Productivity of Non-Default Case

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Abstract

This article is about productivity of non-default patterns in grammar. More specifically it is about the extension of non-default case patterns in syntax to novel items. The study draws on data from Icelandic syntax but addresses general questions about the nature of productivity. Contributions are made to the picture of Icelandic case by presenting new data from natural and experimental sources and those are discussed within the context of the Variational Model of language acquisition. The main claim is that all case marking is based on productive rules, contrary to previous accounts, demanding a rethinking of such notions as the so-called quirky-case. This approach also provides a formal explanation of the nature of Dative Substitution, a well-known morphosyntactic change.[1]

1   Introduction

This study is about productivity of non-default patterns in grammar. More specifically it is about the extension of non-default case patterns in syntax to novel items. We will focus on data from Icelandic syntax but the relevance of such a discussion is not limited to syntax or any one language. Some generalizations about productivity have been proposed in the literature and even if those have been mostly formulated with regard to evidence from morphology, they are stated in terms that can in principle extend to other domains. Let us state a definition of productivity that will be discussed in more detail in §2.1.

(1) **A pattern/rule is productive if and only if it is extensible.** A pattern is extensible if it can apply to novel items (e.g. loanwords) or if it can attract items that already exist but the pattern did not apply to at an earlier stage (e.g. "the dative subject pattern" is extensible if it can attract verbs that previously assigned accusative case to their subjects).

There have been some recent attempts to capture the nature of productivity across domains by applying generalizations about morphological productivity to syntax (e.g. Barðdal 2008). In such work it has been claimed, following well known analyses (Zaenen, Maling, and Thráinsson 1985), that patterns of case assignment should be classified as productive, semi-productive and unproductive.[2]

(2) Traditional Case Model (TCM)[3]
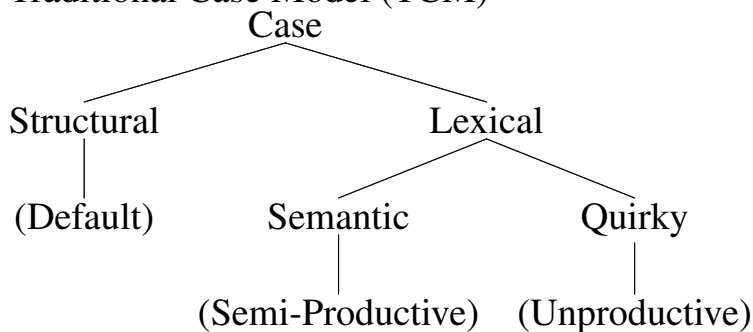
The primary motivation for the distinction between structural and lexical case is that case alternations between actives and passives follow naturally from such a model. Default case is assigned based on the position of an argument in the sentence structure and therefore alternations between different argument positions (subject position, object position) are directly reflected in alternating case assignment (cf. different case assignments to themes in active vs. passive constructions).

On the other hand lexical case is assigned based on lexical features of a verb and thus it blocks such structure based alternations as mentioned above. The distinction between semantic and quirky case is motivated by a much more vague notion that semantic case is "somewhat predictable" based on semantic

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[2]Note that while Barðdal rejects the two dichotomies in the traditional case model she uses the terms semi-productive and unproductive like traditional accounts.

[3]The labels for the categories can vary in the literature. Semantic case is sometimes referred to as thematic and quirky case is sometimes labeled idiosyncratic.

features that are shared by sets of verbs while quirky case is always idiosyncratic in the sense that its argument structure is always per item as opposed to per set. Accounts of such sets of verbs generally refer to theta-roles (experiencer, theme, etc.) (e.g. Jónsson 2003; Thráinsson 2007:181–248).

Drawing on evidence from Icelandic we will argue that the only categorical distinction in (2) that is compatible with empirical facts is the distinction between default (structural) and non-default (lexical) case. With regard to productivity we claim that there are no grounds for splitting lexical case into categorical subclasses. Since productivity is a gradient phenomenon, where even the least productive (quirky) case patterns are somewhat productive, as we will see, we will argue for the hypothesis in (3).

