consider the following example in (31), where comparison is not based on properties but on cardinalities (cf. Solt 2015 on cardinality scales):

(31) There was an old boy with 'a lifetime of badges' on his hat. Excuse me, but we have those too. (Step forward **Lil Kemp** who could **outbadge him** any day).[11]

The example in (31) can plausibly be paraphrased as 'Lil Kemp' defeats the old boy in a contest on who owns more badges'. On this interpretation, both cause and correlate sub-events are stative. While the example may equally well refer to badges worn rather than possessed, the comparative nature is crucially based on the number of badges (most likely of their preferred soccer clubs), i.e. a cardinality.[12] There are no examples in my data that compare property scales with cardinality scales, i.e. we do not find comparisons of, say, the speed of a running-event with the frequency of running-events, i.e. with a cardinality. I take this to be reflected in constraints in

[11] https://www.pinkun.com/opinion/run-in-is-more-nail-biting-than-expected-1-642935 [Accessed: June 05, 2022]

[12] Both the stative nature of the eventuality denoted by example (31) and the inference that comparison is cardinality-based are related to the fact that the base of *outbadge* is an object noun. I will remark on the nature of this discrepancy between base semantics and derivative semantics in Sect. 4.3.

the type signature, so that cardinality scales and property scales are incompatible (32-a), that property scales do not take cardinality attributes (32-b), and that cardinality scales do not take degree attributes (32-c):

(32) a. *cardinality scale* $\wedge$ *property scale* $\longrightarrow \perp$
b. *property scale* $\longrightarrow$ CARDINALITY $\longrightarrow \perp$
c. *cardinality scale* $\longrightarrow$ DEGREE $\longrightarrow \perp$

The frame in Fig. 10 models the semantics of (31) as a comparison between the numbers, i.e. cardinalities, of entities encoded by the THEME arguments of two stative eventualities in CAUSE and CORRELATE, respectively. Accordingly, these two sub-events are both typed *possession_state*, their participants are POSSESSORS, and the comparator accesses the cardinality values α and β that measure out the respective eventualities. Structurally as well as with respect to further types, the rest of the frame corresponds to those presented in Figs. 8 and 9.

The final loci of variable semantic structure in *out*-formations concern the very elements that are being compared, the prominence of comparison, and the kind of result state. Consider the example in (33).

(33) Whatever you do to stay active this summer, make sure to stay hydrated and to properly fuel with healthy meals pre and post-burn. And remember, **you** can never **outrun a crappy diet**! (iWeb)

A natural interpretation of the outrunning-scenario in (33) appears to be roughly ‘cancel out the consequences of a poor diet by running (a certain time or distance or a certain number of times etc.)’. I suggest the following analysis: the object-argument *crappy diet* $\boxed{2}$ is coerced into a causative correlate event $\boxed{5}$,[13] in which the consumption of low quality food and drink results in a state of poor health. In turn, the overall macro-event, i.e. outrunning a crappy diet, constitutes a causation event that nullifies the effect of the embedded correlate event. In consequence, the frame for the example in (33) in Fig. 11 depicts the by now familiar structure of a causative macro-event with three sub-events and two participants (i.e. the syntactic subject- and object-arguments). However, we find differently typed events for the cause (a *running-activity*) and the correlate sub-events (*causation*). The analysis thus shows that the cause and correlate sub-events can be conceptually distinct and may even differ in semantic type.

Unlike in the examples discussed previously, the example in (33) and the formalization in 11, show that it is not necessarily embedded values of scalar attributes in CAUSE and CORRELATE that are being compared. First, on any conceivable interpretation, *crappy diets* cannot run (or move, more generally), and it also seems impossible to coerce such a reading. Second, the very kind of scale to be applied remains underspecified (as the addendum in parentheses to the above paraphrase indicates).

