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The Semantics of Past Participles

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The Semantics of Past Participles

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To Einstein the dog, who sat at my feet snoring as I wrote this dissertation.

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The Semantics of Past Participles

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This dissertation proposes a new way of understanding the semantics of past participles, primarily in English. In some uses, past participles denote an event (e.g. *fed* in *The baby is being fed cheerios*), while in others the participle denotes a result state of an event of the kind denoted by the verb (e.g. *fed* in *The baby seemed well-fed*). This dissertation aims to describe and explain the interpretations and distribution of participial forms, both simple (e.g. *stained*) and compound (e.g. *tear-stained*), across constructions. In particular, we focus on irregularities in the distribution and meaning of adjectival participles. The key thesis is that some participles are used as NAMES, signs with unique denotations that speakers chunk for reuse. Participial names denote complex concepts which autonomously entail a property and the

existence of a previous event via meaning postulates. This usage-based approach reflects how speakers organize their language to reflect the concepts that they want to talk about most, without having to stipulate a well-establishedness condition on the input to a regular rule.

Contents

List of Tables

List of Figures

Chapter 1

Introduction

1.1 Introduction

Events and states are intrinsically connected. When events occur, the state of the world naturally changes, whether that change has to do with some entity being affected or simply that the history of the world comes to include the event that has taken place. When we consistently come to expect a certain result state from a certain type of event, there is an especially tight semantic connection between that event and that state. For example given that (1a) is true, we expect that (1b) is entailed.

(1)   a. The banker stole the money.

       b. The money was in a stolen state.

Past participles like '*stolen*' are words which offer speakers a tool for bridging the event denoted by a verb to a participant which has been affected by that event. There

are a variety of constructions containing past participles in English including *have* perfects (2a), verbal passives (2b-2c), reduced relative clauses (2d), and adjectival passives as predicates (2e) and as prenominal attributive modifiers (2f).

(2)   a. The banker has/had **stolen** the money.

        b. The money is/was being **stolen**.

        c. The money was recently **stolen** by the banker.

        d. The money **stolen** just yesterday by the banker was found.

        e. The money seemed clearly **stolen**.

        f. The **stolen** money was found yesterday.

Across all of the examples in (2), we have a consistent participial form: *stolen*, which is related to the verb *steal* denoting a stealing event. While there is uniformity in form, there are differences in meaning. The syntactic context in which the participle is used affects whether the participle it contains denotes an event or a result state of an event. Intuitively in the paradigm above, the participles in (2a) and (2b) both seem to represent a stealing event, which is either completed (in (2a)) or ongoing (in (2b)). Similarly, in the verbal passive construction in (2c) and the relative clause construction in (2d), the participle modified by a temporal adverb or a *by*-phrase suggests that there is still an accessible money stealing event that can be located in time and has a salient agent. In contrast, *stolen* can also denote the result state of a stealing event rather than the event itself. This is the case for the adjectival participles in (2e) and (2f), in which the money is being ascribed with the result state property of being stolen.

A natural question that arises then is what leads to variation in the interpretation of a participle as denoting an event or a state? While all the participles in (2a)-(2f) share a form, do they also share a meaning? Does the same underspecified participle get squeezed into different contexts which lead to more eventive or stative interpretations? Or should we posit polysemous participles within or across these constructions?

Past analyses have taken different approaches to address this question by employing different grammatical representations, which typically involve the participle meaning being described in terms of the meaning of its corresponding verb. Some (e.g. Embick (2004); Alexiadou and Anagnostopoulou (2008)) assume that the same category-neutral root is present in both stative and eventive readings, but there are different sub-lexical syntactic structures with different features built on top of those roots. Others (e.g. Kratzer (2000)) argue that there are different stativizer operations that act upon verbs to derive participles depending on whether their associated root has a built-in result state. Some assume that adjectival participles and verbal participles denote events of different ontological types (e.g. Gehrke (2015)). Some (e.g. Maienborn (2009)) argue that stative properties are derived ad-hoc from pragmatic context. The many potential representational devices that have been proposed are not always mutually exclusive. Generalizing over these analyses, different interpretations of participles may arise from:

1. Different structural representations (i.e. templatic structures comprised of different syntactic heads or event templates)

2. Different semantic operations (i.e. different stativizers applied to a root)

3

3. Different ontological types (e.g. event kinds vs. tokens)

4. Different pragmatic contexts

Although these representations differ with respect to how they are executed, at least the first three involve descriptions of the participle meaning in terms of the meaning of the root associated with the verb. So, for example, the meaning of *broken* is described in terms of the meaning of *break*.

In this dissertation, I will draw a distinction between this type of descriptivist approach and a different source of lexical meaning: NAMING. The central theory is that speakers use participles to NAME properties after associated verbs as needed to characterize their observations. Adjectival participles can be used as vehicles for innovating names for properties, similar to the pragmatic approach in 4 above. However, I argue that this process has particular consequences for the grammar; NAMING results in the creation of new, autonomous signs that represent unique properties which are reusable in future contexts by other speakers.

The key way in which the naming theory differs from previous approaches is that naming is a category of use rather than an ontological category. Names can be single words or multi-word expressions and can span any syntactic category. Thus, names can be compositional in that interlocuters can access their parts, but the meaning of a name is consistent. In composing a name, speakers rely on analogy-based naming conventions to choose an appropriate form. These conventions are driven by the principle that similar meanings tend to cluster on the same abstract form. Thus, clusters of names with the same form and similar meanings emerge. Crucially names contrast with DIRECT COMPOSITES, which are composed via generalized abstract

rules, such as those found in the syntax.

The way in which names are created and spread is rooted in Kripke's (1972) causal theory of reference. On an individual level, speakers name in order to create helpful shortcuts to refer to concepts in the world that they find useful. But naming is also a social act as groups of speakers pass on the ability to refer using shared names. When a speaker wants to use a name to refer to something, they can choose any form they want. However, reusable names that are likely to spread to a community of speakers are those with a profitable meaning and a rational form. For instance, *tear-stained* names a unique property which speakers can use to refer to a particular state resulting from events of staining with tears. Since the utility of naming is to add new signs to a shared lexicon, the main symptom of a name is that it excludes indexicals (*them-stained). This contrasts with DIRECT COMPOSITES like *stained with tears*, which are composed on-line to contribute to a particular discourse and thus contain variables that are interpreted in a given context and can include indexicals (*stained with them*).

The dissertation is organized as follows: Chapter 2 outlines the naming theory, which explains the semantics of adjectival uses of properties as a result of naming in addition to representations that describe a result state in terms of its corresponding event. Chapter 3 extends this theory to multi-word (compound) participles (e.g *dissertation-driven madness*), demonstrating how naming explains restrictions on what sort of words participles can (and cannot) combine with. Chapter 4 is a corpus-based discussion of such compound participles and the patterns of meaning they tend to cluster around. Finally, chapter 5 is a quantitative analysis comparing the entropy

of names and direct composites.

In the remainder of this chapter, I will discuss the relevant background literature. In Section 1.2, I will outline past work on the semantics of past participles, starting with a brief overview of cross-linguistic definitions of participles. I will then introduce the syntactic distinction made between verbal and adjectival participles (1.2.2), along with commentary on particular related issues including perfect uses of participles, the adverbial modification puzzle, and the syntactic/semantic split. In Section 1.2.3 I will discuss previous semantic classifications of participles found in the literature, starting with classifications based on whether the participle entails a past event and then classifications based on the temporariness of the state. I will also discuss issues related to the notion of target states, followed by a section on alternative representations of adjectival participles. Section 1.2.4 summarizes key issues and presents broad research questions governing the dissertation.

The processes of naming and direct composition reflect an optimization of two different cognitive functions essential to language: to create shortcuts for referring to recurring concepts and to maintain the expressive capacity we need to talk about specific situations. In Section 3, I outline some literature that will be relevant for understanding these aspects of the current proposal, in particular with the influence of usage-based frameworks for modeling language. I discuss how these approaches relate to quantitative measures of association between signs (Section 3.1) and cognitive notions of chunking (Section 3.2). Section 4 concludes with a roadmap to the remainder of the dissertation.

1.2   Approaches to participles

1.2.1   What is a participle?

Participles traditionally have been defined on morphosyntactic grounds. Haspelmath (1994) refers to them as 'verbal adjectives,' i.e. words that behave like adjectives with respect to morphology and external syntax but are regularly derived from verbs. Although this definition presupposes the existence and uniformity of a cross-linguistic adjectival category, the behavior of participles can be seen through a broader lens. In English, the category of *participle* is used for a particular morphosyntactic form with both verbal and adjectival functions. For instance, while prenominal participles display adjective-like features, perfect constructions contain English participles that behave like verbs, not adjectives. There are languages where participles have adjective-like behaviors, but also have consistently distinct features from non-participial adjectives (e.g. Hup, see Shagal (2017:15)) Finally, there are also languages that lack a primary morphosyntactic adjective category that nonetheless have groups of words that resemble participles (e.g. Garo, Seri, West Greenlandic, see Shagal (2017:16)).

Shagal (2017) utilizes a more narrow criterion of 'participle' in a typological survey; she specifically looks at verbal forms that introduce relative clauses used for adnominal modification. Interestingly, in her definition she takes care to distinguish between so-called 'true' participles and derivational verbal adjectives. In her view, participial forms are part of a verbal inflectional paradigm, while verbal adjectives are derivational. Haspelmath (1994:152) cites the examples *understandable* and *re-*

liable as verbal adjectives. While Shagal recognizes that the distinction between inflection and derivation is difficult to draw, she nonetheless offers two criteria for distinguishing between true participles and deverbal adjectives. The first is that participial morphemes should be fully or almost fully productive in that they can attach to all or almost all verbs. The second is that the meanings of participles are transparently related to the meanings of the verbs from which they are derived. While Shagal would likely say that English past participles squarely fall into the participle bucket since -*ed* is part of an inflectional paradigm, adjectival past participles are notoriously constrained, and the relationship between an adjectival participle and its associated verb is not always transparent.

This dissertation develops a theory of the semantics of participles in English focusing on the relationship between the states and events they denote. In doing so, I consider all uses of the past participal form of a verb in which the verb is typically suffixed with -*ed/en*.

1.2.2   Verbal vs. adjectival participles

We can apply several standard tests to participles to determine their category, adjective or verb. Although adjectives aren't uniform in all of their syntactic properties there are some common behaviors typically used as heuristics for diagnosing a word as an adjective. Participles demonstrate adjectival behavior by combining with degree modifiers (3a) and *un-* prefixation (3b), being selected by AP-selecting verbs like 'seemed' (3c) and coordinating with other adjectives (3d) (adapted from Mcintyre (2013:1)). The fact that a participle displays any of these features may be used as

evidence suggesting that it is an adjective.

(3) a. Adjectival degree modifiers: *It is very {neglected/damaged/overrated}*

   b. Adjectival Negative *un*-prefixation: *The presents are unopened*

   c. Complement of AP-selecting verbs: *It {seemed/remained/became} damaged*

   d. Coordination with other A(P)s: *They are {dressed and ready/dead and buried}*

On the other hand, some participles don't display the properties in (3). For instance, in some cases participles cannot be used with adjectival degree modifiers (4a), *un*-prefixation (4b), or AP-selecting verbs (4c), nor can they be coordinated with other adjectives (4d) (adapted from Emonds (2006:19-22)):

(4) a. *She was very elected

   b. *That work was unleft in good hands.

   c. *Many polluted cities remain avoided during the summer.

   d. ?The competent and elected official.

Just because a participle does not display one of the features in (3) does not necessarily mean that we can conclude it is not an adjective. After all, many adjectives do not pass all of the criteria above (e.g. some adjectives cannot be prefixed with *un*-, *unyellow). However, some participles also display behavior that we wouldn't expect if they were adjectives. For instance some participles, such as those derived from double object verbs like *give* and verbs that take an NP object

9

and a predicative NP, like *consider* and *elect*, license NP complements, an ability that adjectives lack.

(5)   a. Fatima was given a gift. (cf. *Fatima seemed given a gift)

      b. John is considered a fool. (cf. *John remained considered a fool)

      c. Mary was elected President. (cf. *Mary looked elected President)

This type of data is used as evidence that these participles are verbs rather than adjectives. Wasow (1977) uses similar observations to propose a distinction between verbal passive participles and adjectival passive participles. Verbal passive participles occur in several constructions, including the copular construction found in the examples above (5). Verbal passives also occur as complements of several verbs, such as *get, have, want* and *see* (Baker (1995)).

(6)   a. Fred [got *kicked by the mule*]

          [GET PassP]

      b. Nina [got Bill *elected to the committee*].

          [GET NP PassP]

      c. Sharon [had the carpet *cleaned*].

          [HAVE NP PassP]

      d. Smith [wants the picture *removed from the office*].

          [WANT NP PassP]

      e. George [saw his brother *beaten by the soldiers*].

          [SEE NP PassP]

10

Additionally, verbal passives can appear in reduced relative clauses (7a) and constructions such as (7b).

(7)   a. The man *given an award* was my friend

        b. With John *given an award*, the family had to celebrate.

Verbal and adjectival passives can sometimes be hard to identify in English, since both can be expressed in an ambiguous surface form in the past tense passive. For example *fed* in (8) could either refer to an event of feeding or the state of the baby having eaten.

(8)   The baby was fed.

We can disambiguate these senses using some of the tools used to test for adjectiveness above.

(9)   a. The baby was unfed$_A$.

        b. The baby looks/looked (un)fed$_A$.

        c. The baby was fed$_V$ the cereal.

The *un* morphology in (9a) unambiguously identifies the participle as adjectival: (9a) is not describing an event in which food is somehow taken away from the baby, but rather the state that the baby is in before being fed. Similarly, when *fed* is selected by *looks* in (9b), we get an adjective. The speaker is commenting on the perceived state of the baby. Contrast this with (9c), where the object indicates that the participle has an eventive reading rather than a state reading.

When the passive is put in present tense, it becomes much easier to get a reading where the speaker is commenting on the state of the baby, since an eventive reading would mean that the baby is habitually fed:

(10) The baby is fed.

The distinction between adjectival and verbal participles is easier to see in some languages than others. For instance, in German, adjectival passives are preceded by the copula *sein* (11a), whereas verbal passives are preceded by the auxiliary *werden* 'to become' (11b) (Borik and Gehrke (2019:6)):

(11) a. *Die Tür ist geöffnet*
          the door is opened
          'The door is open(ed)'

      b. *Die Tür wird   geöffnet*
          the door becomes opened
          'The door is (being) opened'

Perfects

Past participles also appear in perfect aspectual constructions in English regardless of tense (12). From a syntactic standpoint these participles are verbal because they can take objects.

(12) a. The girl has thrown the basketball against the wall.

      b. The former DA had run for president before.

      c. The young couple had escaped the polluted city during the summer.

12

From a semantic standpoint, verbal perfects have been said to have a few different readings:

(13)   a. *Universal*: Mary **has** always **lived** in the city/has lived in the city since she was a child. (Borik and Gehrke (2019:7))

        b. Existential[1]: **Have** you ever **read** 'War and Peace'? (Borik and Gehrke (2019:7))

        c. *Resultative*: Peter **has lost** his sunglasses (Borik and Gehrke (2019:7))

        d. *Hot News*: The Reserve Bank **has** just **announced** an increase in interest rates. (Ritz (2012:883))

The universal perfect (13a) denotes that a persistent state holds over a certain interval of time. The existential perfect (13b) denotes that a particular type of event has occurred at least once in a certain interval of time that starts in the past and lasts up to the present. The resultative perfect (13c) denotes that the result of a past situation holds at present. Finally, the "hot news" perfect (13d) denotes a recent event that the hearer presumably is unaware of. The unifying feature of these meanings is that there is some sort of current relevance of a past event to the present. Dahl and Hedin (2000) consider 'current relevance' to be on a spectrum, so different types of verbs might result in different readings in the perfect. For instance, stative verbs are more prone to universal readings while achievements are more prone to resultative readings (see Borik and Gehrke (2019)).

Clearly, there is a relationship between results of past events and current relevance: often the results of past events are important to the present. This relationship

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[1]Also sometimes called 'Experiential'

has manifested in diachronic change which links perfect readings with resultatives in several languages including English. Typically perfects are derived from resultative constructions and tend to later develop into perfective past tenses (see e.g. Ritz (2012) and Chapter 2 for more detail).

The German adverbial modification puzzle

It has been noted that, unlike verbal participles, adjectival participles are incompatible with some event-related modifiers like manner adverbs, *by* phrases, and instrumentals (14) but crucially not all such modifiers (15). Determining what motivates these modification constraints for adjectival participles has been deemed the "adverbial modification puzzle."

(14) *Der Mulleimer   is*
      The rubbish-bin is
      *von meiner Nichte /*langsam /*genusslich /*mit der Heugabel geleert
      by my niece /slowly /with pleasure /with a pitchfork   emptied
      (Rapp (1996:246))

(15) a. *Die Zeichnung ist von einem Kind angefertigt*
         the drawing   is by a   child produced
         'The drawing is produced by a child.'

      b. *Der Brief war mit   einem Bleistift geschrieben.*
         the letter was with a   pencil   written.
         'The letter was written with a pencil'

         (Rapp (1996:254))

Rapp's (1996) solution to this problem, inspired by Kratzer's (1994) phrasal adjectivization, is to say that these modified adjectival participles are instances where

14

an entire VP has been stativized. The input to phrasal adjectivization includes only "modifiers that provide information that is characteristic for the result state" (Gehrke (2015:899)), though she doesn't specify what exactly it means for information to be characteristic for the result state.

Gehrke (2015) takes another approach. She argues that adjectival participles represent event kinds rather than event tokens. This argument provides an appealing solution to the adverbial modification puzzle since adjectival participles are seemingly only compatible with generic modifiers. Specifically, she notes that event participants of adjectival participles are discourse opaque. Adjectival participles do not license pronominal modifiers (16) nor do they introduce discourse referents which can later be picked out by pronouns (17) or modified by intersective adjectives (18).

(16) a. *Die Tür wird   (von ihm) geöffnet*
        the door becomes by   him   opened
        'the door is being opened by him.'

     b. *Die Tür ist (*von ihm) geöffnet*
        the door is by   him opened
        'the door is opened (*by him)

(17) a. *Die Zeichnung wird   von einem Kind$_1$ angefertigt. Es$_1$ hat rote*
        the drawing   becomes by a   child produced   it   has red
        Haare
        hairs
        'The drawing is being produced by a child. He/she has red hair.'

     b. *Die Zeichnung ist von einem Kind$_1$ angefertigt. *Es$_1$ hat rote Haare*
        the drawing   is by a   child produced   it   has red hairs
        'The drawing is produced by a child. *He/she has red hair.'

15

(18) a. *Die Zeichnung wird   von einem blonden Kind angefertigt.*
      the drawing   becomes by a   blond   child produced
      'The drawing is produced by a blond child'

   b. **Die Zeichnung ist von einem blonden Kind angefertigt.*
      the   drawing   is by a   blond   child produced
      'The drawing is produced by a blond child'

Maienborn (2009) takes an approach to the adverbial modification puzzle rooted entirely in pragmatics. She argues that all adjectival participles denote ad-hoc properties that are created in context. Thus, modification of participles is purely governed by world knowledge. For instance, consider the following sentence (Maienborn (2009:38)):

(19) *Ich hatte Sorge wie der Japaner das Oktoberfest finden würde, aber es*
      I   had worry how the Japanese the Oktoberfest find   became, but it
      stellte sich heraus, dass er schwedentrainiert war.
      put   itself out,   that he Sweden-trained   was.
      'I was worried about what the Japanese guy would think about the Oktober-

      fest, but it turned out he was Sweden-trained.'

In this context, speakers understand that the meaning of *schwedentrainiert* ('Sweden-trained') means that the Japanese guy is able to drink because he spent time in Sweden. Maienborn argues that this is because the speaker builds the meaning 'on-line' using salient contextual knowledge.

   In Chapter 3, I observe a similar puzzle related to what words can and cannot be compounded with English adjectival participles. The naming solution briefly outlined above is compatible with these solutions to which modifiers can occur with German adjectival participles. Like Rapp, I consider complex adjectival participles to

16

be interpreted as names at a higher level, that is as an entire chunk. Like Maienborn, I maintain that adjectival participles provide speakers with a tool for naming new properties. Additionally, I consider the naming of result properties to be a source for creating kinds, similar to Gehrke (2015)'s approach.

The syntactic/semantic split

When Wasow established the distinction between verbal and adjectival passives, he argued that verbal participles are derived from transformational rules in the syntax, while adjectival participles are derived in the lexicon. Although this division of derivational labor has been controversial in later literature (see e.g. Bruening (2014) & Meltzer-Asscher (2011)), the distinction between verbal and adjectival categories of passive participles remains remain widely accepted today.

Borik and Gehrke (2019) point out that the semantic split between 'eventive' and 'stative' notions is often either implicitly or explicitly equated to this syntactic split between verbal and adjectival participles. It is important to disentangle these two notions since there are several instances in which these classes don't line up. On the one hand, we have participles which might seem verbal but appear to have stative properties that might typically be associated with adjectival participles. For example, Borik and Gehrke (2019) refer to the HAVE-passive in German (20), which can have both a passive and a perfect interpretation. Gese (2013) demonstrates that the HAVE-passive is under similar modification restrictions as the adjectival participle.

(20) *Ich **habe** die Haare **gefärbt**.*
      I   have the hairs colored.

   a. 'My hair is in a coloured state' (HAVE-passive)

   b. 'I have coloured the hair.' (PERFECT)

We can also have syntactically adjectival participles with eventive properties. The prenominal attributive position is typically associated with adjective-hood in English. Embick (2004) even uses the prenominal position as an empirical basis for calling a participle adjectival. However, Sleeman (2011) argues for the existence of prenominal eventive participles in both English and Dutch. For instance she argues that *recently* in (21) modifies the opening event itself, not the result of the event.

 (21) recently opened restaurants

Further, in German, attributive participles can allow for modifiers that are not typically licensed for adjectival participles. For example, the attributive participle in (22) can be modified by a BY-phrase which is not compatible with the adjectival participles in predicative position (from Rapp (2001:395)).

 (22) a. *Das von Maria **gemalte** Bild*
           the by Mary   drawn   picture
           'The picture drawn by Mary'

       b. **Das Bild   ist von Maria **gemalt***
           the picture is by Mary drawn
           Intended: 'The picture was drawn by Mary.'

Finally, there is further gradation within the category of adjectival participle itself, which will be discussed in detail in the next section. These distinctions open the

door for participles which seem morphosyntactically adjectival but semantically still have strong eventive entailments. The key takeaway here is that the semantics of a participle roughly correlate with whether it is categorized as a verb or an adjective, but also depend on other factors such as the particular construction it is used in, lexical semantic features of the root from which it is derived, or the particular context in which it is used.

1.2.3   Semantic types of participles

A good chunk of the relevant literature has been devoted to differentiating between categories of participles with different semantic properties, especially among adjectival participles. While verbal participles always denote that some sort of event has occurred, adjectival participles vary with respect to whether there is evidence for an event entailment and, if there is one, what relationship there is between event and state. I will outline two main distinctions here. The first is centered around whether a participle contains an event implication, a state implication or both. The second is centered around whether or not the state denoted by a participle is temporary.

Event, state or both?

Embick (2004) distinguishes between two types of adjectival participles: *resultative* and *stative* participles. These are both distinct from *eventive* participles, which he roughly likens to the classic verbal participle from Wasow (1977). The key difference between the two adjectival participles is that resultative participles refer to the result state of a grammatically represented event and stative participles refer to a simple

state like any other adjective. Embick (2004:356) points out that some participles are ambiguous between eventive and resultative readings (see 23), but correspond to a non-participial stative form, like 'open' in (24). Meanwhile, some participles, like 'closed' in (25), are multiply ambiguous between all three of these readings.

(23) The door was **opened**

    a. *Eventive passive*

       'Someone opened the door.'

    b. *Resultative*

       'The door was open as a result of a prior opening event[2].'

(24) *Stative*

    'The door was **open**'

(25) The door was **closed**.

    a. *Eventive passive*

       'Someone closed the door.'

    b. *Resultative*

       'The door was in a state of having become closed.'

    c. *Stative*

       'The door was in a state of being closed.'

Embick (2004) presents several morphosyntactic diagnostics for discerning these meanings. Compared to statives, resultatives can be modified with manner adver-

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[2]Embick's paraphrase for this is 'The door was in a state of having become open.'

bials (26), cannot be used with verbs of creation (27), cannot serve as resultative secondary predicates (28), and tend to be compatible with *un*-prefixation (29).

(26)   a. *The package remained carefully open.

       b. The package remained carefully opened.

(27)   a. The door was built open.

       b. *The door was built opened.

(28)   a. John kicked the door open.

       b. *John kicked the door opened.

(29)   a. It is *unopen

       b. It is unopened

The key difference between resultatives and eventives for Embick is that resultatives cannot be used with agentive modifiers. For instance, he argues that (30a) can only have an eventive interpretation, presumably due to data like (30b).

(30)   a. The metal is hammered by John

       b. *The metal seemed hammered by John

Mcintyre (2013) adopts Embick's resultative/stative/eventive distinction, but adds an additional class of rarer participles: situation-in-progress participles like (31), which behave like adjectival participles (i.e. selected by AP selecting verbs), but entail in-progress events.

(31)   The flute seems well played, from what I can hear amidst the surface noise.

Embick explains the difference between his classes of participles by proposing different underlying syntactic representations for each. In particular, stativizing heads attach to different syntactic positions for different types of participles. The adjectival passive with a stative reading has a structure where an Asp head attaches directly to the root (32) and there is no v present. He leaves the specifier empty to reflect concerns about whether or not the argument is licensed externally.

(32) *Stative*

```
              AspP
              /  \
            ?     Asp
                  /  \
               Asp_s  √ROOT
```
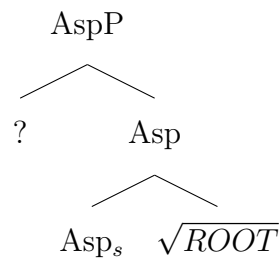
On the other hand, the verbal passive has a structure where an Asp head attaches to a vP with the feature [AG], which gives rise to an agentive interpretation associated with eventivity (33).

(33) *Eventive passive*

```
              Asp
             /   \
          Asp     vP
                 /   \
               v      √ROOTP
               |      /    \
              AG   √HAMMER   DP
                            /  \
                          the metal
```

22
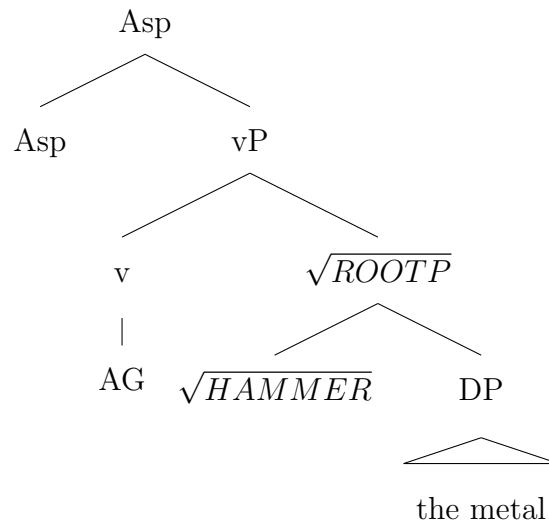
So what about Embick's resultative adjectival participles, which entail eventivity but not agentivity? Embick proposes that resultatives have a different source for encoding eventivity than an [AG] feature on the v. Instead, he employs the feature [FIENT][3] borrowed from Hale and Keyser (1998) & Hale and Keyser (1993), a become operator used to model the structure of de-adjectival verbs like *flatten*. Here we have an Asp_R head which always takes a complement headed by v[FIENT], and v[FIENT] always takes a stative complement (34).

(34)   *Resultative*

$$
\begin{array}{c}
\text{Asp} \\
\diagdown \\
\text{Asp}_R \quad \text{vP} \\
\diagdown \\
\text{DP} \quad \text{v} \\
\diagdown \\
\text{v} \quad \sqrt{FLAT} \\
| \\
\text{FIENT}
\end{array}
$$
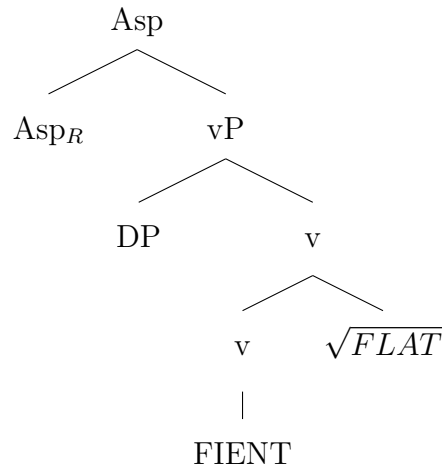
Alexiadou and Anagnostopoulou (2008) apply Embick's criteria for stativity to two morphologically distinct classes of adjectival participles in Greek: *-menos* and *-tos* participles. The *-menos* participle in (35) indicates that there in an accessible frying event, whereas the *-tos* participle in (35b) does not refer to a particular frying event but rather that the potatoes are in a state of being fried, rather than, for example, baked. Crucially *tos-* participles like (35b) do not entail a prior event, passing similar tests that Embick uses to diagnose statives: for example, they can't be modified by

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[3]Short for 'fientive'

manner adverbs or be used with verbs of creation. So, -*tos* participles are considered stative, while -*menos* participles are considered eventive or resultative.

(35) a. *I   patates   ine tiganis-men-es*
          The potatoes are fry-*men*--F.PL.NOM
          'The potatoes have endergone a frying event'

      b. *I   patates   ine tigani-t-es*
          The potatoes are fry-*t*--F.PL.NOM
          'The potatoes are in a fried state'

Embick's three classes of participles, stative (32), eventive (33) and resultative (34), are represented by inserting a root into different templates. The presence of a change of state (COS) interpretation arises for the resultative participles by virtue of the FIENT feature in the template. According to Embick's 'Bifurcation Thesis of Roots' (Embick (2009)) if the change of state meaning component is introduced by a functional head, then it cannot be part of the meaning of the root. Beavers and Koontz-Garboden (2020) argue against this claim, showing that certain COS verbs, namely non de-adjectival COS verbs like *break*, *cook* and *kill* encode a COS meaning in their roots. These contrast with deadjectival COS verbs, like *redden*, *flatted* and *ripen*, which have simple property concept roots (i.e. *red, flat and ripen*) that lack COS entailments.

The particulars of this analysis isn't relevant here, but crucially my analysis follows their lead in employing a certain method. Both analyses focus on whether adjectives imply a grammatically accessible past event. Beavers and Koontz-Garboden (2020) contrasts the entailment patterns of deadjectival and non-deadjectival COS adjectives to show that the former can be built via Embick's regular templates,

24

while the latter involve more complex meanings. This helps them conclude that the deadjectival roots contain a COS entailment. I contrast the entailment patterns of adjectival participles and their cognate verbs to explain the causal relationship between them. I conclude that adjectival participles cannot be represented by inserting verbal roots into regular templates. Instead we need a mechanism like naming to relate the meaning of adjectival participles and their verbal roots.