(3)   **All case assignment is based on productive patterns/rules.**

All grammars of natural human languages contain patterns that are not limited to linguistic items which the speaker has already been exposed to. Those are patterns in the grammar that are part of a productive system and thus they can extend to novel items, as we speak, according to the system. An example of this is the pattern we use to form past tense of regular English verbs. There is a rule, "add -d", that applies by default to any new verb. Should someone invent the Chomskle search engine for finding linguistic articles and whose use would be described by the verb *to chomskle*, any speaker of English would immediately know that the default past tense rule applies to the novel verb, as in (4).

(4)   A: Could you please chomskle that paper on quirky subjects?
       B: Sure! In fact I already **chomskled** it!

A child acquiring English initially needs to learn the rule "add -d" and figure out that this is in fact the default way to form past tense in her language. However, there is no learning involved when a productive rule is applied to a novel item. The rule defines the set of items it applies to and in this example the set is something like "all verbs in the language (unless otherwise specified)". Thus, speaker B in (4) does not have to perform any learning to figure out what rule to use – even if she has never heard the verb before, the new rule applies to it at once as long as the word is correctly identified as a verb.

But the default rule does not hold for all verbs as evidenced by the existence of irregular verbs (e.g. *sing,sung*; *go,went*). There are exceptions to the default (just as there are in syntax, cf. (2)) and those must be learned somehow by the speaker. The irregular patterns of the English past tense are practically never extended to novel verbs and therefore they are not considered to be productive (Xu and Pinker 1995). Since the nature of productivity has been most extensively studied within the domain of morphology (and actually an uncanny proportion of the literature focuses on past tense formation in English) it comes as no surprise that influential views on what kinds of generalizations apply to productivity have their roots in this discussion, sometimes dubbed "the past tense debate". One of the major generalizations proposed in the productivity literature is what we can think of as the default vs. the rest hypothesis, or words and rules:

(5)   **Words and Rules (WAR)** (Pinker 1998, 2000)
      The default pattern is generated by a rule (such as "add -d") while other
      patterns (such as *sing,sung; go,went*) are memorized for each item
      individually. The default is productive but the other patterns are not.

This model of productivity performs quite well on the data it was originally applied to, the English past tense. Within that range one can provide empirical support to (5) by studying language acquisition and diachronic change and since the type frequency of items to which the default pattern applies overwhelmingly outnumbers the irregulars the model can be argued to be pshycologically plausibile. However, the model runs into serious problems when applied to languages with richer morphology such as German. See discussion on the problems of Pinker's approach in Yang (2002:86). The default way to form a plural of a noun in German is the "add -s" rule but this rule applies to only a minority of nouns in the language and there is no doubt that there exist plural formation rules in German that are productive without being default, thus challenging the WAR hypothesis. To account for productivity of non-default patterns while preserving the psychological plausibility of having rules for general cases it has been proposed to replace WAR with a gradient view of generality vs. specificness:

(6) **The Variational Model (TVM)** (Yang 2002)

The default pattern is generated by a general rule. If it is efficient to learn a rule for a pattern that is more specific than the default but more general than a per item rule – such a rule is learned. It is efficient to learn a rule if the proportion of exceptions is sufficiently low (below a tolerance threshold for a productive rule).[4]

But how do such ideas extend to syntax? Barðdal (2008, forthcoming-b [2011]) has shown, using various types of evidence from independent sources, that at least some types of non-default case assignment have been productive in the history of Icelandic and at least some of those still are. There is no doubt that the WAR model in (5) is not compatible with the semi-productive status in (2). If we reserve productivity for the default pattern and nothing else, there can obviously not be any kind of a semi-productive minority pattern. Barðdal (forthcoming-b [2011]) takes this incompatibility to be an argument against (2) and concludes that the dichotomy between structural case and lexical case should be rejected. The current study will in some respects agree with Barðdal's analysis and arguments but disagree with her conclusion. We will argue that the evidence supports the traditional distinction between default (structural) case and non-default (lexical) case while it is incompatible with a WAR view of productivity. So instead of resolving the incompatible views of WAR and (2) by rejecting (2) we claim that WAR must be rejected instead, a conclusion that is independently supported by the facts of German morphology.