The frame in Fig. 11 provides a principled way of treating scalar underspecification in *out*-forms. First, the MEASURE-DIM attribute within the CAUSE remains un-

[13] In the only relevant reading listed, WordNet (see Fellbaum 1998) classifies *diet* as a physical entity noun (‘the usual food and drink consumed by an organism’).

$$
\left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{causation}} \\
\text{CAUSER} & \boxed{1}\ \texttt{you} \\
\text{UNDERGOER} & \boxed{2}\ \texttt{crappy diet} \\
\text{CAUSE} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{running-activity}} \\
\text{AGENT} & \boxed{1} \\
\text{MEASURE-DIM} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{scale}\ (\wedge\ \textit{dimension})} \\
\text{DEG} \vee \text{CARD}\ \boxed{3} & \left[\begin{array}{l} \alpha \\ \copyright_{s,Rel}\ (\boxed{3},\boxed{4}) > \end{array}\right] \\
\text{THRESHOLD-DEG} \vee \text{CARD}\ \boxed{4} & \left[\begin{array}{l} \beta \\ \text{DETERMINED-BY}\ \boxed{5} \end{array}\right]
\end{array}\right]
\end{array}\right] \\
\text{CORRELATE}\ \boxed{5} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{causation}} \\
\text{CAUSE} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{consume-activity}} \\
\text{AGENT} & \boxed{1} \\
\text{THEME}\ \boxed{2} & \left[\begin{array}{l} \textit{food} \wedge \textit{drink} \\ \text{QUALITY}\ \textit{low} \end{array}\right]
\end{array}\right] \\
\text{EFFECT}\ \boxed{6} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{change-of-state}} \\
\text{RES-STATE} & \left[\begin{array}{l} \textit{poor health} \\ \text{THEME}\ \boxed{1} \end{array}\right]
\end{array}\right]
\end{array}\right] \\
\text{EFFECT} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{change-of-state}} \\
\text{RES-STATE}\ \boxed{7} & \left[\begin{array}{l} \textit{nullified} \\ \text{UNDERGOER}\ \boxed{6} \end{array}\right]
\end{array}\right]
\end{array}\right]
$$

Fig. 11 Frame for (33). (Abbr.: CARD = CARDINALITY; DEG = DEGREE; MEASURE-DIM = MEASURE DIMENSION; RES-STATE = RESULT STATE)

derspecified with respect to scale and dimension types. Thus, it is of the scalar supertype ‘*scale* (∧ *dimension*)’ and allows for property scales (with different dimensions) as well as cardinality scales. More importantly, however, the comparator attribute (i.e. ‘$\copyright_{s,Rel}$ ($\boxed{3}$,$\boxed{4}$)’) does not take a value of a measure dimension from the CORRELATE sub-event as input. Rather, the second comparative element is provided by a threshold value $\boxed{4}$ that is merely determined by the CORRELATE (cf. DETERMINED-BY $\boxed{5}$). In prose, we thereby ensure that it is the bad diet that determines the value β that α exceeds, while the nature of these values as degree-values or cardinality-values is not spelled out.

In the following section, I generalize over both the scaffold and the variability presented in this section. I formulate a lexeme formation rule that identifies structurally fixed elements, including those with a fixed type as well as those that are underspecified.

4.3 Generalization: lexeme formation rule for comparative *out-*

The above discussion has shown that we may conceive of comparative *out-* as a process that introduces a fairly rigid scaffold of semantic structure. At the same time, however, this structure is underspecified. Importantly, we have seen that underspecification is typically not resolved on the lexical level, as shown by the different properties of different tokens of the same *out*-lemmas, such as the *outdance*-examples in (22) or the *outswim*-examples in (29) and (30). In contrast to what I have proposed for locative *out-* in Sect. 3.3, the following proposal will not be one of different semantic patterns that each give rise to different lexeme formation rules. Rather, I formulate a single rule that provides both the required structural rigidity and the necessary flexibility.

Consider the lexeme formation rule in Fig. 12. The general conceptual idea behind this rule is identical to the one behind the locative rule in Fig. 6. It describes in frame format an underspecified lexical entry of a complex lexeme and establishes relations between this lexeme and its morphological base (as in Plag et al. 2018, Kawaletz 2021, Andreou 2017). More specifically, the rule describes a lexeme with a phonology *out-*$\boxed{\acute{x}}$, where $\boxed{\acute{x}}$ is placeholder for the stressed phonology of the base,[14] it invariably outputs verbs (CAT V), and has attributes for its semantics and morphological base (SEM and M-BASE, respectively). Let us first comment on the complex lexeme's SEM-attribute, before we discuss its relation to the morphological base.