Target state vs. Post-state participles

The semantic participle types discussed thus far (eventive, stative, resultative) afford us the ability to distinguish between those with just an entailed event, just an entailed state or both. But these types don't tell us anything about the nature of those result states or the different relationships that result states can have to the event. Kratzer (2000) identifies two very different types of result states to contrast two types of participles: target state participles and post-state participles[4]. The difference between the two has to do with reversibility, a notion originating in Parsons (1990). Post-states simply hold by virtue of an event having culminated and will hold forever after. On the other hand, target states are reversible states that are typically associated with a certain event having occurred.

For example, the post states of the events in (36) might be respectively the state of Mel having opened the door, the state of a ball having been thrown, and the state of the bell having been rung. The corresponding target states for the first two events might be the state of the door being open or the ball being on the roof, both of

---

[4]Kratzer (2000) uses the term 'resultant' after Parsons (1990). I opt for Maienborn (2009)'s 'post state' to avoid confusion with Embick (2004)'s resultative

25

which are reversible: the door can be closed; a heroic neighbor can fetch the ball from the roof. According to Parsons, the event in (36c) does not have a reversible target state since there's no way for the bell to be un-rung. All events have a post state associated with them, whereas not all events have a reversible target state associated with them.

(36)   a. Mel opened the door.

       b. Mel threw a ball on the roof.

       c. Mel rang the bell.

Kratzer (2000) diagnoses a participle as a target state participle in German if it can combine with *immer noch* 'still'. So *versteckt* 'hidden' (37) is a target state because it can combine with *immer noch* 'still' and *beweisen* 'proven' (37b) is not because the use of *immer noch* is ungrammatical.

(37)   a. *Die Geisslein   sind immer noch versteckt.*
          The little goats are still   hidden.

       b. *Das Theorem ist (*immer noch) bewiesen.*
          The theorem is   (*still)   proven.

Alexiadou and Anagnostopoulou (2008) also identify a target/post state distinction among *menos-* participles in Greek. Recall that *menos-* participles entail an event has occured. Some of these involve reversible result states which can be modified by *akoma* 'still', while others describe states that hold forever after an event and cannot be modified by *akoma* 'still'. The authors argue that while all *menos-* participles entail an event, only post state *-menos* participles imply agentivity, as evidenced

by their compatibility with agent-oriented modification and by-phrases. In contrast, target state *menos-* participles entail an event but lack agentivity.

To model this, Alexiadou and Anagnostopoulou (2008) take a similar approach as Embick (2004) by arguing that post-state *menos* participles may contain VoiceP (39), which licenses modifiers like agent-PPs, instrument PPs, and agent-oriented adverbs.

(38) *Target menos participles*

```
            ASP
           /    \
        ASP      vP
         |      /   \
        men    v    √ROOT
```

(39) *post-state menos participles*

```
            ASP
           /    \
        ASP      VoiceP
         |      /    \
        men    AG     vP
                     /   \
                    v    √ROOT
```
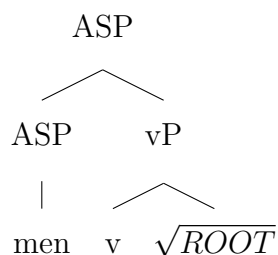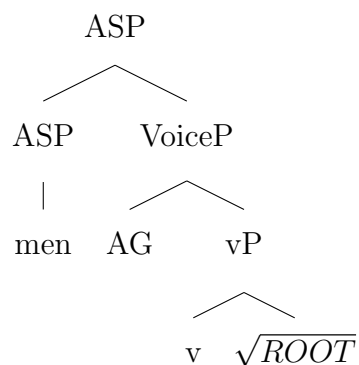
Alexiadou and Anagnostopoulou (2008)'s model encounters a problem in covering all Greek data. Unexpectedly, unaccusative verbs which lack Voice may form post state participles (pg. 40):

(40) *To   grammatokibotio ine (*akoma) adiasmeno*
      The mailbox   is   still   empty

So, post-state participles seemingly may have either the structure in (39) or (38) in Greek. To address this, Alexiadou and Anagnostopoulou (2008) propose that,

27

in addition to the difference in structures, the post state operator is different from the Target State operator, although they are both realized by *-menos*. We end up with both $\text{Asp}_{TargetState}$ and $\text{Asp}_{PostState}$. So, their solution requires both different underlying syntactic structures and different types of stativizer operations to capture the appropriate meanings.

In both Embick (2004) and Alexiadou and Anagnostopoulou (2008)'s approaches, category-neutral roots are inserted into different structures with different features, which give rise to particular readings. In contrast, Kratzer (1998) argues that verbs that allow target state passives are built with both an event argument and a target state argument. This assumes that any sort of stativizer operation can only access a target state meaning in cases where the verb is associated with such a state. For instance, in (41), the verb *pumped up* is associated with both an event argument and a target state argument.

(41) $\lambda x \; \lambda s \; \lambda e$ [pump(e) & event(e) & inflated(x)(s) & cause(s)(e)]

In her analysis, target state participles are derived by existentially quantifying the event argument of a category-neutral predicate with that target state argument:

(42) *It is pumped up.*

Stem: $\lambda x \; \lambda s \; \lambda e$ [pump(e) & event(e) & inflated(x)(s) & cause (s)(e)]

Stativizer: $\lambda R \; \lambda s \; \exists e \; R(s)(e)$

Output: $\lambda x \; \lambda s \; \exists e$ [pump(e) & event (e) & inflated(x)(s) & cause(s)(e)]

As previously mentioned, Kratzer's target stativizer can apply to phrasal and lexical items since and entire VP idiom can be adjectivized in German. For example,

consider (43), where the manner adverbial *schlampig* 'sloppily' cannot modify statives but is allowed in target state passives. Kratzer uses this as evidence that the stativizer affects the entire phrase rather than just the lexical item.

(43) a. *Die Haare waren immer noch schlampig gekämmt.*
        The hairs   were   still   sloppily   combed
        'The hair was still combed sloppily'

    b. **Die Haare waren schlampig fettig.*
        the   hairs   were   sloppily   greasy
        'The hair was greasy sloppily'

Meanwhile, the derivation of a post-state participle involves an aspectual operator, which captures the fact that result state passives have perfective aspect.

(44) *The theorem is proven.*

    Stem + object: λe [prove(the theorem)(e)]

    Stativizer: λP λt $\exists e$ [P(e) & $\tau(e) \leq t$]

    Output: λt $\exists e$ [prove(the theorem)(e)& $\tau(e) \leq t$]

This analysis allows for the fact that if a post state holds at a time, it holds forever after.

Rethinking target states

In Kratzer's view, the derivation of a participle begins with a category-neutral stem. For a target state participle, these stems include a Neo-Davidsonian event variable and a state argument along with a causal relation between the two (i.e. (41)). For post state participles, stems only contain an event variable (i.e. (44)). This view

29

suggests that not only do target states and post-states involve different stativizing operations, but also that the types of stems that each operator can apply to are fundamentally different. Complications arise when we observe that some target states lack event implications, calling into question whether reversibility is a reliable test for determining whether a result state should be represented in the logical form of a participle.

Often target state passives have a predictable event implication. In these cases, we need to have an event of the type denoted by the verb for the target state to be reached. This is demonstrated by (45); we cannot have a pumped-up tire without a pumping up event.

(45)   # The tire was pumped-up but there was never an event of pumping up.

However, sometimes target state passives lack event implications. For example, Embick's statives, like *closed* are compatible with a stative reading (46) in a context where the box is built closed. Embick's explanation is that these behave like 'true' adjectives, derived from a root which is simply ambiguous between stative and resultative participles.

(46)   The box is still closed but there was never an event of closing.

Beavers and Koontz-Garboden (2020) suggest that these are cases where the adjectival participle has become lexicalized, and subsequent lexical drift has led to the loss of an event entailment.

Kratzer also refers to cases where a participle is compositionally related to its corresponding verb, but lacks predictable event implications, for example *obstructed*

(47).

(47)   a. Because of a congenital malformation, tissue obstructed the blood vessel.

        b. The tissue was obstructed but there was never an event of obstructing.
        (Kratzer (2000:393))

Kratzer argues that for these verbs, the Davidsonian argument in the category-neutral stem can be either an event or a state. When it is a state, like (47), the causal relation is between two states: one of which might be the tissue's being where it is.

Other such cases where participles lack an event entailment include spatial extent readings of participles (i.e. *the road narrowed at the end*) or degree achievements that lack change of state entailments (i.e. *reduced fat mayo*) (Koontz-Garboden (2010), Deo et al. (2013)). Koontz-Garboden (2010)'s solution is that verbs with spatial extent readings can have corresponding participles which entail events of spatial change or otherwise some sort of value difference.

In addition to issues with the right representation for target state participles, there have also been issues with the tests used for identifying them in the first place. In more recent literature, there has been pushback to the reliability of using the *immer noch* test as a strategy to distinguish between post state and target state participles. Kratzer (2000:387) herself points out that the test is not always reliable. According to her, if a participle passes the *immer noch* test it can reliably be deemed a target state participle. However, if it does not pass the test we can still sometimes get target state readings. For example, (48a) and (48b) can be felicitous in contexts where people come back to life or potatoes turn raw again. In contrast, Kratzer

31

argues that "true" resultant state passives like (48c) and (48d) can never have target state meanings.

(48) a. #Melchiades is still dead.

  b. #The potatoes are still cooked

  c. *The feast is still over.

  d. *The homework is still done.

Pross and Roßdeutscher (2019) raise several more serious concerns with Kratzer's *immer noch* test and its ability to pick out the right properties to distinguish target state readings from post state readings. For example, we can use established tests (e.g. Beavers (2010)) to show that certain verbs lexicalize a change of state. For instance, (49a) indicates that *verbrannt* 'burnt' lexicalizes a change of state. If this is the case, we would expect that these verbs should always be compatible with *immer noch*, but that is not the case, as seen in (49b) (Pross and Roßdeutscher (2019:32)):

(49) a. #Das Papier ist verbrannt, aber (es ist nicht verbrannt/nichts an ihm ist anders).

      The paper is burnt, but (it is not burnt/nothing is different about it).

  b. *Das Papier ist (*immer noch) verbrannt.*
      The paper is (*still)   burnt.

Pross and Roßdeutscher (2019) go on to argue that the distinction between target and post-states is not a distinction between reversible and irreversible states but rather that of individual states and eventive states. While target states can be determined

by inspecting the individual properties of an entity, post states are dependent on whether it is true that an entity has participated in an event at a given time. For example, the state of a ball being on a roof can be determined by examining the individual properties of the ball at a given time. In contrast, the post state of the ball having been thrown is dependent on the ball's participation in a throwing type event. Pross and Roßdeutscher (2019) and others have drawn a parallel between this notion of target/post states and Maienborn (2007)'s 'Kimian' vs. 'Davidsonian' states, whereby the former refers to states that hold of an entity at a given time and the latter refer to causal effects of a given event.

Alternative representations of adjectival participles

According to Kratzer, target state participles are derived by operators that retrieve target state properties, which are only available for some predicates. On the other hand, many verbs have a post-state property available, as long as we can derive so-called 'job is done' readings from them. For example, the target state reading of (50) implies that the building is empty, whereas there could be a scenario where a building is reported as evacuated after tenants have moved back in. (example from Kratzer (2000:395))

(50) *Das Gebäude ist geräumt.*
       The building is   evacuated

For Maienborn (2009), these job is done readings are extremely important not because they allow for post state readings, but because they allow for target state readings where we might not expect them, specifically with activity verbs. For ex-

ample, "the cat is petted" can be coerced into a natural adjectival interpretation in certain contexts. Maienborn (2009:32) offers such a context:

(51) *Anna hat ihre Nachbarspflichten erfült: Der Briefkasten ist geleert,   die*
Anna has her neighbor-duties   fulfilled: The mail-box   is emptied the
Blumen sind gegossen und die Katze ist gestreichelt.
flowers are watered, and the cat   is petted.
'Anna has done her neighborly duties: the mailbox is emptied, the flowers

are wattered and the cat is petted.'

The idea is that in (51) there is an expectation set up that an event of Anna petting the cat is on par with her other duties. So, the target state associated with the petting event is that the task is completed. Therefore, even though the participle *petted* is not typically associated with a target state, we can coerce one given a rich enough context. Maeienborn also points out that it is easier to coerce participles into adjectival readings with figurative uses:

(52) *Meine Seele ist gestreichelt.*
My   soul is petted.
'My soul is caressed.'

Like the job is done readings, Maienborn shows that even statives like *wissen* 'know,' which Kratzer (2000) claims cannot be used as adjectival participles, can be coerced into contexts where we can get adjectival participle readings. For example, a contrastive setting like (53), which creates a salient alternative to the answer being in a "known" state.

(53) *Is die Antwort gewusst oder geraten?*
Is the answer known or   guessed?

34

Where Kratzer assumes that certain participles lexicalize a target state, Maienborn (2009) puts more stock into the role of pragmatics in deriving different readings of participles. As previously mentioned, for her all adjectival passives, whether target state or post-state, offer a way of creating potentially new *ad-hoc* properties based on the event denoted by the verb. A key argument for this perspective comes from the observation that there are idiosyncratic properties associated with adjectival passives which aren't accounted for by Kratzer's stativizers. For example, in (54a) the adjectival passive is associated with properties not found in the perfect (54b), namely that the manuscript is noteworthy or reputable (Maienborn (2009:38)).

(54)   a. *Das Manuskript is von Chomsky zitiert.*
          The manuscript is by   Chomsky cited

       b. *Das Manuskript ist von Chomsky zitiert worden.*
           The manuscript has by   Chomsky cited been.

In order to capture this function, she posits an underspecified zero-affix for all adjectival passives

(55)   Adjectival $\varnothing$-affix: $\lambda P \lambda x \lambda s \exists e$ [s: Q (x) & result (e,s) & P(e)]

Q is the property that holds for the subject referent x in a state s. Q is further restricted as resulting from the verbal event e, In other words, for the adjectival passive to be interpretable, the free variable Q must be given a suitable value by the context. If the conceptual knowledge associated with the verb's event referent happens to already specify a result property, that will be a good choice for Q. Otherwise, we need to derive it from context. When we get no Q (which seems to just mean when we get no salient result from the verbal event e) then we get a post state

35

reading; in other words, there is not a Q that applies to x such that the pre and post state have a significant contrast.

Maienborn argues that we can see the ambiguity between target and post-state readings in (56) in a context where an author succeeded in finishing and submitting a manuscript to a journal, but the manuscript was rejected, thus making the manuscript not in a state of being submitted. (example from Maienborn (2009:42))

(56) *Das Manuskript ist zwar   eingereicht, aber es ist nicht eingereich,*
      the manuscript is though submitted, but it is not   submitted
      sondern abgelehnt.
      but   rejected

For Gehrke (2015), Maienborn takes the role of pragmatics too far. Gehrke offers an analysis which acknowledges the ability for context to coerce stative readings but also leaves space for certain states to be lexicalized to some extent. She argues that good inputs to passivization are associated with a change of state along a unique, one-dimensional scale. The key aspect of her analysis is that the events and states represented by adjectival passives remain in the kind domain. We end up with the following representation, where an event kind is existentially quantified and Carlson's realization relation (R) instantiates a token of a state kind.[5]

(57) Die Tür ist geschlossen.

      the door is closed

      $\exists e_k, s_k, s[\text{BECOME}(e_k, s_k) \ \& \ \text{THEME}(e_k, \text{door}) \ \& \ \text{closed}(s) \ \& \ \text{THEME}(s, \text{door})$
      $\& \ \text{R}(s, s_k)]$

---

[5]Gehrke employs the following informal event semantics of BECOME from Von Stechow (1998): (P)(e) = 1 iff e is the smallest event such that P is not true of the prestate of e but P is true of the target state of e.

For Gehrke, bad inputs to adjectivization lack a change of state along a unique, one-dimensional scale. In the absence of such a scale, the verb can be licensed by pragmatic context in a similar vein to Maienborn's account.

1.2.4 Research questions

The use of adjectival participles differs from verbal participles. While all participles can be used as verbs to denote events, only some can be used as adjectives to name properties, barring some special pragmatic licensing:

(58) a. ?The necklace is made

  b. The necklace was made

  c. ?The meeting is Herbert-led

  d. The meeting was led by Herbert

  e. ?The bicycle is ridden

  f. The bicycle was ridden

By the same token, while not all verbs *are* used as adjectives, there is a sense that they *could* be. That is, if there is some property of being *made* or *Herbert-led* or *ridden* that we can observe and want to comment on, the sentences in (58) seem like a logical place to start. In fact, adjectival participles are quite often used for such innovations:

(59) This party is lit

(60) That is a snatched look

This leaves us with two seemingly incompatible truths: that the use of adjectival participles is quite constrained and that adjectival participles are regularly used as vehicles for innovation. This brings us to the main research questions of this investigation below, which are listed along with the chapter that will address them:

- How are verbal and adjectival participial forms interpreted? (Ch. 2)

- How can we explain the interpretations and distribution of participial forms, especially adjectival participles? (Ch. 2)

- How are compound participle forms interpreted? (Ch. 3)

- How can we explain restrictions on the modifiers that can be used with adjectival participles? (Ch. 3)

- What patterns of meaning do we observe in the relationship between participles and their modifiers? (Ch. 4)

The answer to this last question requires me to draw a distinction between combinations formed with regular grammatical rules, which we will term DIRECT COMPOSITIONS and combinations that are names. So, the dissertation will conclude by addressing one additional research question:

- What quantitative evidence is there for the distinction between direct composition and naming? (Ch. 5)

1.3 Usage-based approaches to explaining grammar

The central claim in this dissertation is that participles can be used as names for referring to observable phenomena associated with events. A naming convention relates the meaning of the property and the implication of an earlier event to the past participle form of the associated verb. In Chapters 2, 3, and 4, the distinction between (i) word meanings derived through a lexical rule alone and (ii) words whose meaning is assigned through naming, will help answer the research questions above.

In Ch. 5 I will seek further quantitative evidence by contrasting compounds like *tear-stained* (which I argue is a name), with phrases like *stained with tears* (which is not). Since this distinction is a usage distinction, a speaker can choose either method of composition. The core factor motivating that choice is hypothesized to be the following: A speaker is more likely to compose a name, if they feel that the meaning they are expressing will need to be more frequently expressed again in the future.

The theory presented in this dissertation draws on insights from usage-based approaches to grammar, which Bybee (2006:711) characterizes as views that "take grammar to be the cognitive organization of one's experience with language." What this means is that speakers' experience with language, including the frequency with which they encounter certain words, collocations and constructions, has a direct impact on their grammar. Thus, usage-based approaches are particularly apt at explaining how tendencies in language use lead to judgements beyond a binary gram-

matical/ungrammatical distinction, such as the degree to which a speaker recognizes a name as conventionalized or innovative. Since not a lot of the literature on participles comes from this tradition, I will briefly highlight some of the important trends and relevant concepts here which will be helpful later in contextualizing the naming theory within a wider literature. Note that the naming theory does not require us to adopt a view in which usage is indistinguishable from grammatical representations, nor am I advocating for such a view here. Rather, I suggest that certain insights from usage-based approaches are helpful in understanding how exactly speakers leverage naming so that their language is capable of expressing their observations about the world.

While usage-based approaches to grammar have been around since at least Hopper (1987) and Langacker (1988), the technology for empirically testing these frameworks has recently improved. A substantial portion of this dissertation involves the use of a large corpus, enTenTen15 (see Jakubíček et al. (2013)), which contains over 13 billion words. Chapter 4 is a detailed description of what we term 'complex participles' in the corpus, multi-word adjectival participles with additional preceding modifiers such as *rain-slicked* and *leather-bound*. The aim of the chapter is to describe the semantic patterns that emerge for these constructions to better understand the analogy-based conventions that drive naming.

1.3.1 Entropy

Since the formation of names is primarily driven by a notion of reusability, looking at frequency data in a corpus is a helpful tool for highlighting relevant patterns of

use. Frequency data can be used in many ways. For example, association measures can tell us that certain words collocate more strongly than others, such as idioms, particle verbs and prefabricated utterances (aka "prefabs"). (Bouma (2009), Pecina (2008)). We can also use frequency data to measure what patterns speakers are likely to anticipate. Specifically this dissertation uses a statistical notion of uncertainty termed entropy, which was introduced into information theory by Shannon (1948).[6]

Entropy is associated with surprisal. Uses of language differ with respect to how surprising speakers find them. Consider a scenario where the following sentences are uttered:

(61)   a. It's raining cats and (BLANK)...

          b. This morning I (BLANK)...

In (61a), an English speaker familiar with the idiom *it's raining cats and dogs* understands that the next word in this sentence is likely to be *dog*, and therefore if they hear *dog*, they will not be surprised. In (61b) a speaker will be less certain of what comes next, and if they hear *went running* there will be a higher degree of surprisal, though likely not as high as if what came next was *bought an island*, depending on the speaker. Regardless, there is more variability with respect to potential ways a speaker is likely to finish this sentence. To understand the entropy of the empty slots in the sentences in (61) we want to look at the *average* degree of surprisal in the use of that sentence.

More recently, entropy and related notions have made their way into research

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[6]For more detail on related historical and theoretical notions of entropy see e.g. Jaynes (1980), Lesne (2014).

in natural language processing and linguistic theory. Association measures have been used to identify salient verb-argument collocations (e.g. Van de Cruys (2011), Chambers and Jurafsky (2008)), to improve automatic text categorization (e.g. Schneider (2005), Xu et al. (2007)), and for a range of semantic relatedness tasks (e.g. Damani (2013), Recchia and Jones (2009), Taboada et al. (2006)). There have also been similar computational methods for determining the syntactic flexibility of multi-word expressions (e.g. Hanks et al. (2018), Gayen and Sarkar (2013)) and developing probabilistic grammars (e.g. Hale (2003)).

Perhaps most relevant to the current dissertation, Lebani et al. (2015) use entropy measures to quantify variability in idioms. They base their analysis on data from Tabossi et al. (2011) which elicits normative judgements of Italian idioms based on measures like predictability, literality and syntactic flexibility. Lebani et al. (2015) finds that entropy measures based purely on distributional evidence correlate with the psycholinguistic judgements in the dataset. This connection between distributional methods and cognition is particularly pertinent for usage-based approaches to modeling language, since the goal of quantitative approaches to language is to ultimately model the cognitive systems that they reflect

In this dissertation, we are specifically interested in how the use of a participle as a name differentiates it from direct composite uses. Chapter 5 is a quantitative analysis of complex participles aimed at testing the claim that speakers treat names and direct composites differently. Specifically, we hypothesize that components of names, such as *tear* and *stained* used as *tear-stained* should have lower entropy than the same components used as a direct composition such as *stained with tears*. In other

words, speakers should be more certain about what x is likely to be in *x-stained* than in *stained with x*. Since this does not involve a distinction in the representational system in the usual sense, but rather a distinction of usage, entropy provides a way of looking for different forms of evidence that speakers use these types of composition in different ways.

1.3.2   Chunking

Entropy is used in this dissertation to quantify the difference between uses of participles as names versus direct composites. This difference can naturally be interpreted as having a cognitive correlate with respect to how closely-related linguistic units are stored. Literature in memory research provides evidence that learners deliberately and automatically chunk information into units for more economical storage (Gobet et al. (2016)). In his seminal paper, Miller (1956) establishes that chunking information helps to overcome capacity limits on short-term memory. Since naming is a mechanism for creating shortcuts for referring to commonly encountered concepts, we might liken it to chunking.

Notions of chunking differ by field. For example, in literature on perception, chunking is related to principles of gestalt, which describe how humans organize complex stimuli into simpler concepts by grouping similar things together (Gobet (2017)). In natural language processing, chunking is typically understood with respect to 'shallow parsing.' Abney (1992) first suggested chunking as a first step of a parser, a practice which is common today for improving performance on a variety of NLP tasks (Tjong Kim Sang (2002)).

The concept of chunking has played a significant role in usage-based models of grammar. Bybee and Hopper (2001:3) describe a major principle in studies of language use: "the frequency with which certain items and strings of items are used has a profound influence on the way language is broken up into chunks in memory storage, the way such chunks are related to other stored material and the ease with which they are accessed." Research from this perspective has suggested that chunking plays a major role in the emergence of multi-word expressions, especially as it relates to the phonological shape of lexical items (Bybee (2000) and the diachronic emergence of constituents (Beckner and Bybee (2009)).

A word of caution worth mentioning here: Chunking is a gradient phenomenon. That is, the nature of grouping things into units is such that chunks can recursively combine to create bigger and bigger chunks. This property makes usage-based approaches to language modeling particularly compatible with theoretical frameworks which also treat signs themselves as having gradient fixedness, such as construction grammar. While the naming theory could certainly be implemented in such a framework, in this dissertation we maintain that there is a categorical distinction between naming and direct composites. That is, a speaker may choose one or the other compositional strategy for assembling morphemes, but importantly there is gradation with respect to how likely the speaker is to choose one strategy over the other. This will be discussed in more detail in Chapter 3.

1.4 Roadmap to this dissertation

This dissertation provides a novel approach to the semantics of past participle construction in English, grounded in a usage-based approach. We argue that certain uses of past participles, roughly correlated with adjectival participles, are treated as names by speakers, signs that refer to unique, reusable property states named after an associated event. Chapter 2 details how naming can be used to explain the interpretations of adjectival participles in English. Chapter 3 extends the naming theory to compound participles and explains how the composition of names places special restrictions on their form. Chapter 4 is a descriptive corpus study of compound participles and Chapter 5 is a quantitative study on how the naming/direct composite distinction is reflected in entropy measurements.

Chapter 2

Single-Word Adjectival Participles

2.1 Introduction

This chapter is about participles that consist of a single word, such as the word *stained*, in *the stained shirt* or *the shirt is stained*.[1] Participles consisting of more than one word, or *compound* participles such as *tear-stained*, in *the tear-stained shirt* or *the shirt is tear-stained*), as well as participial phrases such as *stained with tears*, are addressed in Chapters 3 and 4.

Participles are traditionally defined as verb forms that can have adjectival grammatical functions. We survey a range of different constructions in which participle forms appear, some apparently ADJECTIVAL and others VERBAL. English past participle forms have VERBAL functions in perfect constructions (*I've torn it*) and verbal passives (*It was being torn*); and ADJECTIVAL functions when used as attributive modifiers of nouns (*(un)torn shirt*) and predicates of copular constructions (*It*

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[1]This chapter was co-written with Stephen Wechsler

is/seems/remains (un)torn). We will assume, based on well-known distributional evidence, that the English participles in the respective grammatical functions belong to different grammatical categories, verb (V) and adjective (A).[2] However, for theoretical purposes here very little hinges on that decision, for we are primarily interested in the semantics of participles. As we will see, the interpretation of a given utterance of a participle turns out to depend on both the lexical category of the participle (V versus A) and the construction within which it appears.

Speakers use adjectival participles to refer to properties of individuals (e.g. the 'stained' property), and to the event type denoted by its verbal root ('staining'). The goals of this chapter are, first of all, to explicate this relation between property state and event, by describing the interpretation of adjectival and verbal participles across the different constructions in which they are used. We also describe the distribution of different verbal roots across the participial constructions. Finally, we seek to explain those patterns of distribution and interpretation.

That explanation is based on recognizing the original RESULTATIVE function of participles: to connect certain obervable property states with their causal origin: a shirt's stain is caused by a prior staining event. So we start with that resultative function in Section 2.2. Then in subsequent sections we see how the loss of either the event or property state component of the meaning of a participle gives us other functions of participles.

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[2]Many adjectives accept negative *un-*, while no verbs do; many verbs are ditransitive, hence retaining an object in the passive (*He was sold a car*); no adjectives are transitive, hence none allow the retained object (**He remained unsold the car; The car remained unsold to him.*)

2.2 Resultative participles

2.2.1 The emergence of resultative participles

The earliest use of the participle form was the adjectival target state use, in which the participle is interpreted as a characteristic outcome of a certain event type (Traugott (2010)). In these uses, the target state consisted of a property of the *affected theme* participant in a causing event, that is, a participant that undergoes a change as a result of the event: in the event described in *Someone tore the shirt*, the affected theme is the shirt. When the participle *torn* is used as an adjective predicated of that individual, it indicates a property of that individual: *The shirt is torn.*

Resultative participles originally had a broader range than now. Specifically, Old English had target state participles built on some intransitive motion verbs, in addition to change of state verbs:

(62) Old English resultatives (a cited in Traugott 1972, 84; b and c cited in Smith (2001:361))

    a. *Swae claene   hio (lar)   waes othfeallenu*
        so   completely she (education) was   decayed
        'she (education) had so completely decayed'

    b. *Nu   si es   dag cumen. (Beowulf, line 2644)*
        Now is the day come
        'Now the day has come.'

    c. *da   wes winter scacen   (Beowulf, line 1136)*
        when was winter departed
        'when winter had departed'

Most of these motion uses were later supplanted by the *resultative perfect* using the auxiliary *have*, seen in the modern English translation lines in (62). Note that the target of 'coming' is to be here: (62a) would only be true if reference time was on the day in question. The state involved is 'being here' while the event is the coming. Similarity, (62b) is true of a reference time when winter is not present. One point of these examples in the present context is that the target state use of the past participle did not originally grow out of the passive. Instead the passive was a grammaticalization of the resultative (see Section 2.3.1 below). The verbal passive also fed the formation of adjectival passives with many more verbs without target states, including verbs of all aspectual classes, with or without target states (see Section 2.3.2 below). But the resultative participle is the fundamental sense and it is that sense that we focus on in this section.

2.2.2   How resultative participles influence verb meaning

The advent of a resultative participle of a given transitive verb often influences the meaning and event structure of the verb itself: it provides the verbal event with a target state. This may seem backwards from what is expected, given the morphological marking of the participle. But the resultative participle is a name for a kind of observable phenomenon, which it serves to connect causally with the event type denoted by its root. The influence of the participle on its root meaning is a kind of back-formation. In fact English has some verbs that were literally back-formed from participles, in the sense that the participles appeared first, before the finite verbs.

49

(63) Some English back formations

abscess$_V$ from *abscessed*

amaze from Middle English *amased*

computerize from *computerized*

custom-make from *custom-made*

dapple from *dappled*

dishevel from *disheveled*

gnarl from *gnarled*

hard-boil from *hard-boiled*

housebreak from *housebroken*

isolate from *isolated*

sunburn$_V$ from *sunburned*

superannuate from *superannuated*

But more interesting are cases where the verb existed first, but the new participle gave rise to a distinct RESULT VERB sense. When the older non-result verb sense persists, we get verb polysemy. For instance, the verb *crack* started as primarily a manner verb denoting actions that produced a sharp sound (64a). Among the more common such actions were breaking actions. In the mid-1500s a resultative participle *cracked* arose with the specific sense of being broken without having come apart (64c). Around the same time the transitive verb developed a distinct sense of bringing about this cracked state (64b) (examples from the *Oxford English Dictionary*):

(64) a. **crack$_1$**: To make a sharp noise in the act of breaking, or as in breaking; to make a sharp or explosive noise (said of thunder or a cannon, a rifle,

50

a whip, etc.)