While we argue for maintaining the distinction between default case and non-default case, we will show, in line with TVM, that no categorical distinctions between subsets of non-default case can be empirically justified. We will show that while the default pattern is certainly productive that does not entail that non-default patterns are not productive. Even the least productive "quirky" patterns are somewhat productive, only less so than the so-called semi-productive case. We will provide diachronic evidence, experimental evidence and evidence from synchronic natural data that shows that non-default (including "quirky") case is productive. We will conclude that the distinction between

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[4]This paper uses the TVM label to refer to the whole set of ideas proposed in (Yang 2002) and subsequent papers by Yang cited throughout this paper. In this use of terminology, rule learning, referred to as Rules Over Words in (Yang 2002), is the subset of TVM that is most important for this study.

structural case and lexical case is empirically justifed while a categorical distinction between semantic case and quirky case is not. The more general case patterns are more productive and the more specific case patterns are less productive but no pattern is entirely unproductive.

The paper is organized as follows: In §2 we review some of the definitions and theoretical foundations this work draws on. A formal definition of productivity is given in §2.1, then we make some observations about a set of definitions we can use to describe variation in §2.2 and in §2.3 we discuss theories on case marking and the semantics of case. In §3 we compare three models of productivity (§3.1) before selecting The Variational Model (Yang 2002) as our analytical tool in §3.2 where we also explain how it can account for the kinds of facts about productivity and variation we are studying. In §3.3 we use those tools to explain Dative Substitution, a well known example of variation in the syntax of Icelandic. In §4 we present evidence of the productivity of non-default, and even the so-called quirky case, in Icelandic. We discuss what counts as evidence (§4.1) and present evidence drawn from natural data (§4.2) as well as psycholinguistic experiments (§4.3). In §4.4 we show that even if case information is tied to a single lexical item, a narrowly defined rule can provide a more accurate account than the idea of a list lookup. We summarize the main findings in §5.

2 Background

2.1 Productivity

Barðdal (2008:9–54) provides an extensive account of what linguists generally mean when they use the term productivity. One of the findings is that although the use of the term in the literature is not entirely random, it is diverse enough to demand further discussion that attempts to establish a common ground for fruitful debates on productivity that are not only rooted in superficial differences in terminology. Barðdal's analysis of the literature uncovers that the term productvity is used to refer to 'extensibility', 'regularity' and 'generality'. Since 'regularity' and 'generality' can be derived from the notion of extensibility, she argues that a definition of productivity should be based on the extensibility concept. We will adopt this position, cf. (1), repeated as (7).

(7) **A pattern/rule is productive iff it is extensible.** A pattern is extensible if it can apply to novel items (e.g. loanwords) or if it can attract items that already exist but the pattern did not apply to at an earlier stage (e.g. "the dative subject pattern" is extensible if it can attract verbs that previously assigned accusative case to their subjects).

We must observe that although such a definition is a useful guide to shed light on linguistic phenomena there is no reason to believe that productivity is a concept of theoretical primacy. For example it is obvious that every design that has been proposed for a generative grammar accounts for productive patterns, regardless of its implementation (e.g. rules vs. constraints). This does not, however, entail that we should not focus on productivity in our research. Even if our ultimate goal is to design a model that accounts for all the patterns in grammar, such a quest is hopeless if we do not have evidence that a pattern we describe is actually a pattern in the speaker's grammar, rather than just a memorized string of sounds with no linguistic structure. While it may be trivial to establish the productivity of some of the most prominent patterns, such as the past tense for regular verbs in English, there are other patterns in grammar that require a great deal of discussion and argumentation in order to uncover their productive (or unproductive) status.