The rule in Fig. 12 states that all comparative *out*-verbs invariably denote causation events, with the two participants CAUSER $\boxed{1}$ and UNDERGOER $\boxed{2}$, and with three sub-events CAUSE $\boxed{0}$!, CORRELATE $\boxed{6}$, and EFFECT $\boxed{9}$. As we have seen, CAUSE and CORRELATE can encode different types of events, such as activities, causative events, or states, depending on the morphological base and context (see e.g. examples (31) and (33)). Accordingly, they are not fixed to any specific event type and merely provided with the supertype *eventuality* that will also inform the nature of their participants (see e.g. Maienborn 2019 on eventuality types). The participants of the sub-events are, irrespective of the individual sub-events' nature, invariably linked to the macro event's participants: the CAUSER is co-referential with the CAUSE's participant and the UNDERGOER is co-referential with the CORRELATE's participant. The EFFECT, in contrast, is defined as a change-of-state of the macro-event's UNDERGOER, whose result state has to be specified contextually.

Recall that, with regard to the scalar-comparative component of the construction, we need to ensure three key ingredients. First, the analysis here rests on the empirically well-supported assumption that comparison brings about the macro-event's EFFECT, and thus needs to be attached to the CAUSE sub-event. Second, it needs to allow for flexibility regarding scale type. Third, it needs to allow for either comparison of event properties (or cardinalities) of CAUSE and CORRELATE or for the mere surpassment of a threshold value. The first condition is tackled straightforwardly by

[14] The OED provides phonological information for 167 out of the 543 comparative *out*-types in my data. For these items, primary stress distribution is unambiguous: all of them have primary stress on the base form. Also, all clearly comparative *out*-verbs in the *Longman Pronunciation Dictionary* (cf. Wells 2007) are listed with primary stress on the base (e.g., *outcláss*, *outfíght*, *outlíve*, *outrún*, *outsmárt*).

$$\left[\begin{array}{l}
\textit{lexeme} \\
\text{PHON } \textit{out-}\boxed{\acute{\text{x}}} \\
\text{CAT V} \\
\text{SEM } \left[\begin{array}{l}
\textit{causation} \\
\text{CAUSER } \boxed{1} \\
\text{UNDERGOER } \boxed{2} \\
\text{CAUSE } \boxed{0}! \left[\begin{array}{l}
\textit{eventuality} \\
\text{ACTOR} \vee \text{UNDERGOER } \boxed{1} \\
\text{MEASURE-DIM } \boxed{3} \left[\begin{array}{l}
\textit{scale } (\wedge \textit{ dimension}) \\
\text{DEG} \vee \text{CARD } \boxed{4} \left[\begin{array}{l} \alpha \\ ©_{s,Rel} \ (\boxed{4},\boxed{5}) > \end{array}\right] \\
\text{THRESHOLD-DEG} \vee \text{CARD } \boxed{5} \left[\begin{array}{l} \beta \\ \text{DETERMINED-BY } \boxed{6} \end{array}\right]
\end{array}\right]
\end{array}\right] \\
\text{CORRELATE } \boxed{6} \left[\begin{array}{l}
\textit{eventuality} \\
\text{ACTOR} \vee \text{UNDERGOER } \boxed{2} \\
\text{MEASURE-DIM } \boxed{7} \left[\begin{array}{l} \textit{scale } (\wedge \textit{ dimension}) \\ \text{DEG} \vee \text{CARD } \boxed{8} \ \gamma \end{array}\right]
\end{array}\right] \\
\text{EFFECT } \boxed{9} \left[\begin{array}{l}
\textit{change-of-state} \\
\text{RES-STATE} \left[\begin{array}{l} \textit{state} \\ \text{UNDERGOER } \boxed{2} \end{array}\right]
\end{array}\right]
\end{array}\right] \\
\text{M-BASE} \left[\begin{array}{l}
\textit{lexeme} \vee \textit{phrase} \\
\text{PHON } \boxed{\text{x}} \\
\text{CAT V, N, A, Phrase} \\
\text{SEM } \boxed{0} \left[\textit{eventuality} \vee \textit{entity} \vee \textit{property} \right]
\end{array}\right] \\
\text{iff } \boxed{3} \simeq \boxed{7} \longrightarrow \boxed{8} \triangleq \boxed{5}
\end{array}\right]$$