Comyn salt cracketh and sperkleth in fyre. (1495)

b. **crack$_2$**: To break anything hard with a sudden sharp report; now chiefly of things hollow, a skull, a nut, etc.

To cracke the nutte, he must take the payne. (1553)

c. **cracked$_{Adj}$**: damaged and showing lines on the surface from having split without coming apart

Not woorth a crakt nut. (1562)

In modern English the result sense dominates, in examples such as (151a). The adjective *cracked* in (151ac,d) has the target result sense in (64c), 'damaged and showing lines on the surface from having split without coming apart'. Moreover, the transitive verb (64a), seems to entail this result, suggesting a distinct sense (*crack$_2$*).

(65)   a. John cracked the glass.

b. The glass is cracked.

c. The cracked glass.

Meanwhile, the older manner (sound emission) sense persists in various expressions such as *crack the whip, crack one's knuckles,* and so on.

(66)   a. John cracked the whip/ his knuckles.

b. The whip is cracked.

c. the cracked whip

The participial forms in (66b,c) lack a target state reading, and have only the post-state reading: they presuppose an earlier event in which someone cracked the whip.

51

Let us review the historical process more carefully. The verb *crack* started out as a verb referring to the emission of a sharp sound ('To make a sharp noise'), and also used for referring to actions that caused such a sound. The OED notes in particular that these uses included sharp noises made 'in the act of breaking, or as in breaking', but also notes other sources of sound such as 'thunder or a cannon, a rifle, a whip'. No evidence is given that the verb was genuinely polysemous; instead it seems that breaking was just the most common source of sharp sounds, which seems plausible. So let us suppose that the verb was general, not polysemous, at that stage.

At some point a distinct transitive verb 'breaking' sense of *crack* emerged. It is not clear whether the participle or the transitive verb was attested first with this special breaking meaning. But in any case the *concept* denoted by the participle had to have emerged in order for the transitive verb to have a distinct sense that incorporates that target state. That property state concept is what gets named by the adjectival participle *cracked*.

So the adjectival participle *cracked* emerged for referring to the phenomenon described in (64c): 'damaged and showing lines on the surface from having split without coming apart'– and for connecting this phenomenon with prior actions causing a sharp sound. One outcome of this diachronic process is a manner-result sense of the transitive verb *crack*: it encompasses both the sound-emission manner and the damaged-and-showing-lines result. The other is of course the existence of the resultative participle *cracked*.

There are many English verbs with this historical pattern of development from

52

sound emission to the physical result: *click, smack, clash,* and *crash*, among others. A relatively recent example is *click*, originally (and still) referring to the emission of a thin, dry, hard sound, and actions causing such a sound (67a,b). Since the 1990s, we speak of 'clicking' a link in an electronic interface, in order to activate a program function or select a particular item on the screen (67c).

(67)   a. **click**₁: To make a thin, dry, hard sound.

(*1682. The little clicking sound of the Dead-Watch.*)

   b. **click**₂: To strike with a click; to cause (anything) to make such a noise.

   c. **click**₃: Computing. To press (one of the buttons on a mouse) and release instantaneously or hold down while performing another action; to activate (a program function) or select (a particular item) in this way, having first positioned the cursor on the appropriate part of the computer screen. (*2000. PC World. Click an entry and drag it to the Insert menu.*)

An example of the verb (68a) and the adjectival participle (68b), the latter from the Corpus of Contemporary American English:

(68)   a. I clicked the link.

   b. Now to figure out how to make the clicked links change color.

Note that the definition of **click**₃ in (67b) does not mention sound emission. This is accurate; not all computer mice or trackpads make a clicking sound, and so the sound emission component has been lost from this sense.

A fundamental point to emphasize here is that the eventive verb root *crack* and the stative participle *cracked* (or *click* and *clicked*) are autonomously grounded in

reality. Events that we identify as 'cracking' are not always associated with achieving a 'cracked' state. Although this is especially clear with sound emission verbs, the detachability of the result is a general property of accomplishment verb-participle pairs. The grounding of a verb root can include utterances in the past imperfective like (69a) and conative constructions like (69b):

(69)   a. John was breaking the branch (but I stopped him before it broke.)

       b. John cut at the fabric (but could not pierce it).

It is clear that we conceive of breaking and cutting actions independently of broken or cut property states. We know that breaking involves 'a blow, shock, or strain' and that cutting involves the use of a blade, and can identify such actions in our experience. We know that broken things are in pieces and that cut things are severed or have an incision, and can identify such states in our experience. But we lack a grounded concept of RESULT such that the **cut'** state is the RESULT of **cutting'**, the **broken'** state is the RESULT of **breaking'**, and so on for other verb-participle pairs. So while we can describe the participle in terms of the verb, this description is inadequate for fully defining the participle. It must be independently grounded.

2.2.3   Naming and describing

The resultative expresses a complex concept, bringing together a state at reference time and a prior event. The term RESULTATIVE obviously alludes to the result of the event; other terms for the state are RESULT STATE and TARGET STATE. Note that words such as result and target are biased towards a focus on the EVENT, and

are perhaps chosen because linguists are interested in deriving the meaning of the participle from its verbal root. However, from a functional perspective it is often more appropriate to focus on the state, since that is what the participle directly portrays as holding at reference time. So a more appropriate term for participles with this function is ORIGIN PARTICIPLE. This type of participle functions by identifying a state in terms of its origin, specifically, in terms of the type of event that brought about that property. In *The glass is cracked*, the participle *cracked* describes an observable property of the glass and also gives some information about the origin of the state, namely a prior event of *cracking* that gave rise to it. We will continue to refer to the state as the target state.

We will say that an adjectival participle NAMES a kind of property state and simultaneously DESCRIBES the causal origin of that state by means of its verbal root. More theoretical background on the distinction between naming and describing is provided in Section 2.5 below, where it is related to the causal theory of reference. For now, we attempt to develop an intuition for it through examples. In *The glass is cracked*, the participle *cracked* names the kind of state in (64c): (the glass is) 'damaged and showing lines on the surface from having split without coming apart'. It also describes the origin of that state from a process given in (64b): Someone/Something *cracked* the glass., where to *crack* is 'to break anything hard with a sudden sharp report'. The description of the referent of *cracked* is stated in terms of another word, namely the verb *crack*; and like all descriptions it is partial, relative to the name.

Naming things after descriptions of their origin is very common in natural language. Here are just a few of the many categories of origin-based naming:

(70) a. region of origin: edam cheese, champagne

b. family of origin: John Smith

c. method of creation: mashed potatoes

The term *edam cheese* names a particular style of cheese, namely a semi-hard cow's milk cheese with a pale-yellow color, and a mild, nutty, salty flavor when it's young, which becomes sharper and tangier as the cheese ages. It is named after the town of Edam in the Netherlands where the style originated. So Edam is also an abbreviated description of its origin. Nowadays this style of cheese is produced in many places besides Edam, and the meaning of the term *edam cheese* is for most practical purposes disconnected from its town of origin. Many speakers learn all they need to know about the meaning of *edam cheese* by eating it. The two phenomena are only connected insofar as the name for the cheese style identifies its place of origin.

Names do not have to indicate origin, of course. *Blue cheese* (also called blue vein cheese) is named for its color, not for any aspect of its origin. We can connect blue cheese to information about its origin with extra words, such as words for its plausible place of origin (Roquefort, France), words for the production method (growing mold on milk curds), or other aspects of its origin. But the name blue cheese does not connect this style of cheese to its origin.

Similarly, property states can be connected to their originating events in different ways. (Or, to put it differently, event types can be connected to their target states in different ways.) Much of the literature on event structure has focused on three ways. First, there are constructions that include distinct names for both the event type (*hammer*) and the target state (*flat*) (see 71a). Second, event types

can be named after root adjectives denoting the property state, forming inchoatives (71b) and causatives (71c). Also, Beavers and Koontz-Garboden (2012) and Beavers and Koontz-Garboden (2020) have pointed out many verb roots such as *drown* that entail both the event and the state (71d,e) (example 72e is from Beavers and Koontz-Garboden (2012), Beavers and Koontz-Garboden (2020)):

(71)   a. Sue **hammered** the metal **flat**.   *resultative secondary predicate*

        b. The dough **flattened**.   *de-adjectival inchoative*

        c. Sue **flattened** the dough.   *de-adjectival causative*

        d. John **drowned** the zombie.   *verb names an event/result complex*

        e. The zombie **drowned**.   *verb names an event/result complex*

The main purpose of this chapter is to call attention to another means of connecting event and state: by using resultative participles as names for observed property states. An example is *cracked* in (72b,d):

(72)   a. John cracked the glass.

        b. The glass is cracked.

        c. John cracked the whip.

        d. John cracked his knuckles.

In a sense this last type could be seen as a variant of type with a verb *root*, rather than the participle, denoting a complex, since the target state expressed by the participle in (72b) applies as well to (72a). However, the verb only has the complex meaning in (72a), not in (72c,d).

2.2.4 Culinary participles

Cooking terminology is rich in participles. Dishes are often named after the method of preparation: *fried chicken, baked potatoes, poached eggs, mashed potatoes, steamed clams*, and so on. The reasons they are so common is rather obvious: The method of preparation has a big influence on the dish, so it's an effective means of classification. In addition this way of naming a dish gives some immediate background on how to prepare it.

The term *(southern) fried chicken* refers to a dish in which the chicken pieces are breaded before frying, producing a crispy outer layer. When a child first learns the term *fried chicken*, they associate it with a concept of a certain kind of food, and only later, after they become interested in cooking, do they associate it with the concept of FRYING after which it is named. Un-breaded chicken can be pan-fried and still be technically considered 'fried,' and yet the special crispy property meaning of 'fried chicken' comes from a common experience with the name for the product, not the process for making it. The word *fried* is a modifier of different kinds of food: *fried chicken, fried potatoes, fried onions*, and so on. All of those dishes were dubbed with names that included *fried*, using a simple naming convention: name the kind of food after some crucial aspect of the process of preparation (here, frying). Once a dish is named, that name (with that denotation) that is passed down from speaker to speaker in a causal chain (see Section 2.5). Those speakers learn about these names through their experience with fried chicken, fried potatoes and fried onions. The names are said to be GROUNDED in their experience with these dishes. Meanwhile the meaning of the verb *to fry* is grounded in experience with methods of cooking in

hot oil.

The point here is that the notion that speakers conceive of the meaning of the adjectival participle solely in terms of a pre-existing verb root, plus a grammatical process of derivation, is an illusion. The word *fried* may be grammatically derived from the verb *fry*, but our interpretation of the term *fried chicken* is primarily derived from our experience with fried chicken. It is only by virtue of our experience with names for properties that we come to infer the all the relevant aspects of the meaning of the related verb. Suppose (as a child) you try fried chicken and you like it. Later you figure out that fried chicken is a result of frying (cooking in oil). At that point you have learned not only about fried chicken, but also about frying: namely that it is an action that is carried out with the intention of creating this food that you like. More generally, adjectival participles are grounded in experience, and as a result that experience also contributes to our understanding of the verb root.

2.2.5 Argument alternations and named states

When an event takes place, there are many potential target states a speaker might want to talk about. This is because any event has multiple consequences. Say Steve waters some flowers. The consequences of that event may include that the soil gets wet, that the watering can gets empty, that the flowers grow, that Steve splashes some water on his shoes and/or that Steve feels accomplished. Here, the post state is Steve having watered the flowers, but any of the consequences above could be defined as target states, for instance by using an adjectival participle as a name. While our world knowledge allows us to reason about events and their potential

consequences, only some of those consequences become significant to the grammar. The question becomes, which consequences are noteworthy enough for a speaker to comment on? And, therefore, which consequences do speakers comment on enough that the grammar treats them as grammatically relevant[3] target states?

There are many ways that speakers can connect events with specific consequences. For instance, speakers can introduce or highlight target states by using a resultative construction. The target states of the events described in (73a-c) are that the sidewalk is clean, the metal is flat and that Harold is in a stupor, respectively. We can think of all of these states as potential consequences of their associated events, for example the sidewalk being clean is a potential consequence of Steve watering it. In using the resultative construction, the speaker is explicitly asserting that a certain target state holds of the object following the event.

(73) a. Steve watered the sidewalk clean

 b. Whitney hammered the metal flat.

 c. Harold drank himself into a stupor.

The types of target states that can be used in resultatives are constrained by specific requirements regarding the relationship between the property scale and the event that are imposed by the construction itself (Wechsler (2005)). The types of target states that are named by adjectival participles are simply determined by what properties are most frequently correlated with the event. When a speaker uses *watered* as a

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[3]Certain approaches to the decomposition of word meaning consider certain ontological features 'grammatically relevant' such that words with those features will have some unified aspect to their behavior, such as verbs with lexicalized results behaving as accomplishment verbs. See also 'event referential' aspects of verb meaning (McNally and Spalek (2022))

passive to name a certain state of the individual, as in (74), the name represents a particular consequence of watering.

(74) The flowers are watered.

In events with multiple participants, name-worthy target states can be defined on different participants. For example, consider events of loading hay on a truck. The participle *loaded* can be used to name a target state that applies to the hay or to the truck.

(75) a. The truck is loaded$_1$ (with hay).

b. The hay is loaded$_2$ (on the truck).

We can treat *loaded$_{Adj}$* as polysemous with these two uses.

(76) a. *loaded$_1$* $\rightsquigarrow$ **loaded$_1$'**

b. *loaded$_2$* $\rightsquigarrow$ **loaded$_2$'**

The property that holds of the truck at the end of an event of *loading* is the state of being full of some cargo, while the property that holds of hay is the state of being in a container.

(77) a. **full-of'**$(y,z)^t$: container y is full of z

b. **inside-of'**$(z,y)^t$: z is in/on container y

As before, implicational relations holding between these constants are represented with meaning postulates.

(78) Meaning postulates for *loaded$_1$*:

61

a. $\Box \forall s, y, t[\mathbf{loaded_1}\text{'}(s,y)^t \implies \mathbf{full\text{-}of'}(y,z)^t]$

b. $\Box \forall s, y, t[\mathbf{loaded_1}\text{'}(s,y)^t] \implies \exists e, x, y, z, t'[\mathbf{load'}(e, x, y, z)^{t'} \wedge \text{CAUSE}(e,s)$
$\wedge\ t'\ \supset\subset\ t]$

(79) Meaning postulates for *loaded₂*:

a. $\Box \forall s, z, t[\mathbf{loaded_2}\text{'}(s,z)^t \implies \mathbf{in\text{-}container'}(z,y)^t]$

b. $\Box \forall s, z, t[\mathbf{loaded_2}\text{'}(s,z)^t] \implies \exists e, x, y, z, t'[\mathbf{load'}(e, x, y, z)^{t'} \wedge \text{CAUSE}(e,s)$
$\wedge\ t'\ \supset\subset\ t]$

The symbols t and t' represent time intervals (temporally contiguous sets of times). The symbol $\supset\subset$ represents the temporal abutment relation (see Koontz-Garboden (2010)): for two intervals t and t', $t' \supset\subset t$ iff the final point of t' immediately precedes the initial point of t. If an event takes place throughout t' and a property holds throughout t, then $t' \supset\subset t$ means that as soon as the event ends, the state of the property holding begins.

For each target state, loaded₁ and loaded₂, there's a scale of effectiveness of the action. That is, there is a scale to which the property state applies to the head noun, *loaded truck* or *loaded hay.* In the first sense, the property maximum of the scale represents a case where the truck is completely full. In the second sense, the property maximum of the scale is such that the hay is completely inside of the truck. These senses correspond to meanings that fall out of the locative alternation:

(80) a. Vinny completely loaded the truck with hay.

b. Vinny completely loaded the hay onto the truck.

The sentences in (80) demonstrate the holistic effect observed in locative al-

ternations such that the object is interpreted as being completely effected by the event (Anderson (1971), Beavers (2010)). These are the same senses associated with maximal interpretations of the scales associated with the properties in (77).

2.2.6 Autonomy of target states and events

We've established that target states are those that represent a characteristic outcome of an associated event. It is also well established that certain verbs lexicalized result states (e.g. Rappaport-Hovav and Levin (2013)). So naturally we may ask whether in these cases the result state of an event will always be the state named by a target state participle. So, for instance, if *to dry* means something like CAUSE x BECOME <dry>, is the target state associated with the participle *dried* simply <dry>, which is entailed along with an event entailment?

One can address this question by contrasting simple adjectives, such as *dry*, *old* and *open*, with their associated adjectival participles *dried*, *aged* and *opened*. A clear difference between these groups is that the latter entails that a previous event of the relevant type, *drying*, *aging* and *opening* has occurred. However, beyond this feature, is the state component in the simple adjectives the same as the target state? Not necessarily: The event entailment associated with the participle can influence the nature of the target state property. This is reflected in how the simple states and adjectival participles are *used*, that is what set of individuals they can apply to. There is an intuition that each member of these pairs is more appropriate in some cases than others. These intuitions are reflected in usage data from sketch engine. Consider the following expressions along with their token count in the corpus:

(81) a. dried cherries (n= 1958) /?dry cherries (n= 35)

b. ?dried skin (n= 530) /dry skin (n= 44,488)

c. old testament (n= 4783)/ #aged testament (n = 0)

d. ?old cheddar (n= 123)/ aged cheddar (n= 690)

e. clean energy (n=109,478) / cleaned energy (n=0)

Food or flowers that are dehydrated with the intention of preserving them can be described using the predicate *dried*. While it wouldn't be truth-conditionally wrong to call preserved fruits *dry*, there is an important bit of meaning missing from the plain-state adjective. The process of drying, especially when done intentionally, often yields properties beyond a lack a liquid, such as the ability to be preserved.

Interestingly, both *old* and *aged* entail an event of existence or growth, and both rely on some sort of standard regarding how much time that event lasts to be sufficient to warrant the application of the adjective. However, that standard often depends on whether there is volition related to the event, which is often the case when *aged* is used, but not *old*. Consider the difference between *aged cheese* and *old cheese*. While both could truthfully apply to a nice, 6-month Parmesan, only the participle captures the meaning that the cheese was left to develop intentionally. Here, the standards for applying *age* differ from those for applying *old*. I might call a block of Parmesan *old* after accidentally leaving it in my fridge for two months, but I couldn't call it *aged*. There are also drastically different connotations associated with *aged cheese* and *old cheese*: the former sounds sophisticated and the latter sounds gross.

In the case of *clean* vs. *cleaned*, there are certainly things which can be

64

described by the simple state that cannot be described with the participle. There are also cases where the meaning of the participle is drastically different from the meaning of the pure state. For instance, *cleaned fish* is fish which has been prepared to cook (i.e. de-boned,etc.), whereas *clean fish* is considered a type of fish that is not contaminated.

We can further observe the independence of these target states in contexts where both properties are involved in different ways. For instance, if I have a bag of dried cherries in my pocket and get caught in the rain, I could felicitously say the sentence in (82a). Here, the cherries are still *dried*, but they are not *dry*. If I come across some aged cheese in my fridge has I bought a long time ago I can say the sentence in (82b) without any redundancy. I can describe a fish that has been cleaned, and also is of a type that is safe to eat (82c).

(82)   a. the dried cherries got wet

      b. this aged cheddar is old

      c. the cleaned fish is clean

The point here is that participles imply events, but also may imply certain causal, spatial, temporal or volitional properties associated with events of that kind, which can have certain effects on the result properties and the entities which they can apply to[4]. For example, (Levin et al. (2019)) differentiate between artifacts, entities made

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[4]Comparisons of this sort are reminiscent of debates about the relationship between *kill* and *cause to die*. Wierzbicka (1975) cuts to the core of the argument:

> Putative causatives like "kill", "break", "open", "build", "cook", "write", etc. *are* causatives in the sense that they do contain a reference to the causal connection between someone's doing something somewhere (something happening somewhere) and something in the same place becoming different from what it was before. But

by humans for a particular purpose, and natural kinds, entities that are not man-made. They show that compound nouns that include artifacts (e.g. 'fork' in 'salad fork') refer to events associated with their heads (e.g. for for eating salad). On the other hand, compounds that include natural kinds (e.g. salad tomato) lack such an event implication. Similarly, the patterns above suggest that properties named by participles, like *dried*, tend to name properties of artifacts since the event entailment also implies intentionality, whereas simple adjectives lack this tendency.

In sum, the difference between plain state adjectives and related participial adjectives can't be explained by simply the addition of an event to its meaning. States named by participles take into account complex meanings associated with events beyond simply the occurrence of a change of state. In the cases discussed here, there are distinct words for the plain states and participial states, however often there is syncretism in these forms (e.g. cf. *open/opened* vs. *closed/closed* Embick (2004)). Still, the subtle difference in uses described here can be extended to *uses* which focus on a plain-states as opposed to a target states. The key takeaway here is that the event (type) implied by the participle can influence the property indirectly, in certain characteristic ways.

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the meaning of these words cannot be represented simply as "causing something to become..." because it involves a whole network of relations - causal, spatial, temporal, and volitional (pp. 527-528).

2.3 Passive participles

2.3.1 Historical origin of the passive

The passive results from reinterpreting the stative adjectival past participle as a dynamic verb (Parker (1976:450-451)). Since the adjectival past participles indicate the characteristic result of an event of a certain type while also implying the earlier event, almost every setting for the use of the target state adjectival participle is a potential bridging context for the emergence of the passive. For example, contexts for (83a) would also accommodate (83b):

(83)   a. The wagon is broken$_A$.

        b. The wagon was broken$_V$ (by someone).

The following Old English word string was ambiguous between an adjectival resultative participle and verbal passive (from Traugott (1972):83):

(84)   a. *An æþeling wurde afliemed$_A$ of   Sciþþian.*
           one prince   was   put-to-flight from Scythia
           'One prince was in exile from Scythia.'

        b. *An æþeling wurde afliemed$_V$ of   Sciþþian.*
           one prince   was   put-to-flight from Scythia
           'One prince was put to flight from Scythia.'

In a transitive active clause with an affected theme, that affected theme is always the object rather than the subject of the verb. But it is the subject of the new verbal use of the participle, as seen in (83b) and (84b). This grammatical shift from object to subject is of course the hallmark of the passive voice.

The grammaticalization of the passive as a pure voice consisted of this process generalizing to all transitive verbs, and not just those that have affected themes. The following examples lack affected themes:

(85) a. The moon can be seen from here.

b. The flute was played well.

c. It is believed to be raining there.

The moon is unaffected by people seeing it and a flute is unaffected by being played, but either of those roles maps to the object of the active and the subject of the passive. And we see in (85c) that even a raised expletive (cp. *We believe it to be raining there.*) can be passivized in the English passive construction.

These new passives can also be used in the same adjectival constructions that use the older target state participles, namely adnominal modifiers and copular constructions:

(86) a. The moon is/seems easily seen.

b. the easily seen moon

(87) a. The flute is well played

b. the well-played flute

At least some of these participles appear to be converted to adjectives, as seen by the possibility of the negative *un-* prefix (e.g. *unseen*), among other reasons. So we refer to these as adjectival passives.

Adjectival passives are adjectives and thus can modify nouns and appear in copular constructions, just like the adjectival resultative participles that we consid-

ered above. For that reason the two functions of past participles are sometimes confused with one another, or analysts seek a unified analysis of them. But they differ semantically, as we will see in the next section.

2.3.2 Semantics of adjectival passives

Adjectival passives can be generally be precisely paraphrased with active (or passive) verbal constructions built from their verbal root. The verbal base for the participle can belong to any of the Vendler situation aspect classes. Adnominal adjectival passives can be paraphrased with a relative clause using the associated verb. The clause is usually (but see below) in present tense if atelic (state or activity), and past tense if telic (accomplishment or achievement).[5]

(88) Relative interpretations of adjectival participles[6]

   a. activity:

       a watched pot = a pot that someone is/?was watching

   b. state:

       a loved child = a child that someone loves/?loved

   c. achievement:

       a noticed singer = a singer that someone noticed

   d. accomplishment:

       an opened bottle = a bottle that someone opened

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[5]Evidence that the examples in 88 are adjectives includes the fact that they all accept the negative *un-* prefix: *unwatched, unloved, unnoticed, unopened.*

[6]The reason for using the active voice paraphrases in (88) is just to avoid ambiguity in the paraphrases.

On the present time interpretations the properties hold at reference time: *a watched pot* is 'a pot that IS being watched'. The present tense of the atelic verbs seems to be a default interpretation that can be overridden with time adverbs:

(89)   a. activity:

   a recently watched pot = a pot that someone was recently watching

   b. state:

   a previously loved child = a child that someone previously loved

The prenominals lack tense and so their default temporal interpretation depends upon their Vendler class: the time of the eventuality is concurrent with reference time for adjectives from atelic verbs and precedes reference time for adjectives from telic verbs. Putting aside the time, the actual property types denoted by the participles in (88) and (89) are the ones denoted by their verbal roots.

By using copular constructions in present tense and considering the appropriate tense on the relative clause description, we can see whether the reference time coincides with the event time. Again, the meaning of the adjectival participle can be paraphrased with a relative clause description.

(90)   a. The pot is/seems watched = (it seems that) someone is/?was watching the pot

   b. The child is/seems loved = (it seems that) someone loves/?loved the child

   c. The wrestler is/seems pinned = (it seems that) someone is/?was pinning the wrestler.

d. The planet is/seems inhabited = (it seems that) someone is/?was inhab-
iting the planet

e. The employee is/seems overpaid = (it seems that) someone overpays/?overpaid
the employee

Now consider participial forms from telic verbs, in the same present tense
copular construction. As expected, they have a past tense interpretation, that is,
they are interpreted so that the event culmination precedes reference time. (That
is, they lack a progressive interpretation in which the culmination of the event lies
in the future. For that we would need an *-ing* progressive: *This bottle is (in a state
of) being opened.*) But the main point here is that in the following examples we
no longer have a complete paraphrase. The adjectival participle entails the verbal
relative clause but not vice versa.

(91)   a. The copy machine is/seems broken → (it seems that) the copy machine
broke

b. This bottle is/seems opened → (it seems that) someone opened this bottle

c. The jacket is/seems lost → (it seems that) someone lost the jacket

d. The balloon is/seems popped → (it seems that) someone popped the
balloon

Sentence (91a) means more than that an event of breaking took place, it says that
the copy machine is currently in a state of disrepair. So 'The copy machine broke'
does not entail that 'the copy machine is broken', because it might have been fixed
already. An opened bottle has a broken seal; if an opened bottle is resealed we would

71

not normally say that it *is opened*. With the evidential verb *seem* the effect is even stronger, since it implies there is evidence of it being opened, for example visual evidence. If you find a jacket then it is no longer lost, but this does not change the past: the past losing event persists. Similarly, if I pop a balloon, patch it up and reinflate it, then it is a balloon that someone popped, but it would sound odd to say that *the balloon is popped*.

In short, the examples in (91) are target state (resultative) participles of the sort discussed in Section 2.2 above. They are not adjectival passives– where we restrict this term to the type that comes from the passive voice forms which have lost the resultative implication, through grammaticalization (see Section 2.3.1). Something must be preventing the adjectival passive interpretation in these examples. We return to solve this problem in Section 2.4 below, where we suggest it is blocked by the perfect construction.

For now let us finish the section with another sort of adjectival passive. All of the examples in (88) involve object relatives, in that the relativized phrase is the object of the verb in the paraphrase. This argument is therefore the subject of the corresponding passive verb. Some participles, including modal adjectives (92a) and (92b), relativize a different argument from the object:

(92)   More relative interpretations of participles

      a. an allegèd thief: a person x such that someone alleged that x is a thief

          $\exists x \exists y$ [ALLEGE(y, (THIEF(x))]

      b. an allegèd burglary: a burglary x such that someone alleges that x occurred

72

$\exists y[\text{ALLEGE}(y, \exists x[\text{BURGLARY}(x)])]$

c. a declared disaster: a thing x such that someone declared that x is a disaster

$\exists x \exists y[\text{DECLARE}(y, \text{DISASTER}(x))]$

d. an invited talk: a talk x such that someone was invited to give x

$\exists x \exists y \exists z[\text{TALK}(y) \ \& \ \text{INVITE}(z, \text{GIVE}(x, y)]$

Here the roles of the thief, the disaster and the talk in their associated events do not correspond to the subject of the passive verbs *alleged*, *declared*, and *invited* respectively. But the event types are the same. All of the participles in (86)-(92), i.e. *seen, played, watched, loved, noticed, opened, allegèd, declared*, and *invited*, classify properties of individuals by an event that took place in the past or is still taking place at reference time. The participle construction simply uses the verb root that is appropriate for referring to the event to do so.

The key takeaway here is that adjectival passives are adjectives that can be paraphrased with relative clauses using the verbal root.

2.4 The perfect construction

The perfect construction emerged in Old English from possessive sentences in which object of the verb *have* is modified by a resultative adjectival participle (93a). In such sentences the subject referent possesses an object referent in a certain state denoted by the participle.

(93) Old English

a. *Ic haefde hine gebundenne.*
   I   had$_V$ him   bound$_A$

   'I had him in my possession, in a bound up state.'

b. *Ic haefde hine gebundenne.*
   I   had$_{Aux}$ him   bound$_V$

   'I had bound him.'

(example from Traugott (1972):93)

This construction was reanalyzed, as explained by Traugott (1972):94 : '*Habb-* was reinterpreted as a marker of perfectiveness and the adjectival nature of the participle was lost.' We suggest in the next paragraph that *habb-* was originally reinterpreted not as a marker of perfectiveness, but as a marker that its subject controls the result state. In any case, in syntactic terms the verb *have* was eventually grammaticalized as an auxiliary, while the adjectival participle modifying the object was reanalyzed as the main verb (Hallman (2021), de Acosta (2013), inter alia). The resulting construction, shown in (93b), would be expressed in modern English as *I had bound him.*

The new construction originally had the resultative perfect interpretation, and only later acquired the existential perfect interpretation.[7] The reason for this is clear: plausible settings for the use of the resultative perfect are bridging contexts connecting the possessive-resultative source to it. This can be seen by comparing the two Modern English translations in (93). Both of these sentences indicate that the agent (I) 'has' the patient (him) in a bound state at reference time, and that it was

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[7]It is generally agreed that not only did the resultative perfect develop first historically, but also that the resultative reading is the prototypical perfect reading (Mittwoch (2008)) and the first perfect meaning that children acquire (Slobin (1994).

caused by a preceding binding event. One semantic difference is that the 'having' is literal in the first construction but only implicated in the second. The reason for this implicature is that the agent has just carried out the action on the patient, and the effects of the action persist at reference time, implying that the agent still controls ('has') the patient at reference time. Note that the possessive source construction does not require that the subject of 'have' and the agent of the causal event be the same person; but the resultative perfect does require it. So a plausible initial role of the verb 'have' in the new perfect construction is to mark its subject as the semantic controller of the result state. The reference time indicated by the tense marking on 'have' indicates the time at which that control was in place. That is exactly how the resultative perfect is interpreted.