Indeed, under the current definition, the term 'productivity' can be argued to be synonymous with 'pattern' or 'rule' which means that the task of establishing a rule, using linguistic argumentation, is equivalent with establishing productivity. Rules are defined to operate in a given context. A classic example is a rule that changes A to B when B occurs between C and D, thereby neutralizing the contrast between CAD and CBD. This can be represented as in (8) using a traditional generative notation.

(8)   A > B / C _ D

If we propose that a rule like (8) is part of a speaker's grammar, we claim that the rule should extend to any item that has the context to which the rule applies. We claim that the rule is something the speaker knows about her language and that this knowledge entails a productive pattern. An important consequence of this view is that as we define productivity to be an effect derived from I-language, as

opposed to E-language, we should be careful to prefer accounts of productivity whose explanations are focused on I-language. Take, for example, Barðdal's Construction Grammar account of where productivity comes from:

(9) **Construction Grammar (CxG)** Barðdal (2008:34–52)
     Productivity is a function of type frequency, (semantic) coherence and the inverse correlation between the two.

The account in (9) says that rules that refer to sets of items of high type frequency will be more productive than those that refer to sets of low type frequency and that a (semantically) coherent set of items is more likely to support a productive rule than a set that is not coherent. The note about the "inverse correlation of the two" refers to the fact that higher type frequency makes coherence less likely. We can take the class of regular verbs in English as an example of this – it is obvious that not all the verbs in the most common class can have a similar meaning (or similar phonological structure).

Barðdal's account is probably descriptively correct. However, as far as explanatory adequacy goes, it is not feasible in a theory of I-language to account for the phenomena under observation only in terms of E-language. This does not mean that the relevant facts of E-language should be ignored. Much of what we know about I-language is based on observing the product that is generated as it occurs in the world. But if we have a choice to formulate our explanation in a way that accounts for what really happens in the language organ in the brain – such an explanation should be preferred. In generative linguistics, an ideal way to achieve explanatory adequacy is to describe patterns of grammar in terms of language acquisition. We can state this as a principled way of evaluating linguistic explanations:

(10) Prefer explanations based on language acquisition.

If we assume that (10) is a principle that tells us how to evaluate different accounts of the same phenomena, there is a sharp contrast between (9) and the TVM model in (6) (repeated as (11)).

(11) **The Variational Model (TVM)** (Yang 2002)
      The default pattern is generated by a general rule. If it is efficient to
      learn a rule for a pattern that is more specific than the default but more
      general than a per item rule – such a rule is learned. It is efficient to learn
      a rule if the proportion of exceptions is sufficiently low (below a
      tolerance threshold for a productive rule).

It is obvious that we need to formulate the TVM account in more detail to
capture how exactly such an approach explains the E-language-based statement
in (9) in terms of how children acquire language, and we will do so in section
§3.
      Before concluding our discussion on the definition of productivity, we should
note that the CxG and TVM accounts of productivity, as described above, fail
to capture the fact that patterns can be productive in I-language even if they are
never attested in E-language. If a model claims that productivity is a function of
frequencies, whether those act as a description of E-language or as stimulus to
a child acquiring language, there is no way to relate productivity to patterns that
have zero frequency. Such patterns, generally described by linguists by propos-
ing constraints of some sort, exist in every speaker's grammar. An example of
this can be seen in (12) where we have a name of an internationally known artist
that starts in a way that is not compatible with Icelandic phonology. A native
speaker of Icelandic, whose phonotactic constraints do not allow such a pattern,
is likely to "repair" the word with an operation we can informally describe as
"add e-", even if she has never before heard or tried to pronounce a word like
that.

(12) ***Ngũgĩ/Engugi** wa Thiong'o er frægur kenýskur rithöfundur.*
      Ngũgĩ   wa Thiong'o is famous Kenyan   writer.
      'Ngũgĩ wa Thiong'o is a famous Kenyan writer.'