Fig. 12 Lexeme formation rule for comparative *out*-. (Abbr.: CARD = CARDINALITY; DEG = DEGREE; MEASURE-DIM = MEASURE DIMENSION; RES-STATE = RESULT STATE)

making the comparator attribute '$©_{s,Rel}$ ($\boxed{4}$,$\boxed{5}$)' attach to the degree or cardinality value $\boxed{4}$ inside the CAUSE. Similarly, underspecification of scale type and dimensions for property scales are ensured by typing the MEASURE-DIM attribute $\boxed{3}$ as the supertype *scale* that encompasses both cardinality and property scales in the type hierarchy (see also Zinova 2016). Finally, the rule provides flexibility of what is being compared in the following way: The comparator states that it is value $\boxed{4}$ (i.e. α) that exceeds value $\boxed{5}$ (i.e. β), where α measures out the CAUSE itself, while β constitutes the value of the threshold. In all cases, even those that do not allow for directly comparing CAUSE and CORRELATE such as the *crappy-diet* example in (33), the threshold is determined by the CORRELATE event via DETERMINED-BY $\boxed{6}$.

Technically less straightforward is the question of how we ensure the default case, upon which we compare properties of these two sub-events. The lexeme formation rule does so via the conditional constraint formulated at the bottom of the AVM: 'iff

$\boxed{3} \simeq \boxed{7} \longrightarrow \boxed{8} \triangleq \boxed{5}$'. In prose, this constraint says the following: if the MEASURE-DIM attributes of the two sub-events are similar or equal (for example both applying to a property scale with the dimension SPEED), the threshold value β (i.e. $\boxed{5}$) is structurally identical to the scalar value γ (i.e. $\boxed{8}$) provided via the correlate's MEASURE-DIM attribute.

Let us finally comment on the morphological base, and how its properties are connected to the properties of the complex lexeme in Fig. 12. As briefly mentioned at the beginning of Sect. 4.1, and shown far more comprehensively by both Kotowski (2021) and Ahn (2022), comparative *out-* is highly promiscuous regarding the input it allows. This does not only hold for the syntactic category or aspectual type of the base form, but also for its ontological class more generally. Consider the examples in (34), which are preceded by a short classification of their ontological type and syntactic category.

(34) a. CAUSATIVE ACCOMPLISHMENT VERB: Bojemoi, that woman has toes that could **outcrush a boa constrictor**!"[15]
b. DEGREE ACHIEVEMENT VERB: [...] the bananas on top of my refrigerator and kitchen cabinets ripened into snacking status the fastest. After four days, they [...] continued to **outripen all the other tested fruit**.[16]
c. ABSTRACT MEASURE NOUN: Mascis' style is as a controlled squall – like a windstorm trying to **out-decibel a jet engine**. (COCA)
d. PERSON/ROLE NOUN **Out-priesting the priests** "isn't the same as embracing the vocation to lead through service"... (COCA)
e. ATTITUDINAL PHRASE For a low-key but tantalizing night in, dust off the Scrabble box and challenge him to **out-dirty-mouth you**. (COCA)
f. EVALUATIVE ADJECTIVE It's not that being considerate is frustrating on its own, but when it becomes a competition to **out-polite somebody else**, it can get annoying. (iWeb)

The list of examples with different properties in (34) could in fact be continued, which serves to show that formulating hard-and-fast selectional restrictions for this prefix is misguided. Accordingly, the rule in Fig. 12 is highly liberal regarding the properties of the morphological base. This holds for its type in general (*lexeme* ∨ *phrase*), its syntactic category ('V, N, A, Phrase'), and its semantic type (*eventuality* ∨ *entity* ∨ *property*). Irrespective of this input, however, the output is by far more determined, and has the capacity to override the base properties. Let us focus on the semantics, and the inheritance mechanism I assume.

Most importantly, it is the complex lexeme's CAUSE sub-event that inherits the base form's semantics, as indicated by the tags $\boxed{0}$ and $\boxed{0}$!, respectively. This can be illustrated by the following examples in (35) ((35-b,c) partly repeated from (19-b) and (33), respectively):

[15] Bishop, David. 2006. *Honour be Damned*. Black Flame Publishing. Retrieved from https://books.google.com, no pagination.

[16] https://www.epicurious.com/expert-advice/tricks-for-how-to-ripen-bananas-article [Accessed: June 05, 2022].