Eventually, the perfect construction began to be used even when the specific resultative property state associated with the root did not hold at reference time. In this use the perfect no longer entailed a specific result, and so the perfect construction spread to all verbs, including even atelic verbs, and the existential perfect emerged.[8] The resultative perfect remained alongside it, and so today these are two main interpretations of perfect constructions, RESULTATIVE and EXISTENTIAL. These are illustrated in (94) and (95):

(94)   Resultative perfect

    a. As you can see, someone has torn the shirt.

    b. As you can see, the shirt has torn.

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[8]A final development in this grammaticalization path, found in many languages but not (yet) in English, is the shift from the perfect to the perfective or simple past (Deo (2015)).

(95) Existential perfect

    a. Someone has torn the shirt before (but it is mended now).

    b. The shirt has torn before (but it is mended now).

    c. I have seen the northern lights.

    d. As of January 2023, 6,338 people have climbed Mt. Everest and reached the summit.

In the next section we look at the semantics of these two constructions and compare them to the adjectival passive discussed above.

2.4.1 Comparison between the perfect and the adjectival passive

We have seen that the resultative perfect entails that a particular kind of result state holds at reference time, and that it was caused by a prior event of a particular kind. In contrast the existential perfect lacks the result state but retains the implication of the prior event. As a consequence of this focus on the event and loss of specification of the resulting property state, the perfect is often considered to be a VIEWPOINT ASPECT indicating a viewpoint on the event (Smith (2001)). It differs from the preterite (simple past) primarily in that the reference time is shifted to the future relative to the event time, so that the clause indicates the current (at reference time) relevance of a past event. It is a state rather than an event because the view of the event from the future is static (Katz (2003)). From the time an event is over, it looks the same for all time.

The formula in (96) represents the meaning of the predicate *has torn*, as in (94b) (*The shirt has torn*).

(96)   *has torn$_{resultative}$*: (= *is torn$_A$*)

   $\lambda y \exists e, t, t'[\textbf{tearing'}(e,y)^{t'} \wedge\ t' \supset\subset t\ \wedge\ t_u \in t\ \wedge\ \textbf{split'}(y)^t \wedge\ \textbf{cause}(e,s)]$

The symbols t and t' represent time intervals (temporally contiguous sets of times), while t_u represents utterance time. For simplicity the phrases are given in present tense only, so that utterance time and reference time are the same. The symbol $\supset\subset$ represents the temporal abutment relation (see Koontz-Garboden (2010)): for two intervals t and t', $t' \supset\subset t$ iff the final point of t' immediately precedes the initial point of t. If an event takes place throughout t' and a property holds throughout t, then $t' \supset\subset t$ means that as soon as the event ends, the state of the property holding begins. The symbols $\textbf{tearing'}$ and $\textbf{split'}$ are non-logical constants: $\textbf{tearing'}$ represents a tearing event and $\textbf{split'}$ represents one particular kind of state that results from tearing, which we could define as 'split by being pulled or pierced with a sharp implement'. (As indicated in (96), we posit this as the meaning of the adjectival passive *is torn* as well; we return to this point below.)

The existential perfect came about through loss of the target state. So to get the existential resultative we simply remove the $\textbf{split'}$ and $\textbf{cause'}$ predicates. Since t is the temporal trace of the target state, this too can be removed and the formula further simplified:

(97)   *has torn$_{existential}$*:

   $\lambda y \exists e, t'[\textbf{tearing'}(e,y)^{t'}\ \wedge\ t' \supset\subset t\ \wedge t_u \in t]$

   $=\ \lambda y \exists e, t'[\textbf{tearing'}(e,y)^{t'}\ \wedge\ t' < t_u]$

77

This represents the set of individuals y that have undergone tearing at some time in the past (relative to utterance time t_u).

There is no 'existential adjectival passive'. That is, an adjectival passive such as $torn_A$ has an interpretation like the resultative perfect in (96), but lacks an interpretation like the existential perfect in (97). The sentence *This shirt is torn* does not hold true for a shirt that tore in the past but was subsequently fully mended prior to the time of utterance. This is the pattern reported for adjectival passives in Section 2.3.1 above. So let us return to the examples in (91), repeated here in (98). As shown here, this adjectival construction represents a state, and also entails a sentence presenting the prior event, but the reverse entailment does not hold:

(98) (see (91)) Resultative adjectival passives

    a. The copy machine is broken$_A$ $\rightarrow$ The copy machine broke.

       The copy machine is broken$_A$ $\nleftarrow$ The copy machine broke.

    b. This bottle is opened$_A$ $\rightarrow$ Someone opened this bottle.

       This bottle is opened$_A$ $\nleftarrow$ Someone opened this bottle.

    c. The jacket is lost$_A$ $\rightarrow$ someone lost the jacket.

       The jacket is lost$_A$ $\nleftarrow$ someone lost the jacket.

    d. The balloon is popped$_A$ $\rightarrow$ Someone popped the balloon.

       The balloon is popped$_A$ $\nleftarrow$ Someone popped the balloon.

The lack of the reverse entailment means that they do not have the existential reading. Regarding (98a), after the copy machine is fixed, it remains true that it broke, but not that it is broken, so the reverse entailment does not hold. A similar situation

holds for the other examples.

Let us hypothesize that the existential readings of adjectival passives are blocked by the existential perfect, leaving only resultative readings of adjectival passives. The perfect constructions that express the blocked interpretation of the sentences in (98) appear here, in passive voice perfect (to match the mapping above) and in active voice perfect (to clarify the intended reading, in which the passives are event-denoting verbs):

(99)   a. The copy machine has been broken$_V$ (before).

          The copy machine has broken$_V$ (before).

    b. This bottle has been opened$_V$ (before).

          Someone has opened$_V$ this bottle (before).

    c. The jacket has been lost$_V$ (before).

          Someone has lost$_V$ the jacket (before).

    d. The balloon has been popped$_V$ (before).

          Someone has popped$_V$ the balloon (before).

It is in the copular construction that we find the clearest case of the perfect blocking of the non-resultative (i.e. existential) uses of the adjectival participles. The diachronic literature on English thus treats this as competition between the *have*-perfect and *be*-perfect for expressing the anterior, beginning in Old English (Smith 2001:, inter alia).[9]

Given the blocking by the perfect construction, what remains of the adjectival

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[9]Example (62) above illustrates the competition between *have*-perfect and *be*-perfect for expression of resultatives, instead of existentials. See Section 2.4.2 for discussion.

participles in copula constructions are the resultatives that we started the chapter with. This has led to an interesting 'semi-productive' pattern, which we are now in a position to explain. That will be the topic of the following section.

2.4.2 Explaining the semi-productivity of resultative adjectival participles

We have just seen evidence that adjectival participial predicates in copula constructions lack existential readings. An existential participle is one that is satisfied by the mere existence of a prior event of the kind indicated by the verbal root. With these interpretations blocked out, what is left are resultatives, adjectival participles that indicate a resulting target state holds. We saw earlier that a target state is grounded independently of the event. That is, these adjectival participles are names for kinds of property states. Therefore the acceptability of any given example depends on whether the informant judging the example can conceive of a property state for the participle to refer to. This is subject to various factors, some of which we will consider in this section.

The first thing to note is that some resultative copula constructions are blocked by the resultative perfect. These are mainly locative achievement verbs:

(100)　a.　* The big day is arrived.

　　　　　The big day has arrived.

　　b.　? Winter is departed.

　　　　Winter has departed.

As noted above, the so-called be-perfect was standard in Old English, but gave way to the have-perfect over time:

(101)   Old English resultatives (repeated from (62b,c)

    a. *Nu   si es dag cumen. (Beowulf, line 2644)*
       Now is the day come
       'Now the day has come.'

    b. *da   wes winter scacen   (Beowulf, line 1136)*
       when was winter departed
       'when winter had departed'

Events of arriving and departing are not really detachable from their results, so it is natural to express those results through reference to the events by verbs in the perfect viewpoint aspect. Apart from that we offer no explanation for this blocking, but just note it and turn to cases where the copula construction fails because of the lack of a discernible result property.

The author of a book almost entirely determines the constitution of the book, so an important property of any book is the identity of its author. In example (102a), *written by Chomsky* refers to the authorship property, so it is acceptable.

(102)   a.   *Syntactic Structures* is written$_A$ by Chomsky.

       b. (*) *Verbal Behavior* is read$_A$ by Chomsky.

On the other hand, (102b) sounds rather poor because a past reader of a book is difficult to conceive as a current property of the book, because that past reading event is not evident in the current state of the book (at utterance time). The tense is wrong for directly referring to the reading event; instead we should say *Verbal*

Behavior was read by Chomsky, using the verbal passive. And the perfect 'present relevance of past event' reading is blocked, by assumption. This explains why the example sounds so poor. However, imagine a context where the speaker is sorting books by which famous people read them. Then 'read by Chomsky' becomes a category. Belonging to that category may be a property of certain books so perhaps 102b becomes more acceptable for at least some informants.

The adjective *scared* clearly represents a property state, and so (103b) is a common way to report the outcome of (103a) or any other cat-scaring event. Petting a cat generally influences it, but *pet* is an activity verb and the participle *petted* does not appear to be a name for any particular type of effect that it has on the cat. So (103d) sounds rather poor:

(103)   a.   Someone scared the cat.

   b.   The cat is scared.

   c.   Someone petted the cat.

   d. ?? The cat is petted.

   e.   The cat has been petted.

Similar restrictions on the use of adjectival participles were noted for German by (Kratzer 2000:388).

(104)   German

   a. *Die Katze ist schon   gestreichelt..*
       the cat   is already petted

   b. *Dieser Kinderwagen ist schon   geschoben.*
       this   baby carriage is already pushed

Kratzer notes that the disallowed readings improve in contexts involving a certain job to be done. Commenting on these examples, (Kratzer 2000:388) writes:

> (7a) and (7b) (= (104a) and (104b)) sound bizarre out of the blue, but as soon as we impose a 'job is done' or 'that's over' interpretation, they become fine. For (7a) (= 104a), imagine a scenario where it is my job to pet my neighbor's cat once a day while he is on vacation. A natural setting for (7b) (= 104b)) would be a factory that produces baby carriages and employs workers whose job it is to push new baby carriages a few times to test their wheels.

Kratzer's ameliorating 'job-is-done' contexts seem to save the English example as well. If petting the cat is on a list of jobs then it greatly improves the example, as (Maienborn 2009:32) showed for German:

(105)   The plants are watered, the mailbox is emptied and the cat is petted.

Some more activity verbs follow, along with failed attempts to form resultative adjectival participles from them and put them in present tense copula constructions:

(106)   a.   Someone has considered the bill.

      b.   The bill has been considered$_V$.

      c.   ?? The bill is considered$_A$.

(107)   a.   Someone has ridden the bicycle.

      b.   The bicycle has been ridden.

      c.   ?? The bicycle is ridden$_A$.

(108)　　a.　　Someone has pushed the stroller.

　　　　b.　　The stroller has been pushed.

　　　　c.　??　The stroller is pushed$_A$.

Summarizing this section, adjectival participles in present tense copula constructions are blocked from the existential reading where there is no substantive result state. As a consequence they require a result state and are acceptable to speakers only if the speaker can conceive of a result. The basis for this explanation will be explored in the next section.

2.5　A Usage-based approach to adjectival participles

This section develops a more explicit theoretical framework for the analyses presented informally above.

2.5.1　Grounding and names

The explanations for the variable judgments of adjectival participles in the previous section are based on the supposition that an adjectival participle following a present tense copula requires external GROUNDING. For example, an informant who is asked to judge the acceptability of *The cat is petted* is required to identify a property of a (hypothetical) cat that is a characteristic result of petting it. The attempt to satisfy that requirement generally fails, at least initially. But then they consider a scenario

in which it is our job to pet the cat. A job by definition has a goal, and the state of the cat that must be achieved in order to fulfill that goal would be the referent of *petted*, in that context. They don't need to know exactly what effect petting has on a cat (happiness, security, decreased likelihood to run off, etc.). They merely assume the cat's owner had some property P in mind in assigning the task of cat-petting, and to report to the owner that the cat is now P, one can say 'The cat is petted'.

According to the analysis in this chapter, the fact that the adjective *(is) petted* requires grounding is part of a broad descriptive generalization: all resultative participles require grounding. We return to this generalization below. The other part of the explanation is showing why the other potential means of interpretation is blocked. That other means is to calculate the meaning of *petted* by exploiting the independently grounded verb *to pet*, together with a past participle grammar rule. The form *petted* that would be derived by that rule, when in construction with a present tense copula, has the existential perfect interpretation, and that form **The cat is petted* is blocked by the *have*-perfect form in passive (*The cat has been petted*) or active (*Someone has petted the cat*).

Returning to the generalization just above, we take it to be a fundamental grammatical stipulation:

(109)   Resultative participles require grounding.

We believe that the study of which grammatical forms require grounding is among the most important issues in the study of word meaning and its relation to syntax. It takes us beyond grammatical representation per se, since grounding is a relation between linguistic signs and the world as perceived by speakers. It is a category of

usage and not a category of grammar such as WORD or LEXEME. In that sense this is a USAGE-BASED study.

Useful terms for describing various relations between linguistic signs and cognized world are GROUNDING, NAMING/NAME, DUBBING, COINING/COINAGE. They will be presented and explained within the framework of the CAUSAL THEORY OF REFERENCE (Geach 1969, Donnellan 1970, Kripke 1972, Michaelson and Reimer 2022). That theory originally arose as an alternative to descriptivist theories of the meanings of proper names. In descriptivist theories, a proper name is a shorthand for descriptive content, and in order for the name to refer uniquely that content must uniquely determine the name's referent. For instance, suppose the name *Wanda* is associated with descriptive content such as *woman, Kristie Denlinger's landlord, middle aged, brunette, talkative*, which uniquely picks out that individual. On the descriptivist view, proper names only refer via implicit definite descriptions.

In the causal theory of reference, proper names refer directly to individuals rather than being mediated by an associated description. In this theory, names come to be linked to their referents initially via acts of DUBBING, where some speaker assigns a form called a NAME to a certain individual: they are said to dub an individual with a name. The act of dubbing establishes the ability to refer with that name. This ability spreads through a speech community and through the history of the language via causal links between speakers:

The central idea of a causal theory of names is that our present uses of a name, say 'Aristotle', designate the famous Greek philosopher Aristotle, not in virtue of the various things we (rightly) believe true of him, but

86

in virtue of a causal network stretching back from our uses to the first uses of the name to designate Aristotle. It is in this way that our present uses of a name "borrow their reference" from earlier uses. It is this social mechanism that enables us all to designate the same thing by a name.

(Devitt (1981):25)

Each use of a name contributes a link to what is called a causal chain, the record of past uses of the name that stretch back to the initial dubbing.

Devitt's (1981) particular brand of causal reference theory also relies on the aforementioned GROUNDING, a process whereby a speaker links their perception of an object to the name. This process is facilitated through a certain kind of thought called GROUNDING THOUGHTS, which represent the sort of knowledge that can be captured with demonstrative expressions: The thought that *that cat is fluffy* comprises a mental representation of a certain observable cat. Grounding provides a way to connect physical perception of an object to a name, which can be used to refer to the object.

The causal theory has been extended from proper names to other categories such as natural kind terms (Putnam 1973) and artifactual kind terms (Bianchi 2020). Learning kind terms is more complex than learning proper names because the learner is presented with an instantiation of the kind, and not the kind itself. The learner should abstract the same kind from it as the 'teacher', that is, the previous speaker in the causal chain. This brings us to word learning, which generally requires exposure to multiple instantiations of the same kind. This is usually modeled as cross-situational learning, often formalized as Bayesian learning (Xu and Tenen-

87

baum 2007). Kind terms can also be acquired from descriptions such as dictionary definitions. And kind terms can be acquired from the linguistic context of the input, where we learn from example how to use a word or other form to convey a meaning. All of these methods have the effect of GROUNDING the term in experience, so that it comes to represent a concept.

Dubbing (or naming) can introduce a new form or, more often, use an existing linguistic form with a new referent. When the form is new we say the speaker has COINED a new term, and the term is a COINAGE. This dissertation is not concerned with coinages but rather with the use of past participle forms for dubbing target state properties.

The collective set of grounded forms can be contrasted with forms that are interpreted grammatically via other forms, usually the constituents that compose it. Examples of the former are the verb *crack* and the participle *cracked*, each of which is grounded (see (64)). An example of the latter is the inchoative *flatten*, which is not necessarily grounded, since its meaning can be calculated from two other (grounded) elements, the adjective *flat* and the inchoative operator BECOME. The meaning of the verb *flatten* is derived from the adjective by addition of an inchoative operator (BECOME) to give the inchoative verb in (110b), plus a causal operator (CAUSE) to give the causative verb in (110c) (Dowty 1979).

(110)   a. The dough is flat.

   b. The dough flattened.

   c. John flattened the dough.

The *-en* suffix appears to encode these operators. In any case *flatten* refers to the

event via a grammatical process of interpretation. There are many causative/inchoative verbs of this kind (Beavers and Koontz-Garboden (2020)), such as the verbs listed in (111):

(111)   Deadjectival change of state verbs (Levin 1993: 245)

awaken, brighten, broaden, cheapen, coarsen, dampen, darken, deepen, fatten, flatten, freshen, gladden, harden, hasten, heighten, lengthen, lessen, lighten, loosen, moisten, neaten, quicken, ripen, roughen, sharpen, shorten, sicken, slacken, smarten, soften, stiffen, straighten, strengthen, sweeten, tauten, thicken, tighten, toughen, weaken, widen, . . .

These verbs indicate that the corresponding adjective denoted state comes to hold (110b), or is caused to come to hold (110c).

2.5.2   Descriptions used as names

Resultative participles (e.g. *cracked*) are grounded in experience with a property state (showing lines on the surface from having split), while also describing a prior causing event kind (cracking events) via a verbal root that is independently grounded. This dual function as name and description is in fact very common in language. It was noted by Kripke in *Naming and Necessity*. Taking an example from Mill (1856), (Kripke 1972:255) notes that Dartmouth, a town in England, is so called because it sits at the mouth of the Dart river. The description of the town's location is used as its name. Kripke (1972) further notes that the descriptive content associated with the form of a name need not always accurately depict its referent: to use Kripke's example, *The Holy Roman Empire* was neither holy nor Roman.

Titles of written works normally have that dual status. The phrase *War and Peace* is the name of a novel by Leo Tolstoy, and also a description of the contents of the novel, which chronicles the French invasion of Russia and the impact of the Napoleonic era on Tsarist society. So the title is grounded in a particular literary work, but it is also a coordinate phrase whose meaning is composed from the component words by a regular grammatical rule.

A name is a unit of grounding. But it is not a minimal unit like a morpheme. The name *War and Peace* formally contains the two other names, *war* and *peace*. There is no semantic composition rule of English that takes those two names along with the word *and* as input and gives back Tolstoy's novel. But they do compose to form a phrase that contributes to a description of one aspect of the novel.

The notion NAME is a category of usage, not grammar. Names can take many different grammatical forms: word, bound morpheme, phrase, even whole sentence (*She gave me a don't you dare look.*) In that sense name may seem similar to the notion of CONSTRUCTION from Construction Grammar (Goldberg 1995, 2006, 2019). However, 'construction' is also a grammatical notion: that is the point of Construction Grammar. We do not assume that every phrase is a name, but every phrase is a construction, in Construction Grammar.

This dissertation is not proposing a new grammatical representation for participles, but rather attempting to explain the data through the notion of naming. It has been repeatedly observed that resultative adjectival participles are subject to a well-establishedness constraint: they can only be formed if they can be interpreted as well-established properties (Kratzer 2000, Embick 2004, Gehrke 2015,

Maienborn 2009, Pross and Roßdeutscher 2019). This is what we reported in Section 2.4.2 above, although they might better be characterized as 'establishable' properties. But while it has been described, there is no clear explanation in the literature. For example, Gehrke (2015:932) notes that the restriction of phrasal participles to a 'conventionally established event kind' 'does not follow so easily'. She assimilates them to pseudo-incorporation, and then notes (Gehrke 2015:920) :

> None of these accounts have a theoretical explanation for why this kind of incorporation is only possible under the well-establishedness condition outlined above, but at least this is another property that all cases that have been analysed as involving pseudo-incorporation (or incorporation in general) have in common.

On the analysis presented here, the participial phrases in question function as compositionally derived descriptions, but they are also required to be externally grounded. If they are not then they are judged unacceptable.

Chapter 3

Multi-word Adjectival Participles

3.1 Introduction

Thus far, we have mostly focused on simple adjectival participles, that is single-word participles that name a property state like *stained* or *proven*. In this chapter, I look at compound participles (i.e. α-participles), such as *tear-stained* and *research-proven*, in which the participle morpho-phonologically combines with a preceding modifying word or words (i.e. α). We contrast compound participles with other constructions that relate participles to α modifiers, such as *stained with tears* and *proven with research*, in which α is found in a PP complement of the participle. We will call these other phrasal participles DIRECT COMPOSITIONS.

A speaker may choose to refer to the same property using either a compound or a direct composition. For instance, I may choose to call a method *research-proven* or *proven with research*. While both expressions may have the same truth conditions,

the constructions for forming compounds and phrases differ in that compound participles are subject to constraints that aren't found in direct compositions. In this chapter, I will outline these constraints and offer an explanation for them based on naming. Given these constraints on compounding, we can think of it as a partially productive process when compared to the composition of phrases relating participles to dependents. I will close the chapter with a discussion of how conditions related to naming explain this partial productivity.

The comparison of English compounds and direct compositions in this chapter is closely related to the German 'adverbial modification puzzle.' Unlike in English, German adjectival and verbal passives are morphologically distinct. Many researchers have noted that German adjectival passives are also subject to modificational constraints not seen in verbal passives. I will propose that the factors which differentiate English compound participles from their phrasal counterparts can also motivate the differences between these two German passive constructions.

3.1.1 Constraints on compound participles

In English, participles can be related to dependents by using both compounds and phrasal constructions. In compound participles (e.g. 112a), the participle is preceded by a word (or words) α in the semantic role of some dependent. The semantic role of α is quite variable across compound participles, for example, α can name an agent, location, or manner modifier in an underlying event. English speakers can also represent the relationship between an α and a participle by composing full phrases directly using syntactic rules (e.g. 112b). In these cases, αs appear in a PP

complement that follows the participle.

(112) a. *government-funded, home-grown, Boston-raised, faith-based*

b. *funded by the government, grown at home, raised in Boston, based in faith*

These two constructions have different distributions. Both compound participles and phrasal participles can appear predicatively:

(113) a. The project is government-funded.

b. The project is funded by the government.

However, only compounds can appear prenominally. The prenominal position seems to want something with a head-final word-like structure.

(114) a. The government-funded project failed.

b. *The funded by the government project failed.

Participles with phrasal complements can modify nouns but, unlike compounds, must follow the noun.

(115) a. *The project government-funded failed.

b. The project funded by the government failed.

There appear to be constraints on α in compound participles that do not apply to participles directly composed in phrases. The most robust constraint is an apparent ban on indexical αs in compounds. For instance, the compounds in (116a) and (117a) are ungrammatical when α is a pronoun or an indexical adverb, unlike the phrases in (116b) and (117b).

94

(116) a. the vodka is Austin-made/ (*here-made)

     b. the vodka is made in Austin/ here

(117) a. this house is Wright-designed (/*him-designed)

     b. this house is designed by Wright/him

Compound participles have the same properties in prenominal positions:

(118) a. The Austin-made / (*here-made) vodka.

     b. This Wright-designed / (*him-designed) house.

Additionally, there are apparent well-establishedness constraints on compound participles such that the relationship between the α and the participle must be recognizable or conventionalized to some extent. For example, although a speaker may be able to reasonably understand the meaning of a compound like *attic-distilled* in (119a), especially given a rich enough context, it sounds degraded when compared to a corresponding phrasal participle (119b):

(119) a. ?This vodka is attic-distilled.

     b. This vodka is distilled in the attic.

Similarly, while α may be a proper name, such as in the compound *Wright-designed*, compounds sound degraded when α does not name a famous person.

(120) a. ?These houses are Joe-designed.

     b. These houses are designed by Joe.

I will first address constraints on indexical αs before addressing well-establishedness constraints.

95

3.1.2 Naming vs. ontological generalizations

How can we explain the apparent ban on indexical αs in compound participles? The naming theory outlined in the previous chapter offers a straightforward explanation: the ungrammaticality of *him-designed* in (117b) follows from the fact that the entire compound participle construction (i.e. α-designed) is treated as a name.[1] Recall that a name is a sign that directly refers to an object, in this case a property, and its proliferation is dependent on two conditions: uniqueness and reusability. The pronoun *him* makes (117b) unacceptable, we claim, because *him-designed* would lack a unique, constant denotation: its denotation would vary with the antecedent of the pronoun. Therefore, compound participles that include indexical αs will not be successfully passed along in communicative speech chains.

Our theory predicts that restrictions on the composition of adjectival participles follow from the fact that they are *used* as names. This contrasts with an analysis whereby there is some sort of putative ontological generalization governing α or the compound participle as a whole. For instance, perhaps there is a constraint on the morphemic structure, syntactic category or semantic denotation type of adjectival participles and/or the words that can combine with them that results in the ungrammaticality of (117b); that the compound is a word, that α must not be an indexical or that α and/or the entire compound must be a kind. We will consider each of these

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[1]This is reminiscent of Rapp (1996) and Kratzer (2000)'s 'phrasal adjectivization,' in which a stativizer operation can take an entire VP as input. Recall that phrasal adjectivization was used as a solution to the adverbial modification problem- that there are restrictions on what types of modifiers can be used with adjectival participles. One shortcoming of this explanation is that it still required some sort of well-establishedness constraint on the input to phrasal adjectivization. Treating compound participles as names doesn't run into this issue.

options and ultimately conclude that naming does a better job of capturing patterns in the data without resorting to unmotivated stipulations.

Wordhood

Let's first consider the possibility that using an expression as a *name* rather than a *direct composite* can be equated to a morphological distinction between creating a word and composing a phrase. The rejection of pronouns in (117) (**him-designed*) does appear to be related to a more general injunction against anaphors within words. Many words are inbound anaphoric islands, that is, they cannot contain anaphors bound from outside the word. Postal (1969:214) notes contrasts such as *McCarthyite / *him-ite*. Perhaps compound participles should be treated as words which disallow referential pronouns.

One issue with this analysis is that the generalization that words are inbound anaphoric islands seems to be a language-particular phenomenon in English. Bresnan (1995) notes that there are several exceptions to the inbound anaphoric island constraint, including incorporated indexical pronouns which occur in a number of languages. For example, the pronoun *-in* in the example from O'dam in (121a) is a referential pronoun occuring within the morphosyntacic boundaries of the word. Harris (2006) also notes that fully referential anaphors are commonly found inside of words in Georgian, such as the referential pronoun *tab-* in (121b).

(121) a. *Kua'-**in***   *gu*   *bakax ma-mai-xim*
           eat-**1sg.subj** DET meat RED:IT-cook.meat.in.a.hole-RES
           'I am eating barbecue'

           Garcia Salido (2014:60)

97

b. *Merab-i$_i$* *čamovida tbilis-ši* **tab**$_{i,*j}$*-is-ian-eb-tan* *ertad.*
Merab-NOM he.come Tbilsi-in self-GEN-DERIV-PL-with together

Merab$_i$ arrived in Tblisisi together with **him**$_i$-ites

Harris (2006:119)

There does not seem to be any type of morphemic structure, whether sub-lexical, lexical, or phrasal, that is designated exclusively either for names or for non-names, across languages. But even narrowing our discussion to English adjectival participles, invoking wordhood does not appear to improve the account over merely identifying them as names. If anything it complicates our ability to account for compound participles with more complicated structures that seem to consist of multiple words for other reasons. In (122) below, the compound participles fail certain wordhood tests. For instance, standard tests for wordhood include that components of a word should not be separable nor should parts of a word be conjoinable with external words (see e.g. Bresnan and Mchombo (1995)). The components of *Russian-owned* can be separated with additional αs; *Russian-oligarch-owned* (122b) and parts of the compound participle (i.e. *Russian oligarch*) can modify coordinated participles (122c):

(122) a. Russian-owned boats

   b. Russian-oligarch-owned boats

   c. Russian-oligarch-owned and controlled boats

Lexical category ban

So, the assumption that a compound participle has the morphemic structure of a word does not help us explain its restrictions. What about a lexical category restriction? Could it simply be that proper names are allowed (Wright) but pronouns (him) are not? Or else, that pronouns and indexical adverbs in general are banned from the α position in α-participles?

Despite the generalization that follows from the previous section, there are cases where some pronouns seem acceptable in compound adjectival participle constructions in special cases where they are locally bound within the construction. For example, consider the following corpus example of compound participles with pronouns:

(123)   Are we living in a **me-centered** world or a **we-centered** world? (explore-life.com)

It is clear from the context of (123) that the pronouns *me* and *we* are not indexicals referring to the speaker. Instead, a person is *me-centered* if they are self-centered; and they are *we-centered* if they are centered on a group that includes them. (And a *me-centered world* is a world full of me-centered people.) The rubric for interpreting these names appears to be that *me* and *we*, within this construction, refer to whoever the individual denoted by the subject of the participle would use those pronouns to refer to. So the pronouns are used meta-linguistically to form names for certain attitudes. It is apparently their role in forming names that causes the pronouns to have a special interpretation that differs from the usual indexical one. There's no

evidence that they change their lexical category, for example from pronoun to noun, in order to appear in (123). Assuming they are pronouns, then we may conclude that there is no restriction against the pronoun as lexical category.

Turning now from people to places, we find that participles with location αs also are restricted. Locations can be expressed with kind-denoting common nouns (124a) or proper names (124b), but not indexical adverbs (124c-124d):

(124)   a.   mountain-grown coffee

             coffee grown in the mountains

        b.   Austin-made vodka

             vodka made in Austin

        c.   * here-grown coffee

             coffee grown here

        d.   * there-made vodka

             vodka made there

Could it be that the lexical restriction is a general ban on indexicals? Not quite. Again, we see cases where certain indexical αs are acceptable so long as they have some sort of descriptive content that allows them to be interpreted metalinguistically as constants. For example, words like *local* also have an implicit contextual variable, for the reference point with respect to which locality is measured, and yet they can be used as modifiers in compound participles. The α 'local' in (125a) can be interpreted indexically (local to the utterance) or anaphorically (local to the reported event) (125b), among other ways:

(125)   a.   John is trying out a **local pub produced** beer.

         b.   While most travel now occurs in urban areas, approximately 77 percent of lane miles are on rural, **local-owned** highways. (fhwa.gov)

Why can *local (pub)* modify the participle, while *here* and *there* cannot? The words *here* and *there* generally require an antecedent in the discourse or utterance context, function almost exclusively as variables, and have almost no inherent descriptive content. In contrast the word *local* introduces a location variable that need not have an antecedent in the discourse or utterance, but can be existentially bound. The word *local* has descriptive content: $\text{LOCAL}(x)^y$ means roughly 'x that is near y' where y is the contextual location variable. When it modifies *pub* it contributes that notion of nearness, so $\text{LOCAL.PUB}(x)^y$ is 'x that is a pub near y', and similarly $\text{LOCAL.PUB.PRODUCED}(x)^y$, 'x that was produced at a pub near y'.