The problem of lack of negative evidence in language acquisition demonstrated
in this example does not undermine the descriptions of productivity discussed
above. They serve only as a reminder that productivity is not limited to patterns
that can be acquired using positive evidence and thus constraints should be con-
sidered as well as rules when productivity is dealt with in linguistic research.

The rest of this paper will only focus on patterns whose acquisition does not depend on constraints so we will put this issue aside for now.

Now that we have defined productivity as extensibility, which is more or less synonomous with having a rule that is defined over a context, in a rule-based grammar, we will turn to variation, a linguistic concept closely related to productivity. In the following chapters we will propose an analysis of the Icelandic case system based on variational acquisition but before we turn to the data we will make some observations about variation in general.

2.2 Variation

We will assume a Principles and Parameters (P&P) version of Generative Grammar (Chomsky 1981) in the following discussion. Let us briefly sketch the big picture of the system before we discuss variation in such a setting. The central concept is the grammar, a machine in the brain that takes cognitive input (semantic material) and produces phonological output. The grammar consists of an innate core and marked periphery (Chomsky 1981:8). Following Yang (2009) we take the distinction between core and periphery to be a distinction between (1) a system controlled by parameter values that are selected from predefined options and (2) rules that are learned from the linguistic envirionment. The core and the periphery are closely interrelated and under this view the periphery is by no means "irregular junk" – it is simply the part of grammar that is outside the core:

(13) The two parts of the grammar:
Core: A genetically endowed system of universal principles whose language specific aspects are decided by parameter values that are **selected** from predefined options during language acquisition.
Periphery: Rules that are **learned** from the linguistic environment during language acquisition.

At any given time the **grammar** is in some kind of a **state**, that affects the mapping between **input** and **output**. By state we mean for example the speaker's level of tiredness, excitement and whatever other factors that may be affecting what happens in the grammar, even if they are not part of the grammar. [5]

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[5]Whether we want to include references to the state in our theory of the grammar is a matter of choice that depends on how we want to treat linguistic performance. The description of per-

Let us define variation using the above terminology, first in a general way:

(14) **Variation** means that semantically and functionally equivalent messages (same input) can have more than one phonological form (different output).

$Grammar(State, Input_1) \rightarrow Output_1$

$Grammar(State, Input_1) \rightarrow Output_2$

The definition in (14) limits the term variation to cases where the same input can give different outputs, without stating the source of the difference. Linguists do not always use the term variation in the same way and instead of arguing for and against different flavors of terminology we will take the above to be our general definition for the purposes of this study and classify the logical possibilities of where variation comes from as follows:

(15)   a. Grammar Internal Variation (different outputs from a fixed grammar)

   b. State Dependent Variation (different states)

   c. Dialect Variation (different grammars)

The place of pragmatic and sociolinguistic factors in such a classification will be discussed below. Note that as the classification in (15) is simply a list of the logical possibilities, it does not in itself imply anything about when and if the explanation of a given linguistic phenomenon should be sought in one of those classes of variation. To clarify the difference between the notions of the grammar and its state we assume that the grammar is a fairly stable machine that has resulted from language acquisition over a period of years whereas the state is something that can change quite spontaniously, such as by a sudden change in pragmatic context. Let us now formalize the definitions we will use for those three classes of variation:

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formance effects remains outside the P&P system but their relavance for the current discussion is that our proposal for the classification of the sources of variation lists state (or performance effects) as one of the three logically possible sources of variation, cf. (15b) and (17). The classification therefore contrasts the state, effects whose source is outside the grammar, but still affect what happens, with (i) effects whose description is only referred to by the description of the grammar, and should therefore be treated as internal to the grammar, cf. (16), and (ii) effects that are triggers for choosing different grammars (or dialects), cf. (18).