(35) a. When you are **running a marathon**, about an hour or two in you feel a feeling of euphoria... (iWeb)

b. **Most camels can outrun most horses,** but the fastest racehorse would probably outrun the fastest camel... (iWeb)

c. And remember, **you** can never **outrun a crappy diet**! (iWeb)

(35-a) shows that the morphological base *to run* is an activity verb, i.e. it denotes dynamic and durative events without an implied endpoint (see e.g. Filip 2011). The *out*-form's general semantic type, however, is never of type activity, but of type causation. For typical examples, such as (35-b), we find the base's semantics inherited by the CAUSE and we can infer that the CORRELATE sub-event is of the same type (here, *running-activity*). However, examples such as (35-c) show that this inference regarding the CORRELATE's semantic type does not hold across the board (see the frame in Fig. 11).

In very many cases, inheritance of the base's general semantic type by the derivative's CAUSE, i.e. $\boxed{0}$! inheriting from $\boxed{0}$, is unproblematic, as for both (35-b) and (35-c). One problem arises with base verbs that are obligatorily transitive, but cannot realize their usual object-argument in an *out*-prefixed form. One such examples is *outcrush* in (34-a) above: the resultative base verb *to crush* has an obligatory PATIENT-argument that cannot be realized with the complex form *outcrush*. Implicitly, however, such examples seem to include attributes for their base's arguments, and I take the problem they pose to be one of the syntax-semantics interface rather than the semantics proper.

More frequently, however, the base does not denote an eventuality to begin with, as for example in the *outbadge*-example in (31) above, as well as in examples (34-c) to (34-e). For instance, for the base and derivative of *outpriest* in (34-d), we may assume a type hierarchy clash of the form 'SEM $\boxed{0}$: *person-entity* $\wedge$ SEM $\boxed{0}$!: *eventuality* $\longrightarrow \perp$'. As described in Sect. 3.3, the !-notation stands in for a copy-and-override mechanism, i.e. inheritance except for stated differences. In the case of type mismatches, the rule in Fig. 12 thus assumes the morphological process to overwrite its base and shift the base semantics to the suitable eventuality type in the derivative semantics. The rule does not make any concrete suggestions to this end, and I will remain non-committal regarding the general problem of how we derive eventuality-readings from non-eventuality-denoting bases. Possible candidates for such a mechanism include coercive processes (as in Michaelis 2004, Audring and Booij 2016, Booij and Audring 2018, or Nagano 2018), metonymical processes (see Baeskow 2021), or referential shifts to embedded eventualities in non-eventive base structures (see e.g. Kotowski et al. 2023, Schneider 2023).

In summary, this section has modeled the word-formation process that gives rise to comparative *out*-verbs as a fairly complex and underspecified lexeme formation rule. This rule incorporates both invariable elements (in particular, event structure, argument structure, and a comparative component) and a variety of underspecified types and attributes that reflect the variability we find, even for different tokens of the same *out*-lemmas. Let us now take stock, compare properties of locative and comparative *out*-verbs, and comment on their relationship in the next section.

Table 1 Differences and commonalities between locative and comparative *out-*

Locative *out-*	Comparative *out-*
Differences	
Variable primary stress	Primary stress on base
Equivalent free forms	No equivalent free forms
Marginally productive	Robustly productive
Restricted base classes	No clear restrictions
Category-preserving	Regularly category-changing
Marginally applicative	Robustly applicative
Variable transitivity	Always transitive
No addition of sub-events	Always adds 2 sub-events
Commonalities	
(Partly) causative-resultative spectrum	

5 Implications

The previous two Sects. 3 and 4 have modeled locative and comparative *out-*, respectively, as two distinct prefixes without recourse to possible similarities between them. In this section, we will comment on their commonalities and differences, as well as on their appropriate classification as morphological processes. First, the question arises whether the two elements can be considered two senses of the same prefix. Second, a related question concerns how justified treating them as prefixes is in the first place, and whether they could equally well be treated as compound elements. Third, I will very briefly comment on possible similarities in their semantic structures that would allow for future investigations into the historical development of comparative *out-*.

We will begin the discussion by taking stock of the two categories' properties. To this end, Table 1 summarizes and juxtaposes core findings presented above.

Polysemy

Overall, the differences between the two constructions clearly outweigh their commonalities. Semantically, it has been shown that comparative *out-* is a much richer process than locative *out-*: it is robustly applicative and sub-event adding. As can be read off from the rule formulated in Fig. 12, the comparative process typically changes the ontological type of the base and adds a substantial amount of structure. As shown in Sect. 3, its locative cousin is (largely) non-applicative, merely adds a mereological constraint, and does not change the base's ontological type. The only commonality listed in Table 1, i.e. being part of the causative-resultative spectrum, only applies to a subset of locative forms, and resultative semantics is a feature of a rather broad class of very many lexical items, constructions, and morphological processes (see Goldberg and Jackendoff 2004 for an overview).