      The point is that *local* can form a name because it contributes reusable semantic content, but *here* and *there* lack descriptive content. They represent locative variables with certain constraints on character (Kaplan 1989), the function from utterance contexts to content. The way to draw upon those character constraints for the purpose of naming is through meta-linguistic use, as with the examples of *me-centered* and *we-centered above.* For example, the name *here-and-now* refers to approaches to therapy that involve the immediate environment of the patients:

(126)   In the sections that follow, we present here-and-now oriented leadership techniques, ranked by the level of their intensity (Chen and Rybak 2018).

The immediate environment of the patients is of course the place and time those patients would call 'here' and 'now'. But these are not the place and time that the

101

author of (126) would refer to as here and now.

A final type of indexical example to consider are temporal adverbs, such as *yesterday* and *today*. The meaning of these expressions usually depends on the time of the utterance context. Indeed, these types of expressions also seem awkward as αs of compound participles:

(127) a. ?I love those yesterday-made cookies.

      b. ?My today-painted pictures are in the living room.

And yet in certain metalinguistic uses, compound participles can contain these αs with character constraints. *Today-focused* is used in the following to refer to decisions that are focused on the immediate environment of the decision-maker, not the utterance time of the speaker.

(128) All of these **today-focused** decisions can add up into taking you far off the path from your vision and make it difficult, if not impossible, to get back on track. (cultbranding.com/ceo/page/3)

One potential counter-point to the following story is that it is possible to conceive of a situation where I can use a truly indexical pronoun to dub a name in a *particular* context. For instance, say Kristie is walking on town-lake trail with her friend Jonny's tiny dachshund. A toddler runs up to the dog and excitedly pets it. Kristie utters the sentence in (129) without objection from the English speakers around her:

(129) Look, it's a you-sized dog!

In this context, it is clear that *you* is referring to the toddler, however it won't be easily reusable with the *same* meaning. This makes it a bad candidate for being established as sign in the language by future users, who will rarely have occasion to use *you-sized* to comment on the size of an object that is comparable to that particular toddler or even to toddlers in general. The key point here is that the restriction on indexicals is not a hard and fast grammatical rule. It is a strong dispreference rooted in the way that compound participles are intended to be *used*.

Kinds

Let us consider next the possibility that the expression α (in α-Participle) must denote a kind, rather than an individual (Carlson (1977)). On this view, (130a) (*tear-stained*) works because *tear* denotes a kind, while (130b)(**them-stained*) fails because *them* refers to the individual sum of tears.

(130)   a. The tear-stained pillow

        b. The *them-stained pillow

Certainly kind-denoting nouns are common in this construction:

(131)   man-made, women-owned, oven-baked, frequency-based, mountain-grown, child-directed, lemon-infused, rat-infested . . .

But this hypothesis breaks down in both directions. Pronouns need not refer to individuals and instead refer to kinds when they co-refer with a kind-denoting antecedent, as in (132a) and (133a):

(132)   Tears are symbols of sadness and . . .

103

a. letters stained with them make frequent appearances in romance novels.

b. * them-stained letters make frequent appearances in romance novels.

(133) a. We (=women) fought hard for women's suffrage and we got the vote in 1920. (Nunberg 1993)

b. Businesses owned by women/us are more common now

c. Women-owned businesses are more common now.

d. *Us-owned businesses are more common now.

The pronoun *them* in (132a) is anaphoric to the kind tears; and *we* in (133b) refers to a kind instantiated by the group including the speaker, namely women. (Note that the speaker must be a woman but she need not have been alive in 1920.) But these kind-referring pronouns still cannot appear in the α-Participle construction if they function as variables (132b & 133d). What matters seems to be the variable itself, rather than the denotation type of the value assigned to it.

Moreover, we have seen already that individual-denoting expressions are perfectly acceptable in the α-participle construction, and indeed are quite common with certain participles:

(134) a. a house designed by Wright

b. a Wright-designed house

Again, the name is acceptable but a coreferential pronoun is not:

(135) a. Frank Lloyd Wright lived in a house designed by him.

b.   * Frank Lloyd Wright lived in a him-designed house.

It seems clear that α is not restricted to kinds but can denote individuals. The crucial aspect of the acceptable expressions seems to be that they are reusable names, regardless of what type of object the name refers to.

Next let us consider the possibility that while α may denote an individual or a kind, the whole α-participle expression must denote an *event kind* (Gehrke (2013), inter alia). Specifically, the proposal is that adjectival participles denote event kinds, which is why they are incompatible with modifiers that pick out spatio-temporal particulars. Further, any modifiers that can be used with adjectival participles must create a well-established event subkind.

The idea that compound participles must represent well-established properties is based on the observation that such constructions where α is a particular individual sound best if the individual is well-known for the role indicated, such as Frank Lloyd Wright in the role of designer (136), but worse if the individual is not well-established or well-known (136b). From the perspective of a kind analysis, *Wright-designed* is a well-established kind, while *Joe-designed* is not.

(136)   a. a Wright-designed house

b. ?? a Joe-designed house

However, the acceptability of such locutions seems to depend not on how well-established the individual is, but rather on how reusable the *name* is, within the context of this construction, to refer to an individual in the role of designer. Frank Lloyd Wright was a famous American architect, but the apparent condition is that

105

the name *Wright* is a well-established name of an architect. The actual individual Frank Lloyd Wright is just as famous regardless of whether we refer to him with the name *Wright* or the pronoun *him*, and yet there is a striking contrast between *Wright-designed* and **him-designed*, as we saw above.

We can see further evidence for this by comparing in-group and public names for the same individual. Friends and family of Frank Lloyd Wright called him *Frank*, but we might hypothesize that even they would be more likely to say *Wright-designed* than *?Frank-designed*, since *Wright* is more widely reusable than Frank, the latter used only by friends and family. We tested that hypothesis by asking a designer who had worked closely with the famed landscape architect Lawrence Halprin, and knew him personally. Halprin was known to friends and associates, including to our informant, as *Larry*. She reports to us that people in his office, when speaking amongst themselves, would normally use locution (137a), but that (137b) is possible with a lighthearted flavor, which we indicate with a winking emoji ☺. Keep in mind that these speakers are otherwise more likely to refer to him as *Larry*, with no condition of lightheartedness, as illustrated in (137c).

(137) a.   a Halprin-designed project

   b. ☺ a Larry-designed project

   c.   a project designed by {Larry > Halprin}

The pattern in (137) accords with our own intuitions: students and colleagues of Prof. Sally Jones could speak of the *Sally-designed graduate program* only with a jocund in-group style. But what about *Jones-designed*?

(138) a.   the Jones-designed curriculum

b. ☺ the Sally-designed curriculum

c.   the curriculum designed by {Sally > Jones}

Suppose Prof. Jones is known to a number of people in her university but is not known widely among English speakers as a whole. The locution *Jones-designed* still sounds perfectly acceptable and such forms in fact appear in news stories that introduce a person and their name to their readers. *Jones-designed* is an acceptable name (with no special jocund flavor) because *Jones* is reusable as long as it is her public name and thus has the potential for reuse.

Treating adjectival participles as names is not incompatible with an analysis whereby they are also treated as kinds. After all, kinds are reusable by nature since a kind of thing can be used to refer to any member of that class. So, it is unsurprising that the types of properties that are named by adjectival participles have a strong tendency to be kinds. The contribution of naming is that it explains *why* we should expect to see "well-established" kind meanings in adjectival participles, while also leaving space for speakers to innovate new meanings given the right context.

3.1.3   German adjectival participial phrases

The form of German adjectival passives and English compounds are quite different; unlike English compounds, German adjectival passives are more clearly phrasal participial constructions. However, they are subject to similar apparent well-establishedness requirements. For example, consider the German stative adjectival use of the participle *von Picasso gemalt* 'painted by Picasso':

(139)   a.   *Das Bild   ist von Picasso gemalt.*
             the picture is by   Picasso painted

             'The picture is painted by Picasso.' (Rapp (1996): 256)

        b.   * *Das Bild   ist von Maria gemalt.*
             the picture is by   Maria painted

             intended: 'The picture is painted by Maria.'

        (Gehrke (2015): 930)

This contrast is said to reflect a familiar well-establishedness condition: that (139a) works while (139b) doesn't because Picasso is a well-established painter while Maria is not. We propose instead a closely related explanation, based on the reusability of names. The sign *Picasso-painted* can be reused, but not *Maria-painted*, because the informants judging these sentences know of a painter named Picasso but not one named Maria, and therefore they can conceive of a reusable property state associated with paintings by Picasso but not Maria. Names can be whole phrases, and we shall propose that *von Picasso gemalt* ('painted by Picasso') in (139a) is an example of a multi-word name.

3.1.4   Parallels for English nominal compounds

The patterns of use we've noted regarding participle compounds echo many of the patterns observed in the use of nominal compounds (e.g. *cat door, field mouse*). Like adjectival participles, nominal compounds have a tendency to refer to kinds (see e.g. Gleitman and Gleitman (1970), Zimmer (1971)), have meanings that can be somewhat opaque when compared to phrasal paraphrases (see e.g. Härtl (2015)), and are generally considered to be morpho-syntactic words, subjecting them to in-

108

bound anaphoric island constraints.

Zimmer (1971) even contrasts compounds with paraphrases by arguing that compounds are names used to refer, while paraphrases are meant to assert. Zimmer's criteria for whether two words can form a compound is that the relationship between the words must be "appropriately classificatory" such that they name a category of some relevance to the speaker. In other words, categories must be somehow nameworthy. Downing (1977) pushes back against this notion with an example of what she calls 'deictic compounds.' For example, consider a scenario where I gesture to a table in which there is a glass of apple juice in front of one chair and ask you to sit in the *apple-juice chair*. The issue here is that *apple-juice chair* is not a category that a speaker is likely to find particularly relevant, and therefore nameworthy.[2] This example is reminiscent of the special context we discuss above in which an indexical can be used in an adjectival participle compound to refer to a particular object in a particular context, such as the *you-sized dog* in (129). Speakers may have certain expectations about what sort of common relationships there are between components of conventionalized compounds, and yet compounds can also express meaning that is particular to a specific context.

Treating compounds as names within the causal theory of reference allows us to explain why any apparent constraints can be bypassed with enough contextual support. Names are simply expressions which directly refer to an object. The mechanism by which we create compounds is not itself prevented from generating ad-hoc names that refer to an object only in a specific context, such as Downing's

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[2]Though, Ŝtekauer (2002) points out this doesn't preclude the name from later becoming more relevant as the world changes

apple-juice chair or a *you-sized dog.* Rather, the mechanism by which we pass on the ability to refer with a particular name, the causal chain, is such that it is difficult for a name to proliferate unless speakers have enough need to use that name to refer to the *same* object across contexts. Therefore, if we treat both nominal and participial compounds as names, we should expect to see traces of this in the form of apparent well-establishedness constraints and resistance toward indexicals.

3.2   Productivity in compound participles

The apparent restrictions on α modifiers in compound participle constructions cannot be explained by ontological restrictions on either α nor on the compound participle as a whole. Instead, by treating compound participles as names, we can explain restrictions on α as following from the two hallmarks of a successful name, that is a name which is passed among speakers, repeated below:

(140)   A successful name

    (i) has a unique denotation; and

    (ii) can be reused by speakers/writers of the language.

Each of these conditions have slightly different effects on α. The first (140i) is a *requirement* placed on the meaning of the sign such that naming results in a sign with a constant meaning. For αs that function as variables, including indexicals like pronouns, locations and temporal adverbs, the uniqueness condition prevents uses where the meaning of the expression will vary with context. This condition alone explains the most robust restrictions on α participles discussed above. However, it

110

is the second condition, that the name can be reused (140ii), which explains intuitions that compound participles can only name well-established properties. This is a condition on use, reflecting the idea that the goal of naming is to add useful words to the language. In other words, the reuse condition reflects the fact that naming is a process for coining words to refer to properties that presumably will be reused by other speakers to refer to the same properties. Just because we *can* use a participle to name a property with a unique denotation doesn't mean that other speakers are likely to *re*use it.

To illustrate how the provisions imposed by the reusability condition differ from those imposed by the uniqueness condition, consider the following data:

(141)   a. doctor-recommended meal

           b. the meal was recommended by a doctor

(142)   a. insect-destroyed plants

           b. the plants were destroyed by insects

(143)   a. ?doctor-destroyed files

           b. the files were destroyed by a doctor

The compound participles *doctor-recommended* (141a) and *insect-destroyed* (142a) sound natural. They name properties that have unique meanings that are commonly encountered in the world. That is, doctors are known for recommending things, and it is helpful for speakers to seek evidence that something has the result property of a doctor-recommendation. Similarly, insects are notorious for destroying things, and it is helpful for speakers to use this participle to identify the result property of events

111

in which something is destroyed by insects.

In contrast, *doctor-destroyed* (143) sounds odd. It potentially *could* name a property with a constant meaning, the result of something that was destroyed by a doctor, but it's unclear what exactly that property would be or what it would apply to. If we are looking for evidence that a plant is *insect-destroyed*, we might be asking why our tomatoes have holes in them. If we are looking for evidence that a meal is *doctor-recommended*, we might be wondering whether it is nutritious. It is difficult to come up with a common scenario where we would need to look for evidence that something has a property as a result of a doctor destroying it.

Importantly, these intuitions are of a different nature than the ungrammaticality of an indexical α (i.e. *him-destroyed*), which results from a violation of the uniqueness principle in (140i). The badness of (143a) is more awkward than ungrammatical. We could invent a marginal context where *doctor-destroyed* could be used as a name for a salient property, making it sound less awkward. For instance, say I am an inspector ensuring that hospitals are practicing secure file-keeping in the healthcare industry and there is a law requiring that doctors shred patient files after five years. I may ask to see the *doctor-destroyed files*, expecting to find evidence of shredded files being properly disposed of. If this is a common practice among people in my profession, perhaps the name *doctor-destroyed* will be a useful term to refer to a property that is commonly encountered by my community. In that case, the name will be passed on through a communicative chain and speakers of the lect in which the name is established will have different intuitions about (143a).

Verbal participles are not subject to the same constraints. That is, they are not

112

used as names for properties so they lack the uniqueness and reusability requirements of adjectival participles. Although contexts in which doctors are destroying files are pragmatically marginal, there is no intuition that the verbal passive in (143b) is ill-formed like there is for the adjectival compound in (143a). In the formation of verbal passives, the participle denotes a certain event type and there is a generalized rule for deriving the passive use from the active which is applied to output the sentences in (141-143b). These are direct composites.

Since names can involve multi-word expressions, naming is also a strategy for composition, albeit with a very different purpose from direct composition, namely the purpose of creating reusable property concept chunks. Looking across paradigms of compound participles (i.e. *war-destroyed, enemy-destroyed, critically-destroyed*), we can observe gaps (i.e. *?doctor-destroyed*). These gaps are not the result of limitations where we can apply a generalized rule (i.e. *destroyed* by x $\implies$ x-*destroyed*), but a record of forms that haven't (yet) been used in naming. Well-establishedness is not a condition on the input of a rule, but a symptom of the fact that speakers choose to name when it is useful.

This argument leads to a different understanding of productivity such that naming is associated with semi-productivity in use rather than semi-productivity in the application of a rule. In the remainder of this chapter, I will discuss various notions of productivity and highlight the way in which in naming is able to explain the semi-productivity of compounds better than other approaches.

3.2.1 What is productivity?

The issue of productivity is key in literature on word formation. Dowty (1979:295) describes the issue as follows:

> On the one hand, it is universally agreed that principles of word formation are real enough principles that must be described in any account of a native speaker's knowledge of his language, yet these principles are everywhere subject to exceptions (at least in a language like English, if perhaps not in some other languages), both in the matter of "productivity" (which potential words are "actual") and in semantics (how the meaning is/isn't determined by the meanings of the parts)

Typically, productivity is thought of as the ability to apply an operation to new words. The primary examples of this tend to be drawn from morphology. For example, the suffix *-ish* can be added to many new words (e.g. the title of the TV show 'Mixed-ish', a spin-off of the TV show 'Black-ish') with the same function that it has on other adjectives (e.g. *hot-ish*, *new-ish*, *friendlyish*). However, while the prefix *en-* is found on many English verbs (e.g. *enrage, engulf, enamor*), it can rarely apply to new words (e.g. **engoogle*). In the literature productivity tends to be a catch-all term for a family of subtly related concepts. In the realm of syntax, productivity is sometimes used to mean generativity, as in the ability to produce novel strings that a speaker has never heard before (Chomsky (1961)). A similar fundamental notion comes from language acquisition, such that children acquiring language develop the ability to employ rules productively to generate expressions

that are absent from their input. In this sense, productivity represents a crucial aspect of linguistic competence: the ability to create new expressions.

We can also think about productivity in terms of frequency. From a usage-based perspective, it is reasonable to assume that speakers are more likely to apply a rule to a new word if they have previously seen that rule applied to a wide range of words. In other words, the higher the type frequency, the number of distinct lexical items that can be used in a given construction, the more productive it is (Perek (2016)). Barðdal (2008) argues that there is an inverse relationship between type frequency and what she calls semantic coherence, the degree of similarity among the meanings of a group of items. Specifically she argues that a construction with a large type frequency requires less semantic coherence in order to be considered productive. On the other hand, constructions with a small type frequency can still be considered productive if they impose a high degree of semantic coherence.

A third notion often related to productivity is the notion of semantic regularity. The logic is as follows: if a process is fully productive, its output tends to be predictable. In other words, for something to be fully productive, it must be fully schematic. For example, *-ish* when combined with an adjective has a regular effect on its output such that the maximum scale denoted by the adjective is not reached. *New-ish* is a property of being not fully new, *friendly-ish* is a property of being not fully friendly, etc. If we apply *-ish* to a nonsense adjective *blargle*, we can predict that *blargleish* will denote a property of being not fully *blargle* regardless of its meaning. Contrast this with the suffix *-ion*, which be used to convert verbs to nouns. *Destroy*, 'to ruin or defeat' combines with *-ion* to form *destruction* 'the act of

destroying.' And yet *transmit* 'to cause something to pass from one place or person to another' can combine with *-ion* to form *transmission* 'the mechanism by which power is transmitted from an engine to the wheels of a motor vehicle.' Here there is idiosyncratic and more general meaning outputted by the composition which can't be predicted by a generalized rule.

So, productivity is associated with three notions i) the ability to apply a process to new words, ii) the ability to apply a process to a wide range of words, and iii) the predictability of the output of a process given the input. With these notions in mind, let's consider the productivity of the compound participles discussed in this chapter. There are ways in which compound participles seem quite productive. They are regularly used to innovate new words for properties. Participles often combine with modifiers to produce regular compound meanings related to their parts: a result property of an event involving that noun (i.e. *Tear + stained =* a result property of a staining event with tears). On the other hand, the data discussed in section 2 suggests that this process is not fully productive since there are limitations on what types of words can combine with participles to form compounds. Additionally, the compound participles often involve subtle idiosyncratic meaning that can't be described in terms of the event. For instance, a *time-stamped card*, does not just mean a card with the property of being stamped with a time. Specifically the time on the stamp corresponds to the time when the stamping took place.[3]

So how exactly can we model this type of semi-productivity in compound participles? And how is it related to semi-productivity in direct composites? In

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[3]The issue of idiosyncrasy in complex participle meaning will be discussed in more detail in the following chapter.

116

order to answer these questions, I will first briefly outline how the notion of partial productivity can be understood and then determine the best way to capture the type of semi-productivity we see in adjectival participles.

3.2.2   Templatic approaches to partial productivity

In templatic approaches to lexical meaning, idiosyncratic roots combine with regular templates to build the meanings of words. While the ways in which these frameworks are implemented vary drastically, typically a lack of productivity is explained in the same general terms: if an operation is semi-productive, there are either restrictions on where the operation can apply, or else each output of the operation is listed as an idiosyncratic sign. For example, to explain the semi-productivity of the prefix *en-*, we could either say that there are strict limits on which roots *en-* can apply to, or else we could list words like *engulf, enshrine, enrapture* as separate entries in the lexicon. Bruening (2018) poses these options as the only two solutions to account for limited productivity and idiosyncrasy in word formation, paraphrased below:

1. **Opaque meaning solution**: All idiosyncratic signs (form/meaning pairs) should be listed as separate (i.e. opaque) entries in the lexicon

2. **Structural solution:** Lexical entries should include syntactic structure, which model the relationship between combinations of forms and their corresponding meanings, with restrictions on which types of meaning can combine.

Taking on the first approach, we might treat compound names as simply opaque signs for properties that may have at some point been derived from a verb but

117

no longer contain any sort of eventive semantic component. The benefit of this would be that awkward or ungrammatical compounds could be explained away by saying that these compounds are simply not found in the lexicon. However, under this view, we lose some crucial benefits of treating the compound participles compositionally. For instance, *tear-stained* and *blood-stained* have a related meaning, namely that there is some property resulting from a staining event. If these are listed as opaque signs independently in the lexicon, there would be no inherent relationship between them. If compound participles with related forms shared some underlying structure, such as the same event entailment, then we would be able to predict this behavior. Listing compound participles as opaque signs without internal structure would take that option away.

The second approach when applied to the derivation of adjectival participles, is akin to saying that we can describe the meaning of a compound participle in terms of the meaning of its parts. *Tear-stained* might be described as a property resulting from a staining event involving tears. In other words, *tear-stained* is generated in much the same way as direct composites like *stained with tears*. In this case, we would propose some general mechanism for deriving compounds from these underlying descriptions, for example a lexical rule[4]. In order to account for the semi-productivity of that rule, we would have to constrain it with one of the ontological restrictions outlined above, for example a ban on indexicals or treating compound participles as words or

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[4]In addition to lexical rules for participles (in the sense of Dowty (1979)), there have also been other rules for the meanings of adjectival participles in which the participle is described in terms of the meaning of the verb. For instance, frameworks that employ sublexical syntax propose transformational rules to derive adnominal participles as reduced relative clauses (Kayne (1994), Cinque (2010), Sleeman (2011)).

property names for event kinds. As we have established, these types of rules don't fully explain the behavior of the compounds.

While both of the options described here have their advantages, neither is entirely satisfactory at explaining the limited productivity and idiosyncrasies in participle form and meaning. On the one hand, we want to allow for a degree of regularity in the meaning of compound participles such that the meaning of an innovative participle compound can be interpreted based on the form. That is, there is an element of the meaning of compound participles that is regularly related to the meaning of their associated verbs (i.e. the existence of a prior event of the same type). On the other hand, there are limitations on the types of words that can combine to form participial compounds, along with idiosyncrasy in their interpretation. The solutions proposed here are unable to handle both of these patterns. [5]

3.2.3 Constructionist approaches to partial productivity

A very different approach to productivity is found in construction grammar frameworks. In construction grammar, constructions themselves have meaning and varying degrees of schematicity. For instance, the double object construction, Subj V Obj Obj2 (e.g. *she tossed me that ball*), is fully schematic. The construction V the hell out of NP, (e.g. *you scared the hell out of me*) is less so in that it has a fixed component *the hell out of* as well as slots which can be filled with various words.

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[5]A middle ground approach might be to say that words are first built from templates and, once established, may subsequently undergo lexical drift which opens the door for idiosyncratic meaning. This predicts that innovations should lack idiosyncrasy. Testing the validity of this approach in representing the meaning of participles would require a more in depth diachronic account of how idiosyncratic meaning develops and/or how speakers interpret the meaning of innovative participles.

In construction grammar, *most* constructions are partially-productive, or rather the empty slots in constructions have varying degrees of productivity. There are certain words which cannot appear in the double object construction (e.g. ?*explain me this* (Goldberg (2019)) and there are certain words which cannot appear in the hell out of construction (e.g. ?*I pet the hell out of my dog* (Perek (2016)). The productivity of a construction is determined by a notion of *coverage*, which is related to the type frequency of words that are used in it and the similarity in the resulting expressions. In particular, "a potential new coinage is judged acceptable to the extent that the formal linguistic category it would join is well attested by similar exemplars" (Goldberg (2016:386)).

This notion, by which semi-productivity is determined via coverage, can help us explain how participle meanings tend to cluster together. For example, we might say that the construction α-*stained* will accept a certain α if it is similar to other αs that could occur in that slot. This is true at least to some degree. The words that do occur in this slot tend to cluster around similar meanings, that is things that are able to stain. This fact can be easily adopted in conjunction with the naming theory such that we are more likely to name a property if other related properties have been named before. For example, say I want to talk about the property of being stained with tomato soup. This is a fairly specific property that may not be that reusable, but resembles conceptual chunks that have been named before (i.e. *tear-stained*, *water-stained*, *blood-stained*. The fact that there are established names with similar meanings makes it more likely that I will be able to say *tomato-soup stained* to refer to an accessible property state chunk. In contrast, say I want to talk

about a property of being scuffed by a branch. Compounds in the form *X-scuffed* are much rarer, and thus I will be less likely to treat this property concept as a name *branch-scuffed* and more likely to use direct composition *scuffed by a branch*. The idea is that when a speaker is considering using a name to refer to a property, they will utilize notions of similarity to existing forms rather than applying a regular derivational rule.

3.3   Conclusion

Treating compound participles as names allows us to explain the special nature of their semi-productivity. The meaning of names are unique, such that they represent signs which denote consistent property meanings resulting from a particular type of event. This requirement explains why αs in these compounds cannot be indexical, since the meaning of an indexical expression varies with context. Names are also intended to be reusable. This condition is especially important in explaining why names for non-established properties sound ill-formed.

While speakers can use any compound participle to dub a participle with a new meaning, the goal of naming is to create a linguistic shortcut to refer to a commonly encountered property. Speakers can choose to express the same property by directly composing an expression using a generalized rule, such as *stained by tears*. However, in using the participle as a name, speakers are signaling that the property concept is reusable (*tear-stained*), making it more efficient for speakers to chunk commonly encountered concepts together.

While there is a spectrum of productivity across particular compound participle constructions (e.g. *X-focused, X-driven*), the choice to use a participle as a direct composite or a name is a binary one. If a speaker believes that a property concept is likely to be re-encountered by others in the future, they will be more likely to make the choice to use the participle as a name. In other words, a speaker may require a certain threshold of perceived reusability in order to decide whether to express their message using a name or a direct composite. Of course, speakers can't necessarily predict what others will find useful, thus judgements about what compound participles sound acceptable will vary in many cases from speaker to speaker and will be improved if they are hedged with contexts that increase the likelihood that the property will be considered salient.

Chapter 4

Classifying Compound Participles

4.1 Introduction

In chapter 2 we proposed a naming convention for adjectival participles, repeated in (144) below:

(144) NAMING CONVENTION:

> If a phenomenal (i.e. observed) property state P is caused by an event type denoted by a verb V, then P can be named with the past participle form of V.

In the previous chapter, we introduced the notion of compound participles, such as *tear-stained*, which involve a participle modified by a preceding word (or words) α. Compound participles can be prenominal (145a) but also can appear predicatively (145b).

(145) a. The tear-stained pillow

b. The pillow was tear-stained

We argued that the entire compound is used to name a property state with the resulting form including the extra component α. We propose an additional naming convention for forming compound participles as follows:

(146) COMPOUND NAMING CONVENTION:

If a phenomenal (i.e. observed) property state P is caused by an event type denoted by a verb V and including a verb dependent α, then P can be named with a compound using the past participle form of V with the structure α-V.

This convention allows α to be any word that is somehow related to an event. This is quite a broad generalization. What exactly is the meaning of α and how does the meaning relate to the meaning of the phenomenal property P and the event after which it is named? It turns out that the relationships between α and the event are quite variable. Consider for instance the range of words that can occur in a compound with the participle *made*:

(147) a. We nibbled our way through dozens of **artisan-made** jams to find them for you. (thenibble.com)

'<u>Artisans</u> made the jams'

b. Also, there's great news for NBC's **Austin-made** Friday Night Lights. (unclebarky.com)

'Someone makes Friday Night Lights <u>in Austin</u>'

c. Ketel One is **hand-made** in small batches for smoothness. (beerliquors.com)

'Someone made the Ketel One <u>by hand</u>'

d. It's legal to purchase gun kits and assemble them at home, avoiding the background checks required to purchase **ready-made** guns from licensed dealers. (insider.com)

'Someone made the guns to be ready (to use)'

e. This hotel normally forms part of a **tailor-made** or short stay itinerary. (holiday-designers.com)

'Someone made the itinerary tailored to particular needs'

f. It's to be a **purpose-made** society. (cuttingthroughthematrix.com)

'Someone made the society for a purpose'

g. The container used for the transport of the corrector is a **custom-made** item. (subarutelescope.org)

'Someone made the item in a customized way'

In these examples, α can include nouns that would be various types of participants in an event denoted by the verb, like locations, agents, and instruments of *making* events. Additionally, α can further specify properties of the head noun (e.g. *ready-made*, *tailor-made*) or else properties that might be otherwise related to the event specified by the participle (e.g. *purpose-made*, *custom-made*).

We noted in the previous chapter that there are limitations on α driven by the uniqueness and reusability requirements of names. The uniqueness condition requires that α have descriptive meaning (in the sense of Kaplan (1989)) that is stable across contexts, the result being that we don't see αs that are interpreted indexically when they are used in names. The second condition, reusability, is of a different nature. It says that names *can* be reused by other speakers. When naming, a speaker doesn't

125

necessarily know whether future speakers will find the name reusable. So, effectively this condition defines naming as a process with a certain intent: to coin terms that speakers will find useful. What effect does this condition have on α?

In order to answer this question, we can't simply look for putative generalizations on what αs are incompatible in compound participles. Instead, we need to get a sketch of how speakers actually use compound participles to reflect what sorts of meanings speakers do find useful to express using names. This is the primary aim of this chapter: to describe and categorize the meanings that have been expressed using compound adjectival participles. To to so, we will use data pulled from a large corpus as a sample of language use.