(16) **Grammar Internal Variation** means that the same grammar can generate different outputs from the same input without changing the state of the grammar:

$Grammar_1(State_1, Input_1) \rightarrow Output_1$

$Grammar_1(State_1, Input_1) \rightarrow Output_2$

The definition in (16) does not classify differences between speakers as Grammar Internal Variation if those result from different grammars or different states. It does not either classify intra-speaker variation as Grammar Internal Variation if it results from the speaker speaking differently in different social contexts, because such differences are explained by variables outside the grammar. Grammar Internal Variation means that the grammar itself is inconsistent. It is a function whose output is not (fully) predictable, even if its input and state are known. In this paper we will treat the so-called Dative Substitution as such a kind of variation, along the lines of Jónsson and Eythórsson (2005:229–231) who speak of "variation within the same grammar".

We might be inclined to think that variation within the grammar, as defined above, would be bad news for linguistics if it exists – this sounds quite random. However, a function whose output is not predictable is not necessarily (entirely) random. There are, for example, phenomena that are described in physics textbooks that have a probabilistic nature while they are highly structured, to a degree where all kinds of reliable predictions can be made. If the structure of some type of linguistic variation is best accounted for by referring to variation within the grammar, that is the approach that should be taken. Note that although variation within the grammar is problematic for traditional implementations of P&P whose designs are quite categorical in nature, the Variational Model we will be assuming in §3 predicts that if the child encounters conflicting evidence when selecting parameter values and learning rules – there will be variation within the grammar she acquires.

Indeed, we will assume that Grammar Internal Variation can only result from inconsistencies in the language environment during language acquisition. If all the unambiguous evidence the child encounters for selecting a parameter value or a rule is fully consistent there will be no such variation. Take for example the case of an Icelandic child whose task is to learn a rule that assigns subject case to the verb *vanta* 'need' (for the sake of the current example as-

sume that subject case must be acquired independently for this verb). If all the sentences she encounters in the environment are consistent with a rule that says accusative subject but only some sentences are compatible with a dative subject, she will successfully acquire a rule for accusative subjects. If, however, some of the sentences she hears are only compatible with a rule that says dative subject the competition between the rules will lead to a mixed grammar where the probability of each case is correlated with the proportion of sentences that are only compatible with each of the two rules. Thus, the nature of the grammar with respect to the two rules will be probabilistic but not random. Note that such probabilistic grammar competition can also be applied to selection of parameter values, cf. Yang (2002:24–58).[6]

Intra-speaker variation that is best explained by referring to conflicting evidence in data encountered during language acquisition should be classified as Grammar Internal Variation. However, if the variation we observe can be better explained by saying the speaker uses form A in a particular type of pragmatic situation but form B in another type of pragmatic situation, and this is a distinction to be made on empirical grounds for each case, we should formulate our analysis of the variation in terms of the state of the grammar, cf. (17). An example of such variation would be if a speaker tends to output less marked structures when there is already a high load of cognitive complexity in the sentence she is pronouncing, e.g. overregularization of inflection morphemes inside a deeply nested recursive structure.

(17) **State Dependent Variation** means that the same grammar can generate different outputs from the same input because the state of the grammar changes:

$Grammar_1(State_1, Input_1) \rightarrow Output_1$

$Grammar_1(State_2, Input_1) \rightarrow Output_2$

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[6]An argument for the view that frequency in the input are mirrored by the frequency of the use of the learner, independently of the context of the use, comes from the study of language change where a new analysis replaces an older one gradually over a period that spans many generations of speakers. Such a change might plausibly reflect the new analysis being extended to new contexts throughout the history of the change but quantitative studies have indicated that a change can spread at the same rate in every context where it applies, en example of this being the gradual rise of *do*-support in the history of English (Kroch 1989). The intermediate stages of the development are consistent with rules or parameter values (competing grammars in Kroch's terminology) applying with a probability that correlates with input frequency independently of the context.