These overall differences are also reflected in distributional similarity measures. As shown by Kotowski and Schäfer (2023), comparative derivatives show a significantly higher degree of similarity to each other than locative derivatives. The authors interpret this effect as a consequence of the comparative prefix's richer semantic contribution and applicative potential.

One particularly striking difference between the two *out*-s are their distinct stress patterns. As mentioned in the discussions of their respective lexeme formation rules, the stress pattern for locative *out*-forms is highly variable with no clear preference for stress on either prefix or base, while primary stress always falls on the base in comparative *out*-forms. The potential contrast is illustrated for *outbreed*, which occurs with both a locative reading in (36-a) (repeated from (17)), and a comparative reading in (36-b) (stress as given by the OED is indicated by acute accents):

(36) a. Naked mole rats breed readily enough with close kin. Although their preference is to **óutbreed**... (COCA) [locative]
b. In the U.S. Orthodox Jews again far **outbréed** their more secular sisters. (COCA) [comparative]

Irrespective of whether this is understood as a lexical property, a property shared by sets of derivatives, or a property assigned post-lexically, locative and comparative *out*- thus do not fulfill a central requirement for any assumption of polysemy: identity of form mapping to distinct senses (see Rainer 2014). While stress is an essentially non-semantic property, all of the above points taken together clearly speak in favor of assuming two distinct morphological processes.

MORPHOLOGICAL CLASSIFICATION

Incidentally, stress may also be informative regarding the respective morphological status of each of the two processes. The diverging stress patterns conform to prosodic differences found across Germanic languages: particle verbs (or separable complex verbs) have stress on the particle, while the homophonous prefix in nonseparable complex verbs does not carry primary stress (see e.g. Fleischer et al. 2012:373ff., Los et al. 2012:145f., Olsen 2014). Possibly unsurprisingly, then, locative *out*- appears to be analyzable as a bound form of *out* as a spatial particle. As illustrated with the examples in (37) (both from COCA), we find the respective base verbs of all locative *out*-forms in the competing particle construction with the exact same interpretations.

(37) a. Workers say they **shipped out** those test batteries last spring [...] [compare to example (2-a)]
b. Your different ethnic groups would start here and then **migrate out** as their jobs or careers moved on. [compare to example (4)]

As assumed by a number of authors (e.g. Dalton-Puffer and Plag 2000, Olsen 2014, Amiot 2005, Bauer et al. 2013:340), bound elements with homophonous free form counterparts should be analyzed as affixes only if they differ in semantic behavior from the respective free form. The fact that locative *out*-'s semantic contribution corresponds to the basic meaning contribution of the particle may therefore prima facie be taken as evidence for a compound analysis (see Tyler and Evans 2003:200ff. and Cappelle and Declerck 2005 on the particle *out*; see Marchand 1969:55ff. for an analysis of *out*-forms as compounds).

Yet, a compound analysis is not entirely straightforward, either. First, while the whole range of prefix meanings is covered by the particle, the particle also shows a by far wider range of meanings than the bound form, and whether we can call the meanings of the two forms coextensive is unclear. Second, the status of particles as free forms is itself not uncontroversial (see Los et al. 2012:ch.2, McIntyre 2007 for discussion). For these reasons, I will remain agnostic as to locative *out*-'s morphological status. At the same time, given some structural changes to the formalizations in Sect. 3 (such as, for example, providing the M-BASE attribute with two forms), the analysis presented there appears also compatible with assumptions of compoundhood.

On a related note, several locative *out*-verbs are part of derivational paradigms (see e.g. Hathout and Namer 2019, Bonami and Strnadová 2019 for overviews). As in (38-a), for example, we frequently find antonymic verbs prefixed with *in*-, while we also find event and object nominalizations that are semantically closely related to the respective verbal forms, as in (38-b) (all attested in the OED):[17]

(38) a. outbreed–inbreed; outmigrate–inmigrate; outpour–inpour
b. outbreed–outbreeding$_N$; outmigrate–outmigration; outstation–outstation$_N$