In addition to looking at the semantic role of α, we will also note how the semantic contribution of α relates to the meaning of the entire compound. While there are clear patterns in terms of the types of meaning the α contributes to the complex participle compositionally, there are also varying degrees to which the result of that composition is more or less transparent. In other words, compound participles can have idiosyncratic meaning beyond simply denoting that an event of a certain type took place in which α played a role in that event. For instance, *home-made* doesn't simply denote that there was an associated event of making that took place in a home. Consider the definition for *home-made* from *Merriam-Webster*:

(148) **home-made**, *adj*: made in the home, on the premises, or by one's own efforts

Something home-made could be made in a home, locally, or else has some degree to which the maker is personally involved in the making rather than it being manufactured and/or mass-produced. The same can't be said for a participle in a corre-

126

sponding phrasal construction:

(149) a. The home-made pasta was made at the restaurant

       b. #Someone made the pasta at home and the pasta was made at the restau-
          rant

       c. # The pasta, made at home, was made at the restaurant

The key point here is that, although there is a degree of predictability in the composition of participles which presumably contributes to our ability to generate new ones and be understood, there also rampant idiosyncrasy in both form and meaning, diluting the explanatory power of regular derivational rules. A second aim of this description is to identify what those idiosyncrasies are by collecting and organizing large quantities of compound participles, with the ultimate purpose of understanding naming conventions.

Finally, there are certain factors related to frequency which also may affect the impression that a name will be reusable. For instance, speakers are more likely to recognize a name for a property if they have encountered similar properties being named in the past. If I hear the word *blarg-made*, I may interpret this to mean that *blarg* is an agent, a location, or an instrument of a making event since I have encountered words like *artisan-made*, *Austin-made*, and *hand-made* in the past with the same meaning. In constrast, if I encounter the word *blarg-focused*, I am likely to interpret this to mean that *blarg* is the thing being focused on, since I have encountered words like *school-focused*, *health-focused* and *Austin-focused* with meanings such that *school*, *health* and *Austin* are the things being focused on:

(150) a. The General Assembly voted Thursday to override Gov. Larry Hogan's veto of two **school-focused** bills. (wypr.org)

b. The Alliance hosts a **home health-focused** Twitter chat on the fourth Tuesday of every month at 2 pm ET. (ahhqi.org)

c. While you're in San Marcos, tour Texas State's campus and stop by the Alkek Library to check out its **Austin-focused** art exhibits. (dailytexanonline.com)

I am less likely to interpret *blarg*-focused to have a meaning where *blarg* is the agent, location or instrument of a focusing event because I have not heard compounds of the form α-focused with these meanings before. The idea here is that, when speakers name new properties, they are not simply adding words in isolation. The reusability of a word will be influenced by the complex web of meanings that already exist in the lexicon and we are more likely to add words that cluster around established meanings.

In sum, the aims of this chapter are threefold: i) to sketch how the meanings of αs in compound participles relate to the underlying event ii) to identify specialized meanings beyond the sum of the parts in a compound and iii) to better understand the nature of semantic clusters that influence reusabilty.

In the following section, I will discuss the methodology used to pull and classify compound participles. In section 4.2 I will present a classification of types of compound participles, starting with a broad overview and then offering a more detailed discussion of each sub-type. In Section 4.3 I will synthesize trends and irregularities in the form and meaning of complex participles overall. Section 4.4 concludes with

128

a discussion of how the patterns above support the notion that reusability drives naming.

4.1.1 Methodology

While most of the literature on adjectival participles relies on linguist-generated examples, which tend to be limited and recycled, this chapter utilizes data pulled directly from a large corpus of English, specifically the enTenTen15 corpus[1], which contains approximately 13 billion words. This type of approach puts us on better footing to model the range of meanings and forms associated with α-Participles as they are actually used in the corpus, rather than as they are deemed grammatical by a speaker.

Note that in this search we will limit our object of study to α-Participles that appear with a hyphen connecting the α and the Participle. This is partially due to the fact that this particular template is the easiest to automatically pull from the corpus without parsing errors due to the limitations of the corpus querying capabilities. For example, in searching for non-hyphenated instances of α-stained, like *tear-stained*, we could search for nouns preceding the participle *stained*. This would get us tokens where both the α and *stained* attribute a certain property to the nominal head that follows, on par with the function of the corresponding hyphenated α-Participle construction. However, we would also get parsing errors where α is not combining with the participle to create a new property. For instance, the α might be the head noun of a reduced relative clause such as *reason* in (151a), the α might modify the

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[1]https://www.sketchengine.eu/ententen-english-corpus/

head noun independently from the participle such as *commemorative* in (151b), or the α may be playing another role such as the direct object of a ditransitive verb such as *adults* in (151c).

(151)   a. One reason stained glass became popular...(vault.com)

        b. ...plans for a commemorative stained glass window have been drawn up (meldrethhistory.org.uk)

        c. I have taught a number of summer art camps for children aged 5-12, and taught adults stained glass techniques (statementsofpurpose.com)

So, pulling hyphenated compound participles from the corpus is more practical. Additionally, we hypothesize that the hyphen is a written manifestation of some of the properties that have been observed in adjectival participles, namely that the modifiers are prosodically integrated into adjectival participles (See e.g. Gehrke (2013) for a discussion of a related phenomenon in German).

Using hyphenated examples of compound participles from the corpus, I will propose sub-types of the meanings of complex participles primarily based on the semantic relationship between the α and the participle. This method requires us to paraphrase the meanings of the compounds in terms of the underlying events after which they are named, in order to determine the underlying role of the α in the event. The strategy whereby meanings are organized according to the role of the noun in an underlying verbal paraphrase is similar to the approach found in Clark and Clark's (1979) categorization of denominal verbs. For example, in (152-154), the verb names

130

a noun that plays a certain case role, locatum, location or agent respectively, in the paraphrase that follows:

(152) **Locatum Verb**

    a. Jane blanketed the bed.

    b. Jane did something to cause it to come about that [the bed had one or more blankets on it].

(153) **Location Verb**

    a. Kenneth kenneled the dog.

    b. Kenneth did something to cause it to come about that [the dog was in a kennel].

(154) **Agent Verb**

    a. John butchered the cow.

    b. John did to the cow the act that one would normally expect [a butcher to do to a cow].

It is important to mention here that Clark and Clark's (1979) paraphrases, like those in (152b-154b), are *not* intended to represent an analysis of the underlying denotation of the denominal, but rather are used as heuristic devices to categorize verbs with "similar origins" (pg. 769). In other words, they assume that the denominals approximate the meanings associated with their so-called 'parent nouns,' but they go to great lengths to point out ways in which the meanings of the denominals are subtly different from the paraphrases. Similarly, throughout this dissertation we have motivated the idea that the meanings of participles that name properties cannot

be fully captured by describing the property in terms of the event after which it is named. Nonetheless, this approach will also be helpful for us in getting a sketch of the types of roles that α can play in the event entailed by the participle.

4.2 Classifications

4.2.1 Overview

To give the reader an idea of the range of α meanings we will discuss, let's start with a brief overview of general trends in the data. We sort compound participles with respect to the relationship that α has to the underlying event entailed by the participle. I found examples of complex participles with αs in a wide range of roles. These include both internal and external thematic roles along with various obliques.

First there are cases where α is a subject in the verbal paraphrase of the participle. These include agents, non-agentive causers and instruments. Note that instruments can also be introduced via *with*-PPs (Schlesinger (1989)).

(155) **Subject α**

    a. **Agentive**: The course will use business cases and **student-conducted research** to explore the dynamic relationships between the electronic enterprise and the e-commerce marketplace. (tesc.com)
    '<u>students</u> conducted research'

    b. **Non-agentive causer**: These developments of the 1960s and 1970s... combined with the immense reconstruction of **war-destroyed infrastructure**, had to be powered by the only energy source that was avail-

132

able... (ensec.com)

'<u>war</u> destroyed the infrastructure'

   c. **Instrument**: And when train carriages are spidered with graffiti, have **knife-slashed seats**, shattered windows, busted lights, dirty floors and an atmosphere of neglect, then it transfers into the mindset of customers (null.com)

'<u>a knife</u> slashed the seats'

'Someone slashed the seats <u>with a knife</u>

Similarly, there are cases where α names what would be part of an oblique in a verbal paraphrase. There are some instances where these obliques correspond to commonly used case-roles, such as location or goal. But the αs in the majority of these compounds correspond to nouns that are assigned certain case roles by a preposition in an underlying paraphrase.

(156) **Oblique α**

   a. **Location**: Over 98 percent of feed provided to BC **farm-raised salmon** are antibiotic free...(farmfreshsalmon.org)

'Someone raised the salmon <u>on a farm</u>'

   b. **Goal**: It's been quite a mercurial week for the **playoff-bound Wizards** (truthaboutit.net)

'The Wizards are bound <u>for the playoffs</u>'

   c. **Towards PP**: This is the only time that ridiculously **landlord-biased laws** worked for me (ironicsans.com)

133

'Someone biased the accounts <u>towards landlords</u>'

d. **To PP**: 5G is set to supercharge the growth of **internet-connected devices**, which could give bad actors more openings to hack your business. (insider.com)

'Someone connected the devices <u>to the internet</u>.'

e. **In PP**: Many were the pilgrimages made to the lone **crow-shrouded house** half a mile up the lake (mhs.mb.ca)

'The house was shrouded <u>in crows</u>'

f. **By PP**: The study used a matched-pair, **cluster-randomized control design** at the school level. (ed.gov)

'Someone randomized the control design <u>by cluster</u>.'

g. **On PP**: The federal government works with provinces, territories, municipalities and the private sector to provide funds to **economically-focused projects.**

'Someone focused the projects <u>on the economy</u>'

h. **With PP**: The Channel 11 article attributed the accident to **rain-slicked roads** (smithandhasslerblog.com)

'Something slicked the roads <u>with rain</u>'

A first departure from αs resembling participants in the underlying event can be found in cases where the α seems to name a *part* of the head noun. For example, *soul* in *soul-destroyed worlds* is naming the part of the worlds that are destroyed.

(157) **Part/Possessive α**

134

a. Poets have the task of finding beauty lurking in an often **soul-destroyed world**. (poetrypf.co.uk)

'Someone destroyed <u>the soul of the worlds</u>'

b. As the camera panned above them, it revealed Ned's bloody, **neck-slashed corpse** in the upper bunk.(filmsite.org)

'Someone slashed <u>the neck of the corpse</u>'

c. The Philadelphia Marriott...is now offering two **value-added packages** which enable travelers to enjoy the city's newest exhibitions this fall and winter. (travelersjournal.com)

'Someone added to <u>the value of the package</u>'

Further, there are a wide range of meanings that occupy the α position which don't name participants in an event at all, especially when we expand our query to αs beyond nouns.[2] These meanings range from temporal and manner modifiers to negation and prepositional components.

(158) **Modifier α**

a. **Temporal:** Add disclaimers on non-responses involving IM caps and **already-answered questions**. (seawolf-monsters.com)

b. **Negation:** I knew–from the other **not-respected kids**–what additional burdens they faced that I escaped. (livejournal.com)

c. **Modal:** Chief among these, from my **admittedly-biased point of view**, is XSLT, which is a superlative declarative syntax.(spacefold.com)

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[2]Note however that nouns can appear as αs in several of these categories as well, along with non-nouns appearing in the categories above. See "Notes on Form" section

d. **Scalar:** They involve **heavily-biased content**.(searchengineland.com)

e. **Manner:** An **incrementally-generated complete history** of program execution and output (mit.edu)

f. **Preposition: Finger up-raised** to heaven (adelphia.net)

g. **Reflexive:** Access to this airfield was stopped because the owners are fed up with the **self-conducted tours** by spotters.(aircraftspotting.co.uk)

h. **Types:** It's not the **leather-bound book**. (nrb.org)

4.2.2 Subject αs

Let's take a closer look at those complex participles in which α incorporates what would be considered a subject in the argument structure of a verbal use of the participle.

1. **Agentive:** α names an agent in an underlying verbal paraphrase

Examples:

student-conducted research, industry-conducted testing, bear-destroyed shack, human-caused emissions, balloon-caused outages, manufacturer-determined specifications, laboratory-determined data, Chinese-edited periodical, user-created extensions, human-created language, guest-recommended shower heads, bee-delivered pollen, state-sponsored competition, officer-involved shootings?, snail-transmitted parasites, expert-answered emails, faculty-directed programming, critically-destroyed movie, manufacturer-recommended photo paper, tribally-sponsored activities, computer-generated script, owner-occupied appartment,

ant-tended aphid, time-tested methodology, comma-separated listing?, retro-inspired push-carts, fan-voted award, Western-backed uprising, user-led project, board-certified plastic surgeon, federally-issued certification, women-led organizations, god-created being.

Proper names: Mendenhall-coached teams, Michelin-decorated chef, IBM-sponsored studies, WHO-recommended antibiotics, Kent Nagano-conducted Zappa, Koch-funded Beacon Hill Institute

Some α-Participles are *agentive* participles, such that α plays an agentive role in a verbal paraphrase. In these cases the α, like *student* in *student-led meeting*, is assigned an agentive case role by the verb. In other words, there is an intuition that *student* carries an agentive meaning when it is used in the complex participle *student-led*, supported by the ability to paraphrase it such that the α is the subject: *students led the meeting*.

A first observation here is that the participles differ from their corresponding paraphrases such that α does not introduce a discourse referent. Semantically, the α terms in this group have a proclivity towards generic meanings. For instance, *snail-transmitted parasites* involve the generic kind *snails* rather than a particular snail. This quality has been observed in German adjectival passives, which has led to analyses arguing that these participles denote event kinds. However, we also see αs which refer to particular groups like *The World Health Organization* in *WHO-recommended*, or proper names like *Mendenhall* in *Mendenhall-coached teams*.

Turning to the form of the complex agentive participles, another initial observation is that verbs which require prepositions to introduce their internal argument

lack that requirement as complex participles. For example, *voted* selects for the preposition *on* to introduce the argument *award*, but lacks such a requirement as a complex participle.

(159)   a. fans voted *(on) the award

          b. a fan-voted(-*on) award

Another feature to note here, which is true of several of the categories below, is that the form of α is much more liberal than the corresponding forms that we would expect to occur in a verbal paraphrase. For example, in addition to nouns that name participants, we see adjectives and adverbs in the α slot that seem to also be contributing agentive semantic information in a similar way. For instance, consider the following examples where α is not a noun:

(160)   a. federally-issued certification

          b. critically-destroyed movie

          c. Chinese-edited periodical

          d. retro-inspired pushcarts

Let's take a closer look at these examples. First consider *federally-issued*, in which *federally* refers to *the federal government*. Albeit less frequent,[3] we also see cases of *fed-X*, such as *fed-brokered*, *fed-backed*, and *fed-supplied* and *federal-X* such as *federal-funded*, *federal-led*, *federal-mandated*. In this case, the form of the α doesn't seem to have much effect on the meaning of the participle, which suggests that they

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[3] *federally-X* has 21,479 hits in enTenTen, *fed-X* has 1,403 and *federal-X* has 635

are allomorphs. In other words, *federally-issued*, *federal-issued* and *fed-issued* all have the same meaning.[4]

We can observe a similar pattern with the example *retro-inspired*, where *retro* is the thing that is doing the inspiring. While *retro* is usually used as an adjective, here it might be a stand-in for something like *retro style*. That is, we might paraphrase *retro-inspired pushcarts* as something like *pushcarts inspired by retro style*.

Consider the next example, *critically-detroyed movie*. Here, *critically* isn't performing the function we would expect of the adverb *critically* in a full clause. That is, it is not describing the result state of the destroying (cf. *He was critically hit*), nor is it really describing the manner in which the movie is destroyed (cf. *She thought critically about the movie*). Instead, it is telling us something about who is doing the destroying (critics). Setting aside the polysemous interpretation of *destroy* which can be taken literally, let's compare the meaning of *critically-destroyed movie* to the meaning of *destroyed*. While both carry an entailment that the movie was criticized, only the first entails that the critics were the ones doing the criticism since (161b) can be used in a context where amateurs destroyed the movie.

(161)   a. #The movie was critically destroyed but critics didn't destroy the movie.

        b. The movie was destroyed but critics didn't destroy the movie.

It is also worth noting here that the construction *critically-X* coexists with the construction *critic-X*, though the two have quite different usage. For example, in enTen-Ten the form *critically-X* occurs 11,371 times, overwhelmingly with the participle

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[4]Though, *fed* may refer to the Federal Reserve Bank: e.g. *Since 1971, Fed-issued currency has no precious metal backing, indeed no backing whatsoever.*

acclaimed. For comparison, *critic-acclaimed* occurs only once. On the other hand, the construction *critic-X* occurs 81 times with a wide range of participles, including *critic-voted*, *critic-led*, *critic-compiled*, *critic-recommended*, and *critic-fueled*. If both *critic-X* and *critically-X* were derived from the same rule, we would need some other explanation for this difference.

Turning to *Chinese-edited*, we see an instance of an adjective naming a quality of the agent of the editing event rather than the agent itself. Still, the α here is undoubtedly related to the agent, as in the editors, rather than some other participant. Note that, again, this participle occurs alongside a form with a nominal α, *China-X*, for example *China-based company*, *China-related advertisements*, and *China-ruled city*. However, in each of these instances *China* seems to be contributing very different types of meanings, naming either the location, the culture or the government associated with China respectively. In all of these contexts, the role of the α is quite distinct from the agentive α in *Chinese-edited*.

2. **Non-agentive causer:** α names a non-agentive causer in an underlying paraphrase.

   Examples: war-destroyed infrastructure, wind destroyed building, Katrina-destroyed casino, tuberculosis-destroyed lung, war-injured soldiers, stroke-injured brain, night-shrouded world, mist-shrouded mountains, fiat money-created Great Depression, productivity-created wealth, opioid-involved overdose, alcohol-involved assault, freeze-destroyed Ben Davis, air-rusted pipe, battle-hardened members, behavior-driven development, sun-dried tomatoes

   In addition to agents, αs can name non-agentive causers. Some of these α-

140

Participles can be paraphrased as transitive verbs with the causer in subject position or in a periphrastic causative paraphrase.

(162) a. War-destroyed infrastructure

    i. *War destroyed the infrastructure*

    ii. *War caused the infrastructure to be destroyed*

  b. stroke-injured brain

    i. *A stroke injured the brain*

    ii. *A stroke caused the brain to be injured*

  c. air-rusted pipe

    i. *air rusted the pipe*

    ii. *air caused the pipe to be rusted*

However, others sound odd with a transitive paraphrase and the periphrastic causative seems more appropriate since α is a more indirect causer.

(163) war-injured soldiers

  a. *?war injured the soldiers*

  b. *war caused the soldiers to be injured*

Lastly, there are some non-agentive causers which can be paraphrased as transitive subjects but interestingly enough cannot be used in periphrastic construction.

(164) mist-shrouded mountains

  a. *mist shrouded the mountains*

b. *?mist caused the mountains to be shrouded*

This variability in potential underlying forms for complex participles with similar meanings makes even our heuristic categories difficult to operationalize. Further complicating this picture are the outlying cases where the head noun has some sort of eventive component which is related to α, for instance the case of *alcohol-involved assault* or *opioid-involved overdose*. In these cases, the α is the causer of the event associated with the noun rather than the participle:

(165)   a. alcohol-involved assault

the assault involved alcohol

alcohol was involved in the assault

alcohol caused the assault

   b. opioid-involved overdose

the overdose involved opiods

opiods were involved in the overdose

opiods caused the overdose

3. **Instrument:** the α would be assigned an instrumental case role in an underlying verbal paraphrase.

Examples: computer-implemented method, leather-bound chair, CRISPR-edited T cells, tarp-shrouded figures, hand-created Bible pages, hand-written document, blood-written pages, hand-delivered food, microneedle-delivered vaccine, internet-delivered diploma, knife-slashed bodies, snow-slashed mountain, radio-transmitted data, electronically-transmitted transcripts, orally-transmitted stanza,

remotely-geared lantern, machine-driven learning, steam-powered, nuclear-armed submarine, spring-loaded button, brake-operated anti-dive, brass-plated knob, money-backed commodities, leather-wrapped journal, wood-paneled library, astroturf-lined beer garden, lacto-fermented foods, air-conditioned apartment, web-based intake, Gorgonzola-zapped onions, adhesive-backed template

Just as with the agentive participles, with instrumental αs we see cases where α has a generic or even metonymic flavor. For instance, the instrumental paraphrase of *hand-created* could be *someone created something with their hands*. This paraphrase misses a crucial aspect of the meaning; *hand-created* refers to something that was not created with some sort of automatic machinery, but rather by employing manual skills. Note that if you make something in a factory you also use your hands, for instance to press buttons on a machine, but this requires technical skills rather than manual ones. So, things made in a factory are not *hand-made*. On the other hand, if you weld a sculpture by hand and it involves manual skills, then you can call it *hand-welded* or *hand-made*, even if you also use tools. From a naming perspective, it makes sense that we would have a special form for this property because manual skills have a special value in society, and therefore artifacts created using manual skills also have a special value.

Just as we saw in the agentive category, we can again identify some non-noun αs with instrument paraphrases. For instance, consider *orally-transmitted stanza*. On one hand, we can paraphrase this as *someone transmitted the stanza orally*, in which case *orally* would be considered a manner modifier, telling us that the event occurred by means of speech. However, we could just as easily construe *orally-transmitted* to

143

mean something like *someone transmitted the stanza with their voice* resembling an instrumental paraphrase. However, when we look at the context for this particular piece of data, the choice between these two paraphrases doesn't quite matter:

(166) This hymn began as an **orally-transmitted stanza** reflecting on Romans 14:7–8 and was expanded by a Spanish-language hymnal committee to offer additional examples of the many dimensions of life... (hymnary.org)

The crucial meaning here is that the stanza has been passed down by word of mouth rather than by other means, like via writing. To use *orally-transmitted* with this meaning, a speaker doesn't need to determine whether *orally* should be considered a manner modifier or an instrumental modifier of the associated event.

Similar blurred lines exist across several of the participles which, at first glance may seem to squarely belong in this category. Is *sun* in *sun-dried* a causer or an instrument? Say there was a towel left out in the sun that happened to dry. In this case, we might consider the sun to be a non-agentive causer if we use the expression *sun-dried towel*. However, more often the term *sun-dried* is used to name a type of process where something is intentionally processed using the sun, for instance *sun-dried tomatoes*. In this case, we might consider the sun to be an instrument utilized for a particular purpose. Consider the example *machine-driven learning*. This refers to a type of artificial intelligence field that focuses on building systems that can learn to identify patterns from data. In this case, does *machine* refer to the instrument with which the learning is driven, or the thing which itself is doing the learning? To parse the meaning of *machine-driven* is it really important that we know this?

The big takeaway here is that there are many ways for something to be con-

144

sidered an instrument in an event because there are many ways in which something can be used to help reach a certain result. Compare *hand-written pages* to *English-written pages*. Do we have grounds for saying that *hand* is more of an instrument than *English* here? It seems like knowing whether an α names an instrument is less important in understanding the meaning of the complex participle than understanding the way in which that instrument is significant in naming the property associated with the event.

This supports the view that there is no general compositional rule for compound participles. Clearly, there are meanings for participles that cluster around thematic roles and likely influence naming, especially when names are first dubbed or linked to less rich contexts that clue the listener into the intended meaning (see e.g. Valles-Botey (2003), Gagne (2002)). However, those clusters seem to be relevant for participles of varying levels of generality/specificity; the category 'instrument' may be a sort of basic level category with special significance.

4.2.3   Oblique αs

In addition to αs named after subject participants, there are also several cases where α is named after individuals that would be oblique participants in verbal paraphrases. Typically, these are licensed by prepositions that are either obligatory or strongly associated with the verb. For instance, *focus* is typically associated with a PP headed by *on*, and the α-focused construction typically names α for the participant introduced in that PP.

In some cases, the α meaning relates to a clear case role. Specifically, *location*

(typically represented with an *in*-PP),*goal* (typically represented with a *to*-PP, and *beneficiary*, typically represented with a *for*-PP or *towards*-PP.

4. **Location**: the α would be assigned a location case role in an underlying verbal paraphrase.

   Examples: membrane-bound aggregates, wheelchair-bound person, earth-bound, Australian-raised Russell, farm-raised salmon, city-raised friends, home-delivered food, membrane-located proteins, starboard-located club, foreign-located payment, locally-raised Easter ham, centrally-located restroom, tip-located adhesion, Australian-trained horse, Boston-trained doctor, Estonia-based developer, laboratory-developed, Oxford-educated health secretary, bottom-fed group, helmet-mounted camera, shore-based anglers, laboratory-determined data?

Depending on the verb, the named location can be where the event took place (e.g. *city-raised friends*), where the result of that event came about (e.g. *home-delivered food*) or where a certain state holds (e.g. *membrane-located proteins*, *wheelchair-bound*).

We do have a few examples of adjectival αs describing a location rather than naming the location itself, such as *foreign-located payment*. Relatedly, one example, *laboratory-determined data*, is included in both the agentive and location categories. One interpretation could be that the data was determined in a laboratory, but there is also a metonymic interpretation such that 'the laboratory' is standing in for the body of people who are doing the determining. Crucially, a speaker doesn't need to disambiguate between these two potential paraphrases to use the complex participle

146

laboratory-determined. In other words, again the meaning of the participle doesn't rely on the choice of the underlying paraphrase.

Additionally, there are some allomorphic αs in this category as well:

(167)   a. central/centrally-located

      b. Australian/Australia-trained

      c. local/locally-raised

Finally, I found a few instances where the α could be interpreted as a goal or a beneficiary. However, these examples were quite restrictive and only appeared with two particular verbs, namely *bound* and *geared* respectively.

5. **Goal:** the α would be assigned a goal case role in an underlying verbal paraphrase. Examples: safari-bound tourists, ferry-bound motorists, playoff-bound New York Yankees

6. **Beneficiary:** the α would be assigned a beneficiary case role in an underlying verbal paraphrase. Examples: student-geared projects, tourist-geared information, girl-geared company, kid-geared experiment

There are many additional instances where the case role doesn't squarely fall into a particular theta role. The semantics of these αs are determined by the semantics of nouns which would be in oblique PPs in an underlying paraphrase.

7. **Other Oblique αs:** the α would be assigned an oblique case role by a preposition in an underlying paraphrase

towards: Confucian-biased accounts, landlord-biased laws, road-biased car, metal-geared listeners, growth-geared outlook, community-directed healthcare, infant-directed singing, gag-oriented diversions

to: stage-bound genre, street-involved women, internet-connected room, Faradic-related mechanism

in: crow-shrouded house, controversy-shrouded resignation, English-written messages, systems-involved children, police-involved deaths, drug-coated balloons

by: air-delivered missiles, cluster-randomized trial, group-randomized trial, color-matched buttons

on: patient-focused health, risk-focused strategies, female-focused event, growth-focused Toronto, recruiter-focused blogs, economically-focused campaign, technologically-focused education, art-focused trip, counterterrorism-focused panel, French-centered character, rules-based order, Krylov-based algorithms, Torah-based Noahide Code

with: reggae-inflected bass, country-tinged ballad, age-associated impairment, fear-filled reaction, poverty-stricken family, goods-laden vehicles, rain-slicked tunnel, gag-laden script

The relationships between the αs and the participles are diverse in this set since prepositions can assign a range of different verb-specific roles. However, we also have diversity in this set with respect to how the α and the head noun relate to the argument structure of the corresponding verb.

As a starting point, these examples typically can be paraphrased with a passive

148

and a preposition, following (168a), which relates to the output (168b).

(168)   a. Y is Verb.Past.Part Preposition α

      b. α-Participle Y

For example:

(169)   a. Accounts are biased toward Confucius

      b. Confucian-biased accounts

Given this analysis, the semantic relationship between α and the participle should in principle be whatever the semantic relationship is between the two in the verbal paraphrase, by-and-large determined by the preposition typically used with the participle. And generally that seems to be the case:

(170)   a. Vehicles are laden with goods $\rightarrow$ goods-laden vehicles

      b. Families are stricken with poverty $\rightarrow$ poverty-stricken family

      c. Missiles are delivered via air $\rightarrow$ air-delivered missiles

However, when we consider a wider paradigm relating α and the head noun, Y, in both active and passive forms, more distinct patterns emerge. Consider the table below (Table 4.1). Some oblique participles can only be paraphrased with the head noun in the subject of a passive and the α introduced by a preposition, for example *community-directed healthcare*. However, some participles like *poverty-struck* can also participate in an active paraphrase where α sits in the subject position and the head noun as the object. We also can get the complete opposite relationship, for instance with *alcohol-involved assault*, whereby an acceptable active paraphrase

149

involves the α in subject position, and the passive involves the head noun in subject position.

In some cases, the related preposition behaves like a particle, for instance *focus on* and *relate to*. If we allow for the particle in the active paraphrases, there are also cases where we can either get all four paraphrases, for instance *motion-related mechanism* or just those in which the head noun is the subject, for instance *risk-focused strategies*.

Token	Y Verbed (Prep) α	Y was Verbed Preposition α	α Verbed Y	α was Verbed Preposition Y
community-directed health-care	*healthcare directed the community	healthcare was directed toward the community	*community directed the healthcare	*community was directed toward healthcare
poverty-struck family	*the family struck the poverty	the family was struck with poverty	poverty struck the family	*poverty was struck with the family
alcohol-involved assault	the assault involved alcohol	*the assault was involved in the alcohol	*alcohol involved the assault	alcohol was involved in the assault
motion-related mechanism	the mechanism related to motion	the mechanism was related to motion	motion related to the mechanism	the mechanism was related to motion
risk-focused strategies	the strategies focused *(on) risk	the strategies were focused on risk	*risk focused on the strategies	*risk was focused on the strategies

Table 4.1: Types of Oblique paraphrases

We also get specialized meaning with α-Participles that we don't get in verbal paraphrases following (168a). For instance consider the term *cluster-randomized trials*, which we could paraphrase to mean *someone randomized the trial by clusters*. However, this paraphrase doesn't quite get at an important aspect of the meaning, that the clusters, which are groups of subjects, are randomized rather than individual subjects. This part of the meaning isn't explicitly captured in the paraphrase, but rather implicit in the meaning of *by cluster*.

Another snag to point out here is that, semantically, a lot of these αs seem to have similar roles as the αs which play a theta role in an underlying verbal paraphrase. For instance *leather* in *leather-bound book* could easily be considered an instrument. *Stage* in *stage-bound* might be considered a location. *Age* in *age-associated impairment* might even be considered a non-agentive causer. Again, categories based on paraphrases of thematic roles in the associated event are helpful heuristics, but don't necessarily capture the specialized meaning associated with the participle.

4.2.4 Non-Participant αs

8. **Part/whole**: α names either a part of the patient noun or something that the patient noun would possess in a verbal paraphrase

   Examples: soul-destroyed societies, brain-destroyed Terri Schiavo, internal-geared hub, gene-edited reptiles, spine-injured athelete, price-slashed gifts, budget-slashed state school, carb-slashed sandwiches, value-added services, health-themed book, value-added package, sensible-sized container

   While typically the patient role involved in the α-Participle construction is

151

reserved for the head noun, the individual which holds the property named by α-Participle, there are several cases in which α names either a part of the patient noun or something that the patient noun would possess in a verbal paraphrase. For instance, *soul-destroyed societies* might be paraphrased as *the soul of a society is destroyed.*

Part-whole interpretations are quite flexible, in that the whole of which the α names a part can be a name for an actual part of the head noun, such as *neck-slashed body* or simply have some sort of inalienable relationship to the head noun, such as *carb-slashed sandwich.* In the latter case, the relationship between *carb* and *sandwich* is such that sandwiches have carbs. Carbs belong to the set of features of the sandwich. We can also see part/whole relationships reflected in 'job-is-done' readings, such that the job that is completed is part of a larger whole of tasks. For instance consider the case in 171 below, where the meaning of *prayer-answered flag* is highly dependent on context:

(171)   See those papers floating in the air like Thai Prayer Flags? They have winning tickets taped to them, along with the vast quantities of cash the recipient received, mostly in the $100 to $1000 spectrum, with a few legit hefty sums as well. No doubt the sight of so many previous lucky ticket holders is an incentive to keep spending your meager wages on this scheme. Maybe you'll be the next one to fly your own **prayer-answered flag**. (chanfles.com)

Here, the meaning of *prayer-answered* could be paraphrased as *something fortunate, like a winning lottery ticket, that is the result of a prayer having been answered.* The flag here has come to represent the property such that a certain job, the prayer being

152

answered, is done.

9. **Modal**: α qualifies the speaker's commitment that the property indicated by the participle holds of the head noun

   Epistemic examples: actually-destroyed, perhaps-answered question,

   Deontic examples: admittedly-biased, needlessly-destroyed dipoles

In some constructions, α indicates something about the speaker's attitude or evaluation toward the property. This can either involve epistemic certainty or deontic evaluations. Here, the α doesn't have a relationship to the associated event, but rather to whether the result property of an event held. For instance, consider *perhaps-answered question.* We could conceivably use this in a context where there was an answering event but the speaker isn't satisfied with that answer.

10. **Scalar:** α names a scale that applies to the property named by the participle

    Examples: all-but-destroyed research, almost-destroyed capital (on scalar reading), best-written shows, completely-randomized, fully-geared character, further-slashed home goods, gravely-injured victims, half-answered questions, half-destroyed capitol, heavily-biased ESPN announcing crew, highly-recommended reference, hyper-focused audience, more-destroyed leg, most-biased states, nearly-destroyed target, partially-destroyed, quasi-randomized, semi-destroyed room, slightly-edited quotation, super-involved, well-geared characters, most-loved fiber network, multi-coloured design, over-hyped disappointments, fully-owned subsidiary, much-coveted award, high-skilled jobs, highly-anticipated film, masters-trained therapist

153

In other cases, α can be used to name a property that includes some type of scalar meaning. The scale depends on the property meaning associated with the participle. For instance, some scalar αs like *half* and *almost* can indicate that the result property we would expect from a certain type of event hasn't been reached. This can mean that only part of the head noun has the result property or that the result property has only been partially been attained. For example, *half-answered questions* might mean that all of the questions weren't answered completely, while *half-destroyed capitol* could mean that parts of the capitol were completely destroyed. There are also scalar αs which comment on the intensity of the property, such as *hyper*-focused, or *heavily*-biased. Depending on the word, this type of modifier can also be ambiguous with respect to whether it indicates intensity on a scale or to how the property is distributed. For example, *most-loved* fiber network can either mean that one person loves the network with a high intensity or that the most number of people love the network.

While many scalar αs are adverbs, we can get nouns that also represent scales. Fore example, in the case *masters-trained therapist*, *masters-trained* means that the head noun has the property of having been trained such that they have received a masters degree. *Masters* here is specifying the degree to which the therapist is trained.

11. **Manner**: α names a manner in which the event takes place and/or the property holds.

    Examples: *Event-oriented manner:* badly-answered question, carefully-located muscles, correctly-answered riddles, incrementally-implemented acts, easily-

answered queries, aptly-titled book, ill-fated character, rote-memorized fact, fine-tuned, publically-declared heir, properly-conducted research, sharply-edited video content, successfully-answered questions, sustainably-raised veal, tightly-focused topics, well-answered questions, well-edited list, ill-gotten gains, laser-focused strategy, critically-needed funds

Result-oriented manner: artificially-created cyborgs, beautifully-located Ocean Studios, beautifully-written series, drily-written report, dynamically-created pattern, gorgeously-created sets, ready-prepared paints, custom-implemented Manufactrons

Ambiguous: digitally-created simulations, politically-biased decision, closely-written sheet, newly-obtained facts, fast-paced world, fair-minded government, ill-conducted actions, perfectly-created files, positively-geared investors, proficiently-delivered music, reasonably-conducted arbitration, scientifically-conducted survey, shoddily-written essay, specially-created scenes, superbly-written book, randomly-generated items

Additionally, α can name a manner applying to the event in a verbal paraphrase is done, which is almost always encoded as an adverb. Manner modifiers can apply to the event named by the participle, the result of that event or both. For instance, for *badly-answered question*, the answering is bad, not the question itself. For *gorgeously-created sets*, the sets themselves are gorgeous, not the creating events. However, in the case of *digitally-created simulations*, both the creation and the simulation can be considered digital. We can also have α that express a range of meanings that somehow encode information about tense or aspect. For instance α can comment on

the time when the state denoted by Participle holds of the head noun with respect to an utterance or situation time. For instance *already-answered questions* indicates that the questions were answered as some time previous to another time, likely the utterance time. Relatedly, *newly-created roles* indicates that the creation of the roles happened as a past time that is relatively close to the utterance or situation time. It can also comment on how long the state denoted by Participle has held, for instance *long-destroyed Earth*.

12. **Temporal**: α provides temporal information about the event named by the participle.

    Examples: long-destroyed temple; my last-time-edited file, already-answered questions, already-destroyed statue, always-answered phone, annually-conducted survey, commonly-raised objections, currently-recommended rates, daily-recommended dose, earlier-transmitted frames, first-created man, formally-destroyed voice-box, frequently-destroyed Tokyo Tower, freshly-created zone, just-created message, long-ago-answered quibbles, long-biased strategies, long-destroyed Earth, never-answered question, newly-created roles, now-destroyed village, once-destroyed office, pre-edited copy, previously-answered questions, rarely-implemented narrative alternates, recently- conducted program, since-destroyed locomotive, soon-to-be-destroyed home, then-injured Kirk Barron, yet-to-be-answered doubts, lightly-raced horse, now-ruined castle, pre-booked tickets, pre-recorded message, re-established relationships, newly-minted Lieutenant, twice-impeached former president

These types of temporal examples have been particularly relevant in the literature on

participles since they are sometimes used as evidence that the participle still denotes an event since it is spatio-temporally accessible, though often with a counterargument that α is actually applying to the result state rather than modifying the event (see e.g. Rapp (1996), Maienborn et al. (2016)). What is particularly interesting in this data is that the range of temporal modifiers extend far beyond the examples that recycle through this literature (i.e. *recently*). These temporal modifiers can indicate that a state held at a previous point in time but no longer does (e.g. *once-destroyed, previously-answered, then-injured*). They can indicate how long a state held before another situation time (e.g. *newly-minted, long-destroyed*). They can indicate the extent to which an event or state is habitual (e.g. *commonly-raised, daily-recommended, frequently-destroyed*). Any nuance in tense and aspect achievable with verbal morphology is also available with temporal modifiers in the α position of complex participles.

There are certain cases where the α could be interpreted as a temporal modifier or a a scalar modifier. For instance *least-answered question* in the example below could be interpreted as quantifying the number of answering events or quantifying the number of people who answered the question. Regardless, we don't need to disambiguate these senses to use the complex participle.

(172)   With nearly 155,000 responses in total, and nearly 1,700 for the least-answered question, I believe this poll is fairly representative of my readers and the readers of my readers, and therefore gives genuinely useful information about current JavaScript library use. (quirksmode.org)

13. **Negation**: α negates something

Examples: anti-biased families, non-answered voicemails, non-biased reviews, non-destroyed limb, non-recommended browser, not-answered questions, un-caused behavior, still-not-answered question, un-answered question, un-edited style, so-called graduated students, so-called betrayed partner, non-stickered crime books, no-strings-attached fellowship, non-motorized trails, face-undetected state, de-authorized government, un-tethered dog, de-identified data

Another common role for α is to negate something about the meaning of the construction. Interestingly, these constructions are able to negate different types of meaning. α can have narrow scope such that it negates the property denoted by the participle and ascribes that newly named property to the noun. For example. *anti-biased families* are the families which have the property of being against bias. Another great example of negation taking narrow scope can be seen in the following example:

(173) "(Our volunteers) make the best of their slow-growing funds, offering nonalcoholic-involved entertainment events and education for all of the campus as well as serving with no material reward," he said. (bradleywilsononline.net)

Here, *nonalcoholic-involved entertainment* doesn't refer to entertainment that doesn't involve alcoholics, but rather entertainment that doesn't involve alcohol. The negation applies even before the *ic* suffix in α.

α can also have an effect of naming a property that holds of something such that it *hasn't* participated in an event, for example *un-answered question*. Finally, there is the interesting case of *so-called* which negates the speaker's commitment to

158

the use of the name itself in a particular context. For example, in a context where a speaker uses the string *so-called betrayed partner*, they presuppose that someone believes the property of being betrayed holds of the partner, but objects to that belief themself.

The fact that α can negate any aspect of the meaning makes it particularly malleable in context. For instance, in the following example, *face-undetected state* doesn't simply indicate the state of a face being undetected, but rather that it previously was detected and no longer is. This particular example resembles those discussed in Maienborn (2009) where adjectival participles serve as a means of constructing salient alternative states.

(174) ...in the plural face detection state, when any one of faces detected by the face detector is determined to change from the **face-detected state** to the **face-undetected state** while the respective detected-face indicators are displayed, the first indicator display controller controls the display to immediately hide the detected-face indicator of the face determined to change to the face-undetected state (justia.com)

14. **Preposition**: α is a preposition

Examples: off-bound places, under-written character, up-raised wings, above-shown graph, down-turned eyelashes, under-discussed topic, over-worked, under-paid, above-named contemporaries, over-written screenplay

Some prepositional αs can translate to a verbal paraphrase such that the preposition tells us something about the event. For instance, *up-raised wings* can be

159

paraphrased as *something raised their wings up*. However, we can also have preposi-
tional αs that behave more like scalar αs. For instance, an *under-written character*
is a character whose development is less than expected. In contrast, an *over-written
screenplay* is one in which the writer is providing too much descriptive information
than appropriate for the modality. Again, we see some quite idiosyncratic meaning
that is difficult to capture with an accurate and succinct paraphrase.

15. **Self**: α is *self*

    Examples: self-answered questions, self-biased engagement, self-conducted tours,
    self-created instrument, self-involved neotraditionalists, self-delivered services,
    self-destroyed man, self-directed savings, self-professed Islamic states, self-ensured
    scholarship, self-addressed envelope

    While many complex participles can have *self* in the α slot, the roles that *self*
can play are quite diverse- including agentive (e.g. *self-answered*) and oblique (e.g.
self-biased) meanings. In the case of *self-professed Islamic states*, we need a more
idiosyncratic paraphrase to capture the meaning, for instance *someone professed that
they are Islamic states*. In all of these cases, the referent of *self* must have two distinct
roles- the answerer and the asker, the biaser and biasee, and the professor and the
Islamic state entity.

16. **Types:** α names a type to which the head noun can be ascribed

    Examples:

    α *is a type of Participle*: community-randomized trials, higher-geared steer-

160

ing, right-handed debut, spot-stitched flower, sheet-fed press, helium-voiced rendition, pure-bred Clydedale, cherry-picked data

α is a type of Y: plastic-geared servos, plasma-delivered therapies, catheter-delivered devices, kiwi-bred Standardbreds

α is a type of Participle and a type of Y: spiral-bound notebooks, not-quite-dominatrix-geared hero, rugby-tackled, gift-wrapped presents, deep-fried bread, shrink-wrapped lettuce, ground-checked photos

Another semantic cluster of complex participles are those where α doesn't name a participant in the associated event, but instead indicates that either the head noun is of a certain type, the event associated with the participle is of a certain type, or both. This criterion is not mutually exclusive with the previous argument-based categories, so some examples that belong in previous groups may also fit here. For instance, consider *student-written papers*, where the α is playing an agentive role. We could also say that *student* is a type of paper. The fact that *written* connects the two could be inferred based on world knowledge about what students tend to do with papers.

The ability to consider something a type of something else is, at its essence, subsective composition. So, the underlying meaning of these participles is closely tied to the relationship between the α and the head noun more so than the meaning of the participle itself. So, while we don't find consistent paraphrase templates based on verbal argument structure in this category, we can typically omit the participle and still infer the right relationship between the α and the head noun:

161

(175)   a. spiral-bound notebooks

someone bound the notebooks in a spiral-like way

spiral notebooks

b. helium-voiced rendition *renditions the use the voice you get after inhaling helium*

helium rendition

c. catheter-delivered devices

devices which deliver something via a catheter

catheter devices

17. **Miscellaneous:** α has a meaning beyond what can be expressed with a verbal paraphrase

Examples: blue-biased grey, muscle-bound bartender, concrete-bound, remote-geared Eleco, airborne-transmitted disease, monolithically-delivered package, prayer-answered flag, niacin-bound chromium, questions-answered thread, aero-engined car, old-fashioned chest, co-created Doogie Howser, double-geared design, individually-determined colorways, integrally-geared lantern, multi-located corporation, negatively-geared owners, prevention-recommended practices, re-created basement, sexually-transmitted diseases, nationally-acclaimed stars, warehouse-sized computer, time-stamped, jointly-owned, jam-packed store, raw-dried salami, trophically-transmitted parasites, heart-ripped ballads, time-released design, first-come first-served basis, Cable-stayed bridge, fully-fledged idea, weather-stripped system, ego-involved goals, Buckeye-bred player, straight-laced, down-trodden, policeman-turned-firefighter, questions-to-Billy-answered

162

thread, time-released design

For many of these, there is a relationship to a verbal paraphrase but, like many of the idiosyncratic examples pointed out before, the meaning includes idiomatic information beyond what can be captured by a simple verbal paraphrase. For example, consider *muscle-bound*. We could paraphrase this expression as *someone is bound by muscles*, but this literal paraphrase doesn't capture the actual meaning: someone with overdeveloped muscles. Someone who hasn't heard this expression before may be able to conceive of the literal paraphrase and therefore deduce what the idiomatic meaning might be. However, there is a degree to which the speaker needs world knowledge to make that connection between the transparent meaning and the idiomatic meaning.

Similarly, *time-released design* might be paraphrased as *a design in which something is released periodically (over time)*. The α here is giving temporal information, but itself is not very informative. Instead, speakers understand the meaning because they have heard it used in this way before and are therefore able to associate the idiomatic meaning with the name.

A curious case of a complex participle with an ambiguous verbal paraphrase is *nationally-acclaimed stars*. To put this in an active paraphrase we could say this means *someone acclaims the stars nationally*, but this isn't quite right. Rather, *nationally* is telling us something about who is doing the acclaiming or where the acclaiming takes place. We might say that *the nation acclaims the stars* or simply *the stars are acclaimed nationally*, but either way the relationship between the α and the events of acclaiming is left a bit vague. The takeaway here is that the

163

meaning of *nationally-acclaimed* doesn't seem to rely on our understanding of events of acclaiming. So, deriving the meaning from an underlying verbal paraphrase is not particularly helpful here.

There are also cases where there is a corresponding verbal paraphrase, but it lacks the specialized use associated with the participle. For instance, consider the example *fully-fledged idea*. Here, we could paraphrase the meaning as *someone fledged the idea fully*, but the verb sounds odd here. The verb *fledge* is specifically used in reference to birds which are ready to fly for the first time. However, the complex participle *fully-fledged* can extend to describe other literal or metaphorical analogous circumstances.

A similar case comes from *down-trodden*, which is derived from the verb *tread*. *Tread* denotes events of walking in a certain way and can be used to talk about literal walking events or can be extended to talk about metaphorical walking events when the surface of walking is animate (i.e. *don't tread on me*. However, the participle *down-trodden* is specialized only for use in metaphorical cases:

(176)   a. The king treads carelessly on the flowers.

      b. The king's administration treads carelessly on his people.

      c. # the flowers were down-trodden.

      d. the people were down-trodden.

Let's consider a last example in context. Consider the use of *parrot-taught* in the following:

(177)   On other tracks the bass player seems to be playing very crude early Motörhead

164

runs, so they may have been parrot-taught or even played by Lemmy himself.

Here, *parrot-taught* can be paraphrased as *taught by imitation, as a parrot imitates speech.* Unlike *muscle-bound*, this particular form is not itself a very established idiom (insert Sketch Engine frequency data). However, it relies on an understanding of how *parrot* is used metaphorically to indicate imitation.

18. **Verbal Gaps**: the participle lacks a corresponding productive verb

   Examples:

   Simple participle: miffed

   Complex participles: playoff-bound team, goods-laden vehicle, cable-stayed bridge

This chapter has thus far flagged circumstances where a verbal paraphrase deviates from a regular pattern or must account for some type of specialized meaning in the participle. However, there are also cases where there is no corresponding verb with which we are able to create a paraphrase in the first place. One way in which this can happen is that a corresponding verb becomes rare or obsolete.

This can happen with both simple and complex participles. For instance, the participle *miffed* has a corresponding verb *to miff*, meaning "To take offence (usually with with or at); to annoy" (OED (2023)). This verb was converted from an obsolete noun *miff*, meaning "a petty quarrel." The Oxford English dictionary classifies the verb *miff* as belonging to frequency band 3, which is defined as the following: "these words are not commonly found in general text types like novels and newspapers, but at the same time they are not overly opaque or obscure." For contrast, the

165

adjective *miffed* belongs in frequency band 4, which have more specificity in terms of subject domain that higher frequency words but are "remain recognizable to English-speakers. While both uses are relatively low, the adjectival participle is markedly more recognizable than the verb to the extent that a speaker may recognize the adjective, but not the corresponding verbal phrase *someone miffed someone.*

Similarly, we see complex participles with obscure or obsolete corresponding verbs. For instance, *bound*, as in *playoff-bound team* has an obsolete corresponding verb from Middle English, *boun*, meaning "to prepare, make ready." So, while we could paraphrase the meaning of *playoff-bound* and *someone bouned for the playoffs*, clearly this is not an active form in the minds of speakers allowing them to derive the meaning of the resulting participle.

In the case of *goods-laden vehicle*, the participle is related to the verb *lade*, meaning "to load"[5] inherited from Germanic. Both the adjective *laden* and the verb *lade* are relatively obscure and generally confined to literary uses, however in order to understand and use the template *X-laden*, a speaker does not need to have any knowledge of the verbal use at all.

Finally, *cable-stayed* is a property used almost exclusively to describe a type of bridge that is supported by cables. It is unclear here whether *stay* represents an obscure transitive use of the verb *stay*, meaning *to support or hold up* or a technical use of the verb meaning *to support or strengthen with stays*. Again, this is a case

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[5]There is an interesting etymological relationship between *lade* and *load*. The noun *load*, from which the verb *load* is derived, initially had a meaning *carriage* and later was extended to mean "that which is laid upon a person, beast, or vehicle to be carried; a burden." According to the OED the development in the meaning of *load* "has been influenced by the association of the noun with lade v.; in extreme northern dialects this word is not distinguishable.

166

where the exact relationship between the participle and an underlying representation does not matter for a speaker to understand the meaning of the participle.

19. **Denominal**

    Examples:

    health-themed book, three-legged stool, open-hearted person, plastic-geared servos, ten-sided die

Finally, I will mention here that there are several instances of what appear to be complex participles but instead involve nouns in the slot where the participle would be. In these cases, the noun has the same participial morphology as the participles, though historically it is a different morpheme -*ed*, homophonous with the past participle. Under a derivational analysis of adjectival participles, the similarity between these forms and the participles would be coincidental. However, under the naming theory, both denominal and participial examples are instances of complex names.

4.3   Notes

In the following sections I will summarize trends in the data with respect to the form and the meaning of complex adjectival participles.

4.3.1   Notes on form

An important takeaway with respect to the form of α is that there is more unpredictability and variability with respect to how certain αs appear in complex participles than their corresponding forms in verbal paraphrases. In this data I have

indiscriminately included αs of all types, including most often nouns and adverbs but also the occasional adjective or preposition. Just as there seems to be no semantic restriction on what type of meaning can be captured in the α position, so too are we lacking any restriction on the form that α can take.

Sometimes α can take multiple forms without changing the meaning of the name. For instance:

(178) a. cf. sex-transmitted disease vs. sexually-transmitted disease

       b. cf. special-made cake vs. specially-made cake

       c. cf. annual-salaried service vs. annually-salaried service

       d. cf. local-made beer vs. locally-made beer

       e. cf. less-known vs. lesser-known

       f. cf. old-fashion rollercoaster vs. old-fashioned roller coaster

       g. cf. full-trained vs. fully-trained

However, sometimes the α must occur with a particular form:

(179) a. cf. frequently-destroyed Tokyo vs. *frequent-destroyed Tokyo

       b. cf. daily-recommended dose vs. *day-recommended dose

Further, sometimes having the same α with a different form creates a slightly different meaning. We saw this above with agentive participles like *China-related* vs. *Chinese-related*, but this pattern can be seen across types. For instance, consider the difference between *sun-heated* and *solar-heated*. While both may have the same underlying form, *someone headed something with the sun*, their usages are slightly

168

different, which may lead to subtle distinctions in their connotations. Specifically, *solar-heated* is more often with head nouns like *pool*, *laboratory* and *home* whereas *sun-heated* is more often used with head nouns like *pavement*, *water*, *metal*, and *rocks*. So, *solar-heated* seems to have a specialized meaning whereby entire buildings or structures use a man-made solar system for heating, whereas *sun-heated* is more transparently related to the paraphrase.

Not only does flexibility in form apply to αs part of speech, but it is also relevant when α is a proper name. This type of data is of particular import to the literature on adjectival participles because proper name αs are potentially a counter point to the hypothesis that adjectival participles denote event kinds rather than event tokens (see Chapter 1 for a more detailed discussion). A crucial pattern to observe here is that choice of the α proper name is dependent on world knowledge shared by the interlocuters.

For example, consider the complex participles with proper names below. In (180a), the α is a full name, but in (180b) and (180c) there is enough context for the speaker to use just part of the full name. Additionally, the form of the name is dependent on what form the speaker knows the referent as. For instance, The Russo Brothers (180d), The Pet Shop Boys (180e) and Dr. Clark (180f) are the names those individuals are known as professionally. So, those forms of α are appropriate.

(180) a. It originated as the short story "Wang's Carpets" which originally appeared in the **Greg Bear-edited** anthology New Legends. (wikipedia.org)

   b. He quotes former Iowa Governor and current Secretary of Agriculture Tom Vilsack as saying that **Gates-sponsored** Monsanto and biotech in-

dustry projects in Africa will help "knock down some the concerns that are expressed globally and domestically about biotechnology." (gmwatch.org)

c. I visited the Louvre back in 2017 and the **Mona-driven** crowds were very distracting. (kottke)

d. Coon provided the voice and motion capture for Proxima Midnight, a member of the Black Order and a child of Thanos, in the **Russo Brothers-directed** action film Avengers: Infinity War (2018). (wikipedia.org)

e. What is your favorite **Pet Shop Boys-written** song dealing with the subject of lost love? (geowayne.com)

f. Offering a 7-minute **Dr. Clark-recommended** cycle would eliminate the flexibility that many users of The Ultimate Zapper want and need.(intergate.ca)

The final trend I will mention here with respect to the form of participles is that there are often frozen or specialized forms seen in both α and the participles themselves that we wouldn't expect to see in a full verbal paraphrase. The instances above where a participle lacks a productive verbal counterpart are demonstrative of this same feature. If participles were derived on-line from underlying forms, then we wouldn't expect to see this asymmetry between adjectival and verbal uses.

For instance, consider the examples below, where there are shortened or particular forms of the α:

(181)   a. The **oft-injured** Lamela is at least a week away from returning to the lineup and possibly more. (rotowire.com)

b. Android The LandPKS app helps users make more sustainable land man-

agement decisions by allowing them to collect **geo-located** data about their soils and vegetation. (echocommunity.org)

c. The call was a missed call or voicemail/ **auto-answered call** – these appear in the Outlook Inbox folder. (skylook.biz)

d. Again and again we were caught up and passed by the splendid **home-ward -bound** colonial packets, some of them carrying an appalling press of canvas, under which the long, snaky hulls, often overwhelmed by the foaming seas, were hardly visible... (explorion.net)

e. As an added bonus, the museum's Napier Railton race car, which still holds the speed record on the Brooklands circuit, will run on the runway providing the sounds and smells of a 24 litre **aero-engined** car. (vc10.net)

f. Only quiz attempts that have been started are **auto-submitted**. (canvaslms.com)

g. Our mission is to produce and sell **lacto-fermented** foods with a brand that inspires humanity and raises awareness about the importance of organic fermented vegetables in our diet and lifestyle. (pickledplanet.com)

To sum up, the form of α in compound participles can vary in ways that differentiate it from underlying paraphrases.

4.3.2 Notes on meaning

The crucial concept that the data in this chapter illustrates is that the meaning of a complex adjectival participle can't always be reduced to an underlying verbal paraphrase. There have been several instances of idiosyncrasy mentioned above, but an aspect of specialized meaning that hasn't yet been explicitly discussed involves participles which are used in particular communities. In some cases, in order to understand *how* the meaning of a participle might have an idiosyncratic meaning that differs from a straightforward paraphrase, the speaker must have special knowledge confined to a group of speakers. In other words, they must speak a particular lect.

To illustrate, consider the examples below. In order to know what it means for a healer to be *under-geared* (182a) we have to know what sort of scale is standard for calling a healer appropriately geared. In order to know what the relationship is between *reverse* and *biased* in *reverse-biased*, (182b), we need to have some sort of knowledge of circuits. In order to know that *justice-involved* (182c) has a special euphemistic meaning, the property of having spent time in jails or prisons, a speaker needs to speak a lect in which that idiomatic meaning is accessible.

(182)   a. My problem right now is, since I'm geared, specced, and gemmed for raiding, I cannot carry an **under-geared healer** through heroics anymore. (bbs.stardestroyer.net)

       b. Fig.2: the input protection for the PIC32 consists of two **reverse-biased diodes**. (siliconchip.com)

       c. Reentry Works is not just a singular program, but an overall strategy to

invest and innovate in evidence-based solutions to best serve the **justice-involved population**. (workforce.org)

Another important feature related to the meaning of complex participles is that α is sometimes obligatory in order to use a participle as a name[6]:

(183) a. *based approach (cf. evidence-based approach)

b. *caused damage (cf. hurricane-caused damage)

c. *created project (cf. user-created project)

d. *raised child (cf. Austin-raised child)

Further, sometimes there are corresponding simple participles without α that have very different meanings:

(184) a. cf. an involved task vs. a student-involved task

b. cf. a driven student vs. a money-driven student

c. cf. determined students vs. market-determined outcome prices[7]

Both of these points support the idea that simple participles, that is participles without an α modifier, are dubbed names autonomously from their α-Participle

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[6]Goldberg and Ackerman (2001) make similar observations about obligatory adjuncts, for example:

(1) a. #a built house
b. a recently built house

They argue that these adjuncts arise from the pragmatic requirement that every utterance have a focus, which is why examples like (1a) sound better in certain contexts, such as contrastive focus (i.e. the house was built, not just designed)

[7]It might not be fair to compare these two since they differ with respect to their head nouns, but crucially *determined* can only apply to animate head nouns, while α-*determined* can only apply to inanimate head nouns. This in and of itself is good evidence that the two names have quite different meanings since they have complementary selectional restrictions

counterparts. We might even think of these as α-Participles with null αs. In other words, we don't need to propose a rule that derives the complex participle from the simple participle; the two can be established independently.

On the other hand, as was briefly mentioned in the section on types, sometimes the *participle* is optional such that the property named by α-Participle is equal to that named by α:

(185)   a. cf. a centrally-located restroom vs. a central restroom

      b. cf. student-conducted research vs. student research

      c. cf. human-created language vs. human language

      d. cf. tourist-geared information vs. tourist information

      e. cf. recruiter-focused blogs vs. recruiter blogs

In these examples, the listener is able to infer the relationship between α and the head noun without needing to explicitly refer to an event. This is likely due to the fact that the participle is the most likely, or perhaps most intrinsic[8], action that would relate α and the participle. So, interlocutors are relying on world knowledge to understand the meaning of the participle, rather than a particular underlying form.

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[8]For a more nuanced discussion of default interpretations of modifiers and nouns see McNally and Boleda (2017).

4.4   Discussion

In this chapter, I have categorized a large number of naturally-occurring examples of complex adjectival participles based on the relationship between the α modifier and the participle. Recall that the aim of this exercise was threefold: to sketch how α meanings relate to the underlying event involved in the naming of the compound, to discuss examples of idiosyncratic meaning in participle compounds and to identify how frequency leads to clusters of similar forms that share meaning.

We noted several ways that the α meaning can relate to the property meaning and the meaning of the underlying event, along with instances where the composition is associated with idiosyncrasy. The naming theory is able to capture the irregularities without stipulating gaps or exceptions to a regular rule. As discussed in the previous chapter, under a templatic framework, in which the meaning of the participle is solely described in terms of the meaning of the verb, we would need to explain why rules are semi-productive. However, under the naming theory, the reason that there seem to be more restrictions on α composing with certain verbs doesn't have anything to do with systematic gaps in where we can apply a derivational rule. Rather, simply, speakers haven't heard this property named with this form before. If there were a circumstance where a speaker wanted to name a property resulting from a recommendation that took place over the phone, then the speaker could dub *telephone-recommended* as a new name and, if it were a useful enough name it could set off a causal chain through which that name would get established via reuse.

What strategies does an interlocutor rely on when hearing a new compound participle for the first time? Let's say you hear someone refer to something as *clown-*

recommended, a compound with no hits in the SketchEngine corpus. The goal is to identify the property being referred to, and the form of the participle is quite helpful in this task. You will primarily draw on your knowledge of clowns and recommending events, as well as any potential relationship between them, to infer the meaning of the participle. But this task is not done in isolation. You will also draw on your knowledge of other names in the form α-recommended (as well as your knowledge of names in the form clown-participle). Many αs that are used with *recommended* name agents, so if an α in a new coinage names something that could reasonably be interpreted as and agent, the listener is more likely to interpret the coinage to have a meaning such that α is a recommender. For instance a listener might interpret *clown-recommended college* to mean that the college has a property such that clowns have recommended it.