The situation is certainly very different for comparative *out*-. Here, a prefix analysis is clearly preferable, as we do not find free forms of *out* with a similar comparative semantics or argument structure altering potential. This is illustrated by the oddness of the examples in (39-a) and (39-b). As far as I can tell, we also do not find semantically closely related forms for comparative *out*-verbs, at least not as forms listed in the OED, and it is thus unclear that they form part of derivational paradigms in the way locative *out*-verbs do:

(39) a. ??Camels can run out horses. [compare to ex. (19-b)]
b. ??We try to drink out our friends. [compare to ex. (20-b)]

SEMANTIC RELATEDNESS

We have thus arrived at the rather unambiguous conclusion that comparative and locative *out*- are distinct word-formation processes, and that a polysemy analysis is misguided. As noted by Kotowski (2021), the development of a comparative meaning component is largely obscure, and we do not seem to find cognates of *out* in other Germanic languages with a similar semantics. None of this precludes semantic relatedness, though, and assumptions that comparative *out*- developed out of locative sense(s) are apparently uncontroversial (see Brinton 1988, Nagano 2011). However, specific claims on how spatial and scalar semantics in *out*-prefixed verbs are connected are certainly in need of empirical investigations into historical data. I will therefore refrain from providing speculative analyses, but merely point to two possible structural configurations in my respective semantic analyses that suggest themselves as possible loci of semantic shifts.

The generalizations over attestations of the two *out*-constructions in Figs. 7 and 12 provide two possible elements of structural similarity. First, we find a fairly straightforward structural overlap between causative locative examples (as in *to outship nuts*; see example (2-a)) and comparative examples, which I have argued always include cause and effect sub-events. If such an analyses is on the right track (see also

[17] I thank one of the reviewers for this observation.

McIntyre 2003), the semantic shift is one of a translocation (or change-of-location) sub-event to a more general change-of-state sub-event. At the same time, this analysis does not account for the comparative meaning element at all, and does not account for non-causative examples of locative *out*-. A second possibility, translating Talmy's (2000) and Tolskaya's (2014) ideas to my formalizations, would analyze spatial regions as the metaphorical source domain, and different regions on scales as the target of a metaphorical shift. Roughly, such an analysis would treat the type of comparative *out*-'s comparator, i.e. $>$, as the analogical counterpart to locative *out*-'s mereological non-containment constraint (i.e. spatial region $\boxed{2} \not\subset$ spatial region $\boxed{1}$). For the reasons mentioned above, in particular the lack of necessary historical data, I will remain noncommittal regarding the question of how (and how closely) the two constructions are related.

6 Conclusion

This paper set out to provide the first systematic analyses and formalizations of the semantics of both locative and comparative *out*-verbs. The investigation has been based on a broad dataset of corpus attestations of roughly 600 types and more than 1,500 tokens. Generally speaking, and contrary to implicit assumptions in the literature, there is ample evidence that locative and comparative *out*- are two distinct prefixes. The comparative prefix is highly productive, regularly changes the base's category, is clearly applicative, always transitive, bears primary stress on the base rather than the prefix, and does not have unambiguously equivalent free forms. Locative *out*- systematically differs regarding all of these properties, which clearly speaks against a polysemy analysis.

On a related note, the frame formalizations of the two processes have revealed further fundamental differences. Despite its semantic complexity and the diversity of base forms it allows, comparative *out*- has been shown to be fairly rigid with regard to a number of properties, in particular its event structure as well as argument structure. In consequence, I have proposed a single abstract lexeme formation rule for this prefix. In contrast, and despite their relative paucity, locative *out*-derivatives are semantically by far more dependent on their base. They give rise to a number of subpatterns that are related via a highly abstract mereological constraint only, and I have proposed an inheritance hierarchy that connects several distinct lexeme formation sub-rules for the locative prefix. While none of this should be read as an argument against historical relatedness, it therefore seems safe to say that the comparative sense of *out*- has developed into a distinct prefix.

A number of interesting open questions will have to be left to future research. For example, given the relatively uniform output of the comparative prefix, very many attested base forms have to undergo type shifts of some sort – for example, from entity or property to eventuality. Whether such mechanisms are fully or partly predictable, and whether they rely on purely coercive or metonymic, or yet other processes, is still not well understood. Also, as mentioned at various points in this paper, the historical development of the comparative prefix is largely obscure, and to my knowledge there is no dedicated study to this end available. Finally, the rather rare locative prefix may also yield worthwhile follow-up investigations on why this morphological form has survived and on the marginal niche it occupies next to *out* as a particle.

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