How about the compound *tailor-recommended*, which also has no hits in the corpus? We may also find that the similarity between two names has to do with not the relationship between the participles, but the similarity of the αs:

(186) a. tailor-fit

b. tailor-built

c. tailor-designed

d. tailor-made

e. ?tailor-recommended

Analogy to other uses of *tailor* αs could bolster the ability to make sense of *tailor-recommended* as having a similar meaning, namely that something is recommended

to cater to specific needs.

So, crucially, speakers rely on analogy to choose forms that will easily be associated with certain meanings, but these strategies will not generalize over paradigms to grammaticalize rules. In this model, naming conventions simply boil down to what sorts of forms a speaker has heard in the past mapping onto certain meanings. The most successful names, i.e. the most reusable, will be those whose form resembles other complex participles with similar meanings.

Chapter 5

Naming and Entropy

5.1 Introduction

If a speaker wants to describe a property using a participle, they have the option of composing an expression by employing syntactic rules, in other words by forming a direct composite. For instance, say I want to describe businesses with female leaders like Karen S. Lynch, Mary Barra or Oprah Winfrey. I have several options about how to convey this information. I can compose an active sentence like (187a) or compose a P-NP structure like *with women leaders* to ascribe to the noun *business* like (187b). I can also use the participle *led* to form a perfect (187c), a passive (187d), or a reduced relative clause (187e).

(187)   a. Women lead these businesses

        b. businesses with women leaders

        c. these business have been led by women

d. these businesses are led by women

e. businesses led by women

Importantly, if I choose any one of these options, I will form the expression by employing a general syntactic rule, such as a rule for forming active or passives clauses. In contrast, in Chapter 3 we claimed that speakers could also choose to name the property *women-led* by employing a naming convention. If I choose this option, I will determine whether *women-led* should be considered a conceptual chunk with the potential for reuse. In doing so, I won't rely on a rule (i.e. α-led), I will decide whether this concept is name-worthy.

The decision of whether a concept is name-worthy is determined by a speaker's impression of whether they think the concept will be referred to in the future. Within a speech community there may be variation with respect to whether individual speakers find a concept reusable. However, a speaker who is otherwise indifferent about whether to use a name or a direct composite to express a concept (i.e. *women-led* vs. *led by women*) will be influenced by hearing others use a name for that concept; hearing the name is evidence that it should be referred to by name. Additionally, if a speaker has heard similar properties being used as names (e.g. *community-led, parent-led, Democrat-led*) this may also bolster the perceived nameworthiness of a concept. This capitalizes on the well-established fact that the lexicon is organized according to paradigmatic relationships between words (see e.g. Murphy (2003) inter alia), and the fact that the interpretation of novel compounds is influenced by analogy to other compounds (see e.g. Gagne (2002), Libben et al. (2020)). In this way, even if some concept has a very small bias towards being expressed as a name, that

179

bias can be amplified. The resulting frequency with which we can observe a concept being named for the whole speech community reflects the average of all speakers' individual biases.

Complex participles represent reusable chunks of information, shortcuts for concepts that are commonly encountered. Direct composites represent the output of a general rule. The effect that this has on *use* is that, for a given participle like *led*, we should expect to see less variety in the compound names it is used in than in the direct composites it is used in. This is because we assume that there is some subset of concepts that can be expressed with a given participle that are name-worthy. Names are only used to express these concepts, while direct composites can be used to express both name-worthy and non-name-worthy concepts. Therefore, it follows that with α-*stained*, one is relatively less uncertain (i.e. more certain) about the value of α compared to *stained with* α, where one is relatively more uncertain about the value of x.

We can quantify uncertainty by looking at entropy. Entropy is a measure of uncertainty; the higher the entropy the more uncertain something is. This chapter will test the following hypothesis (188a), rephrased as (188b):

(188)   HYPOTHESIS:

    a. Compound names have lower entropy than direct composites

    b. For a given participle P, α-P will be less suprising than the same α and P used in a direct composite.

In order to test this hypothesis, we will need data that reflect the *use* of participles. We will use a large corpus, enTenTen, as a sample of language use. For a

given participle, I will compare its use as a compound name and a direct composite with respect to the entropy of α.

5.1.1 Corpus

This study uses The English Web Corpus, enTenTen, which belongs to the TenTen corpus family developed by Sketch Engine (Jakubíček et al. (2013)). The 2020 iteration of the corpus used in this study, enTenTen20 contains about 36 billion words and includes a range of web-based texts from a range of genres[1]

Testing the hypothesis in (188) requires a very large corpus. Even the most frequent participles used in compounds are relatively rare in a corpus overall. For example, in enTenTen there are 5,981,951 tokens of compound participles with the participle *based* (e.g. *community-based*, *evidence-based*, *text-based*) and yet these make up only 0.017% of the corpus. For a slightly less common, albeit still reusable, participle like *stained*, (e.g. *blood-stained*, *tear-stained*, *grass-stained*), there are 30,526 tokens comprising 0.00000847% of the corpus. For a rarer still participle, like *negotiated*, (e.g. *peer-negotiated*, *union-negotiated*, *market-negotiated*) there are 5,493 tokens, comprising 0.000000152% of the corpus.

If we used a smaller corpus such as the British National Corpus, which contains 100 million words, with the same ratio of compound participles we would expect to get about 14000 tokens in the form α-based, 71 tokens in the form α-stained, and only 13 tokens in the form α-negotiated. A smaller corpus quickly limits the amount of compound names we can glean for particular participles. Ultimately the more

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[1]Top genres include Culture and Entertainment, Travel and Tourism, Religion, Technology and IT, Economy Finance and Business, and Science.

data we have the better we can approximate use. Therefore, a massive corpus like the enTenTen is going to be the best option for the task at hand.

The corpus is designed to pull only linguistically valuable content and discards between 40-60% of downloaded text to avoid spam, machine-generated and otherwise unwanted content so that it can be used as a valid proxy for language use. Additionally, the corpus undergoes a deduplication process which removes identical or slightly altered versions of the same content at the paragraph level. Still, with a corpus of this size there is always a degree of unwanted content. So tokens that do not seem to represent natural language use, for instance advertisements with incomplete sentences, were excluded manually when possible.

The corpus is lemmatized and tagged with a Penn Treebank dataset for part of speech. These tags include a specific tag for participles. Simple lemmas were searched using the Sketch Engine web interface and more complex grammatical structures were queried using a special corpus query language (CQL). The majority of data used in this study was pulled from the corpus using CQL. Before outlining the methodology used to test the hypothesis above, we will first briefly outline how exactly entropy is measured.

5.1.2 Measuring entropy

How exactly do we measure entropy? In this study we use so-called 'Shannon entropy' (Shannon (1948)), H, which calculates the level of surprisal (i.e. information) of a discrete variable X given its distribution. Shannon entropy is measured in bits[2] and

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[2]Specifically, bits are defined as the average amount of missing information that a receiver would need to specify the the outcome of x when the receiver knows the distribution $p(x)$ (Lesne (2014:4))

is defined by the formula in (189):

(189) $H(X) = -\sum_{x \in \chi} p(x) \log_2 p(x) \geq 0$

To see how this formula works, let's apply it to the problem at hand. We can test our hypothesis by measuring the entropy H(X), letting X range over the two constructions, [x-Ved] (e.g. *tear-stained*) and [Ved Prep x] (e.g. *stained with tears*). We predict that the entropy measure for [x-Ved] is lower than the one for [Ved Prep x] for a given participle, Ved. We can start by calculating the probability *p(x)* that a certain x, say *tear* will occur in the *x* slot. To do so for *tear-stained* (i.e. to calculate p(*tear*)), we take the number of tokens of *tear-stained* and divide by the total number of α-stained tokens. The surprisal is measured by calculating -$\log_2$(p(x)). A probability is always between 0 and 1 and the log of a number less than one is negative, so the negative sign before log reverses this so that the entropy value is always positive. This is then multiplied by p(x), which represents the share of *x-stained* tokens in which x= *tear*. The same happens for all x values in the corpus (i.e. *blood, grass, etc.*) and they are summed, giving some positive number as the entropy value of α in the construction.

Let's look at a few particular cases to demonstrate. Say our entire corpus contains 8 tokens of *x-stained*, all of which are *tear-stained*. The only probability p(x) would be 1, making -$\log_2$(p(x)), the entropy measure, 0. If we randomly sample one token, we would be unsurprised to see *tear-stained*.

Let's say, on the other hand, that each x in our 8 token corpus were unique: *tear-stained, sweat-stained, blood-stained, wine-stained, pit-stained, water-stained, grass-stained, dirt-stained*. In this case, the entropy of each token is -$\log_2$(1/8)=

3 bits of information. The average over all of these would give us the same 3 bits. Regardless of which token comes out of a random sample, there will be the same amount of (maximum) surprisal.

In the middle of these two extremes say we have a corpus with seven tokens of *tear-stained* and one *dirt-stained*. If we sample a random compound, the probability that we will get *dirt-stained* is the same as above, (1/8), making the surprisal 3 bits. But the probability that we will get *tear-stained* is (7/8), making the surprisal -$\log_2(7/8)$= .19 bits. So the average surprisal (entropy) in this scenario will come out to (7/8)(.19) + (1/8)(3) = .54 bits.

As we can see from these examples, measures of entropy are related to the amount of variability there is in a corpus. That is, entropy is higher when x is more variable, such as the case where all eight of our tokens differed. This relates back to our initial hypothesis. Names are more favored when there is a desire to establish a sign, or to use an established sign. Direct composites appear to be unaffected by whether the speaker has such a desire. While naming is productive in the sense that speakers *could* create potentially any name with any meaning, the corpus will reflect only names that speakers *have* created. So we expect a smaller range of αs to appear as names in a corpus compared to direct composites with the same components.

5.2 Methodology

The general methodology for this study can be outlined as follows:

1. Identify a set of participles that can occur in the α-participle constructions.

2. For each of these participles, pull tokens of the participle used as a name and used in a direct composite.

3. Pull lists of the αs in each token.

4. Calculate the entropy for the αs for participle in each construction and compare across constructions.

I will detail each of these steps below.

5.2.1   Step 1: choosing participles

To generate a list of participles to use as a test set, I began by pulling a randomized sample of all verbs which are tagged as participles in the corpus. I selected the first participles with sufficient usage in all of the constructions under inquiry. There are some participles which occur in direct composites but are not found in compound names, or else are found quite rarely. For example, the verb *tussle* only has 13 tokens in the corpus in the form α-tussle (e.g. *wind-tussled hair*). There are only 2 tokens of the form α-recoil (e.g. *short-recoiled barrel*). Names of the form α-*eavesdropped* don't appear in the corpus at all. I pulled participles that had at least 200 tokens of each of the constructions below.

I tested 65 participles in total:

(190)   *acquired, aimed, answered, attached, based, biased, bound, built, caused, claimed, collected, conducted, connected, constrained, created, delivered, designed, destroyed, determined, developed, directed, discussed, edited, employed, focused,*

185

founded, geared, given, guided, held, implemented, informed, injured, involved, limited, linked, located, manufactured, negotiated, packed, passed, patented, published, raised, randomized, recommended, ruffled, sanctioned, selected, shifted, shown, shrouded, slashed, specified, sponsored, stained, stamped, submitted, supported, surrounded, tackled, taught, topped, transmitted, turned, written

5.2.2   Step 2: pulling data

Direct composites

I pulled data for direct composites of two types: passives and reduced relative clauses. In (191) the participle is *stained*, the head noun is *the pillow* and the α is *tears*.

(191)   a. PASSIVE:

   The pillow was <u>stained</u> by/with **tears**

   b. REDUCED RELATIVE:

   The pillow, <u>stained</u> by/with **tears**

We want to pull direct composites that can be directly compared to names. In the examples in (191), *tears* plays an instrumental participant role in the staining event and is introduced by a prepositional phrase. In the last chapter we established that αs in names can also be adverbs and adjectives in addition to nominal participants (e.g. *disgustingly-stained, half-stained*). The corresponding adjectives and adverbs surface in many places in direct composite constructions, so it was best to limit our search to only direct composites in which a nominal α is introduced via an immediately

186

preceding P, such as the examples above, and compare those to uses of nominal αs in names. In other words, α-*Ped* always matched with *Ped-Prep-α* for all values of α.

Queries for these constructions are listed below, in CQL followed by an explanation and an example for each. Brackets represent word boundaries and tags represent part of speech classifications assigned to lemmas via the Penn Treebank dataset.

(192)   PASSIVE:

    a.   [tag = "VB.*"] [tag ="RB"]?   [tag = "VVN" & lemma = "stain"] [tag="IN"] within $< s/ >$

    b.   [be verb] [optional adverb] [participle with the lemma 'stain'] [preposition] within a sentence

    c.   [is] ([very]) [stained] [with]

For the passive query, the head noun is the lemma immediately to the left and the α is immediately to the right. Therefore, I filtered out cases where the passive was embedded in a relative clause (e.g. *the pillow which was stained with tears*) by removing tokens where the lemma to the left was *which* or *that*.

(193)   REDUCED RELATIVE:

    a.   [tag = "N.*" & tag!="NNSZ" & tag!="NNZ" & tag!="NPZ" & tag!="NPSZ"] [tag = "VVN" & lemma = "stain"] [tag="IN"] within $< s/ >$

    b.   [(Non-Possessive) Noun] [participle with the lemma 'stain'] [preposition] within a sentence

c. [pillow] [stained] [with]

For this query, the head noun is the first lemma in the query and the α is the first noun to the right. I did not allow for optional adverbs in this construction as in the passives because it significantly slowed down processing time.

Names

In order to pull tokens of participles being used in compound names, we want to look for cases where the α immediately precedes the participle as in the following:

(194)   a. the **tear**(-)stained *pillow*

        b. the *pillow* is **tear**(-)stained

In the present study, we focus on pulling prenominal participles, as in (194a), with nominal αs since it is easier to identify these strings using the Sketch Engine query language. There are a few ways to pull these tokens, each with their own positives and negatives. We'll call this the NVN construction. We can pull this using the following query:

(195)   NVN CONSTRUCTION:

    a. [tag = "N.*" & tag!="NNSZ" & tag!="NNZ" & tag!="NPZ" & tag!="NPSZ"] [tag = "VVN" & lemma = "stain"] [tag = "N.*"] within $< s/ >$

    b. [(Non-Possessive) Noun] [participle with the lemma 'stain'] [Noun]

    c. [tear] [stained] [pillow]

While this query does pull certain compound names, as mentioned briefly in the previous chapter it also pulls a lot of other data that is hard to control for. For example

this query gives us tokens where α heads a relative clause (e.g. *one reason stained glass became popular*), where it modifies the head independently of the participle (e.g. *commemorative stained glass window*) or where it plays another role such as the direct object of a ditransitive verb (e.g. *I taught adults stained glass techniques*). These are not instances of the compound being used as a name. So, this query results in a lot of noise.

Another option is to pull hyphenated participles. The asterisk in the query indicates an absent element, so this searches for all words in which α precedes a hyphen and the participle in question.

(196)   Hyphenated Name

    a. [*-stained]

    b. tear-stained

Results from the query above were filtered for hyphenated compounds that precede a noun. There is a lot less noise in this query than the NVN construction, however the downside is that hyphenated compounds are lemmatized as one word, so we can't control for the part of speech within words. This means that we can't ensure that the α is a noun. For both of these queries, processing the raw data through a parser is the only way to filter out the noise. This is handled in the next step of the methodology.

For each participle in (190), up to 5,000 tokens were pulled in each of the four constructions, totalling 1,144,828 total sentences containing participles in one of the four constructions above.

5.2.3 Steps 3 & 4: identifying αs and Calculating Entropy

The final and most challenging step in this methodology involves identifying αs in the pulled data and calculating their entropy for each verb in each construction. To do this, the raw data was run through the spaCy dependency parser. This step serves two purposes. The first is to filter out noisy data from the dataset, that is data that didn't actually pull the participle used in the desired direct composite or name construction intended by the query. So the parser acts as a filter. If a participle ended up with less than 100 tokens in a construction, it was excluded completely. Otherwise, for each participle, we randomly sampled 100 tokens in each construction. With this filter, we ended up testing 36 participles[3] across the 4 constructions.

The second function is to pull out lists of αs in each construction. Depending on the construction, the α should have a different dependency relationship with the participle and the head noun. For names, the α will modify the participle, which will modify the head noun. For passives and reduced relatives, the α will head a NP within a PP which is a dependent of the participle.

5.3 Results

For each participle, we calculated a measure of α entropy across 100 random tokens for each verb of the four different constructions. These results are illustrated in figure 5.1 and figure 5.2 below. Since entropy was measured across 100 random tokens, the

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[3]*answered, biased, caused, claimed, constrained, created, delivered, determined, directed, edited, focused, geared, guided, injured, involved, limited, linked, located, manufactured, passed, patented, published, pumped, raised, randomized, recommended, sanctioned, selected, shown, specified, sponsored, surrounded, transmitted, written*

maximum entropy measure is 6.64 (i.e. -log2(1/100)). This is the case where all 100 αs are distinct. The maximum entropy measure in indicated by the blue horizontal lines in the figures below. In figure 5.1, the four constructions are represented along the x-axis and entropy measures for each verb across these constructions are plotted on the y-axis. Both passive and reduced relative uses have higher entropy overall. Additionally, both name constructions have noticeably wider range of entropy measures than the direct composite constructions, especially the hyphenated participles. In figure 5.2, each verb is plotted on the x-axis and the constructions are color-coded. The passive and reduced relative entropy measures are both quite high, while the NVN and hyphenated entropy measures are lower and cover a wider range.
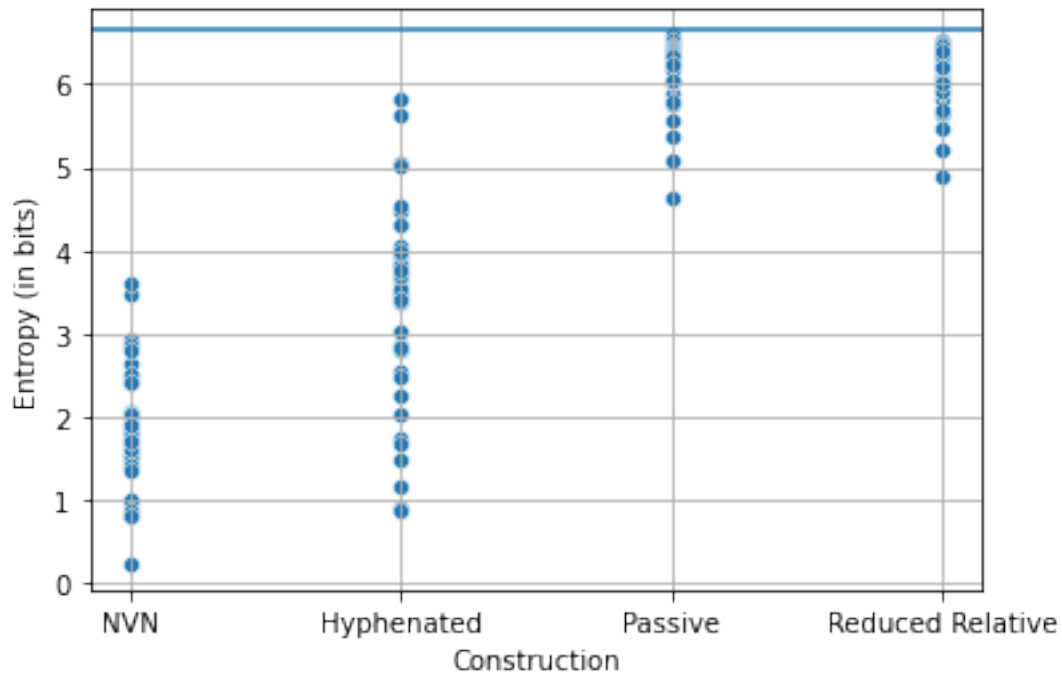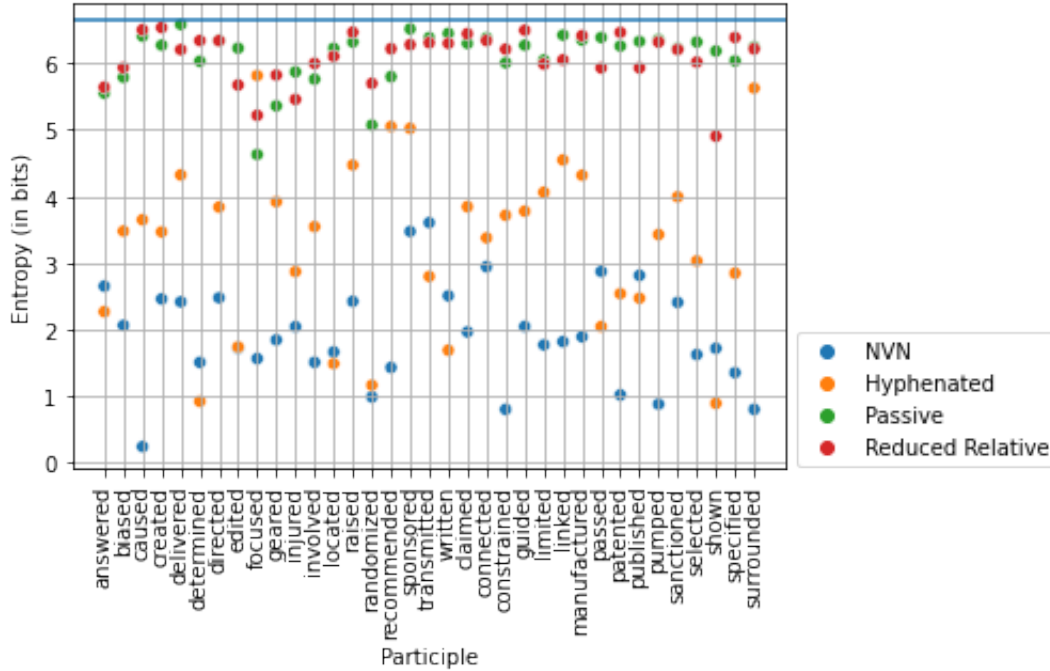

Figure 5.1: Entropy Measures across Constructions

Figure 5.2: Entropy Measures across Participles

A paired T-test was used to test whether there is a significant difference between the entropy measures across participles in each construction. T-tests allow us to determine whether any observed difference between two samples could be attributed to random chance. A paired test allows us to compare differences in entropy across the use of the same verb because it compares two measures for the same independent object. The hypothesized mean difference is 0, meaning that we are testing significance against the null hypothesis, that there is no difference between the entropy of α in names and direct composites. We will set a threshold for statistical significance[4] at p=0.001. P values for t-tests compared across constructions are

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[4]If we set the p value at 0.01, using the Bonferoni correction, we would divide that number by the number of tests performed, 7, giving us p $\approx$ 0.001

summarized in (Table 5.1).

An average measure of entropy in names was averaged across tokens used in hyphenated and NVN constructions. An average measure of entropy in direct composites was averaged across tokens used in passives and reduced relative clauses. There was a statistically significant difference between these averages, such that p<.001. There was also a statistically significant difference between each of the individual name measures and direct composite measures. As expected, when comparing our two direct composite constructions, reduced relatives and passives, there was not a statistically significant difference between the entropy of αs (p=0.878). Surprisingly, when comparing the entropy of our two measures for names, hyphenated participles and the NVN construction, the difference in entropy *was* found to be statistically significant if our significance threshold is p=.001, but was not as hugely significant as the other factors where p < .0001. Additionally, the entropy of hyphenated uses were more variable than the NVN uses.

Construction Comparison	p value
AVG Name vs. *AVG. DC*	p <.0001
NVN vs. *Reduced Relative*	p <.0001
Hyphenated vs. *Reduced Relative*	p <.0001
NVN vs. *Passive*	p <.0001
Hyphenated vs. *Passive*	p <.0001
Reduced Relative vs. *Passive*	p = 0.878
Hyphenated vs. **NVN**	p = .0085

Table 5.1: T-test P values for entropy across constructions

5.4 Discussion

The results of this study support the hypothesis that αs used in compound names have lower entropy than those used in direct composites. So, speakers are relatively less uncertain about α when a participle is used as a name as opposed to a direct composite. These findings support the idea that speakers use names for a special subset of concepts that they deem reusable compared to the concepts expressed using direct composites. The entropy measures among participles in name constructions was also more varied than that of the passive and reduced relative constructions. This pattern makes sense if we assumed that some participles happen to have more nameworthy concepts than others.

The fact that there was a statistically significant difference between hyphenated participles and NVN constructions (i.e. *tear-stained* vs. *tear stained*) raises additional questions regarding what other mitigating factors may govern the entropy of participles. Perhaps entropy is an implicit aspect of a speakers' linguistic competence that influences their decision to use a hyphen while writing out a compound. Or perhaps there is some other attribute in the data affecting the entropy values. This is a potential question to be explored in future work. We could also extend the present study to a wider and/or more fine grained breakdown of constructions types. For instance, we might predict that αs in present tense passives which, following Chapter 2, are more likely to be part of names, may have lower entropy than all passives. We also may look at perfects to see whether α entropy values in these constructions resemble the other direct composites. Finally, we could look at not just noun αs but adverbial αs.

194

This study follows O'Donnell et al. (2011) in using entropy as a way of understanding how derivational processes are driven by reusability. It is not necessary to adopt a distinction between names and direct composites to accept the premise that differences in language use, which arise from how speakers chunk information, may be quantified in terms of entropy. For instance, we might hypothesize that noun-noun compounds, such as *girlfriend* have lower entropy relationships than approximate periphrastic paraphrases, such as *a friend who is a girl*. However the case explored here capitalizes on the fact that there are relatively consistent constructions for creating direct composites with participles. In contrast, periphrases for noun-noun compounds are quite variable so would be difficult to quantify.

This approach has potential for explaining other phenomena through the lens of naming, especially as it is related to semi-productivity. The naming theory has the ability to explain certain facts about grammar that can't be handled with ontological semantic category distinctions. For example, a name like *tear-stained* and direct composite like *stained with tears* have the same meaning and logical type. However, the prenominal position seems to be specialized in English for only uses of participles as names. Therefore, the distinction between names and direct composites is not only a strategy for speakers to derive new words, but also a difference recognized by the grammar.

Chapter 6

Conclusion

6.1 Summary

We began this dissertation with an observation that certain uses of participles in which the participle denotes a property (i.e. *tear-stained*) give rise to meanings that can't be described solely in terms of the corresponding verb. In Chapter 2 we proposed a new approach to analyzing the meanings of these participles: they are names, signs with meanings that speakers chunk in order to be used again. When a speaker wants to refer to a result property of an event, they have a choice to either apply a regular grammatical rule to form an expression or utilize the following naming convention to coin a new sign:

(197)   NAMING CONVENTION

If a phenomenal (i.e. observed) property state P is always immediately preceded by an event type denoted by a verb V, then P can be named with the

past participle form of V.

When participles are used as names, they represent complex concepts which relate a property to an event indirectly via meaning postulates such that the participle entails a certain property (198a) *and* the existence of a previous event (198b):

(198)   a. $\Box \forall s, y[\textbf{broken'}(s, y)^t \implies \textbf{not-working'}(y)^t]$

       b. $\Box \forall s, y[\textbf{broken'}(s, y)^t \implies [\exists e, x, t'.\textbf{break'}(e, x, y)^{t'} \wedge \ t' \supset\subset t]]$

This semantic model has several advantages. First of all, it explains how there can be a unidirectional entailment relationship between a participle denoting a temporary property and an entailed prior event. It also allows us to derive causation between the event and the property without stipulating an overt CAUSE operator. Another advantage of the semantic architecture in (198) is that meaning shifts are easier to explain. In 198, there is no event variable represented in the logical form of *broken*, but there is an event entailed by the sign via a meaning postulate. Since naming establishes a new non-logical property constant, (i.e. not-working') broadening may result in the loss of the event postulate, giving way to participles that lack an event entailment. On the other hand, broadening may result in the loss of the property entailment giving way to existential perfect readings.

In Chapter 3 we discussed how the definition of names, repeated in (199) gives rise to special properties in the α of compound participles (α-participles).

(199)   **name**: An expression that:

       (i) has a unique denotation (intension); and

       (ii) can be reused by speakers/writers of the language.

The uniqueness condition requires that the expression's denotation be constant. Therefore, the only permissible αs are those with descriptive content that, when compounded with a participle, can have the meaning of a non-logical constant. This rules out αs which are interpreted indexically.

The second condition, reusability, defines naming as a processes intended for coining new signs. With this condition, restrictions on α can be explained via naming without appealing to an ill-defined and stipulative well-establishedness constraint on a rule. Instead, well-establishedness is a natural consequence of the fact that speakers will only name concepts they find worthy of reuse.

In Chapter 4, we saw the naming convention extended to compound names:

(200)   COMPOUND NAMING CONVENTION:

If a phenomenal (i.e. observed) property state P is always immediately preceded by an event type denoted by a verb V and including a verb dependent α, then P can be named with a compound using the past participle form of V with the structure α-V.

The convention is such that any conceivable relationship in which α is a dependent of the underlying verb can lead to a compound participle. The chapter presented a descriptive study of compound participles from the enTenTen corpus, focusing on patterns in their meanings and forms. A key takeaway from Chapters 3 and 4 is that the reusability condition leads to semi-productivity in naming since only certain concepts will be deemed name-worthy by speakers. Names are only used with a subset of the properties that can be expressed by direct composites. This fact lead to the hypothesis explored quantitatively in Chapter 5: that αs used in names

will be relatively more predictable than αs used in direct composites.

The study in Chapter 5 tested the above hypothesis by gleaning large amounts of data on participles being used as part of compound names and direct composites. For a given participle, αs used in compound names had significantly lower entropy measures than corresponding αs used in direct composites. This finding provided evidence that the distinction between naming and direct composition is grammaticized; certain constructions are specialized for use as names. These differences can't be accounted for by ontological explanations.

6.2 Future research directions

Past explanations for the meanings of adjectival participles relied on templatic explanations in which the meaning of an adjectival participle could only be described in terms of the meaning of the verb from which it is derived. Naming provides an alternative explanation for how speakers leverage their existing language to coin new terms. There is a possibility of extending this framework to understand the behavior of participles in other languages, as we did with certain German adjectival participles in Chapter 3, which also may provide speakers a way of chunking event and property meanings.

One advantage of the naming theory is that it is able to explain *why* we see certain patterns related to 'well-establishedness' in the data. There have been various concepts related to well-establishedness, such as salience, canonical use and informativity, that have been used to explain a range of phenomena including pseudo-

incorporation, weak definites and denominal verb conversion. Often well-establishedness is seen as a condition on applying a certain rule. Naming has the potential to explain these phenomena in a new way.

Finally, the concept of naming offers a new way to think about what tools language users have for creating new words. We consider naming to be a type of composition. Names can be single words or multi-word expressions; their form is not determined by morphosyntax. And yet this type of composition doesn't require speakers to use a regular rule. The fact that naming is driven by reusability suggests that speakers are constantly seeking ways to make their language more efficient. Understanding certain processes in terms of naming can help us better model an ever-evolving language.

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212

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