The third logically possible source of variation, dialect variation, should be chosen as an analytic device if the phenomenon in question is best described by saying the speaker is bilingual in the sense that she can systematically switch between different grammars that result from distinct sets of language acquisition evidence, cf. (18). In this case the grammar function itself, the one that carries out the transformation between input and output, can be switched for a different version of such a function.

(18)   **Dialect Variation** means that different outputs are generated because there are different grammars:
$Grammar_1(State_1, Input_1) \rightarrow Output_1$
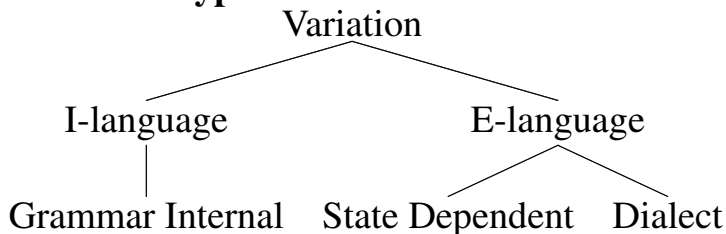$Grammar_2(State_1, Input_1) \rightarrow Output_2$

The reader will note that State Dependent Variation and Dialect Variation, as defined here, must be somehow related. Firstly, the source of the variation lies outside the grammar in both cases as opposed to Grammar Internal Variation where variation is produced by grammar internal inconsistencies. Thus, if we approach the classification of variation from a source point of view we could say that Grammar Internal Variation is I-language variation whereas State Dependent Variation and Dialect Variation are both E-language flavors of variation. Secondly, the same kind of a trigger can in principle be the root of the two E-language variation types.

Let us for example take some social variable/feature like [± formal (situation)] whose different values leads to different outputs. A hypothetical speaker might normally use dative subjects for a given set of verbs where the same speaker would use accusative subjects in a formal social context.[7] It is possible to build references to the social variable into the grammar algorithm and thus ensure different outputs if we did not worry about the autonomy of the grammar, in the spirit of some flavors of sociolinguistic theories. There could simply be a rule that transforms dative subjects to accusative case when the [+formal] feature is present. Then the feature from outside the grammar would affect an otherwise fixed grammar. The other possibility is that the speaker knows a different grammar, the formal dialect, which may have a different set of parameter values and rules.

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[7]Since we are strictly working on a formal definition we are not concerned with whether the example is plausible or not.

Then what is the distinction between State Dependent Variation and Dialect Variation? While it is possible to maintain that no such distinction should be made in linguistic theory, or that only one of those is linguistically interesting, we will, for the sake of our definition, base the difference on whether the explanation of the variation is a spontaneous change of state (such as a moment where processing difficulties affect the output) or a long term acquisition phenomenon (years of exposure to systematic differences between dialects). Under this refined view we will assume speech styles, such as formal language, to be a type of dialect variation. This means that a social context can be linked to dialects whereas performance limitations are linked to the state of the grammar. Whether one agrees with such a distinction or not, it should at least be clear that there is a difference in nature between Grammar Internal Variation and Grammar External Variation. I-language Variation means that the grammar knows that its output is probabilistic in nature whereas E-language variation allows for different outputs from the same input even if the grammar itself is consistent and categorical, because the source of the difference is outside the grammar.

(19) **Variation Types**

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                        Variation
                   ┌───────┴────────┐
              I-language          E-language
                  │              ┌─────┴─────┐
          Grammar Internal  State Dependent  Dialect
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A tree representation of the variation classes that have been discussed is given in (19). This classification follows directly from our definitions and makes no assumptions about whether we will find any of those classes in our linguistic research. An analysis that concludes that a particular variation pattern belongs to a particular class must always be the result of an empirical inquiry. As always, we have to look at the facts of the world to know which analysis provides the best explanation of those facts. In the following discussion we will review traditional analyses of case systems and – referring to Icelandic data – we will identify facts about productivity and variation that must be accounted for in linguistic theory. In §3 an explanatory model of those facts will be presented and in §4 we will discuss evidence that challenges some traditional assumptions about
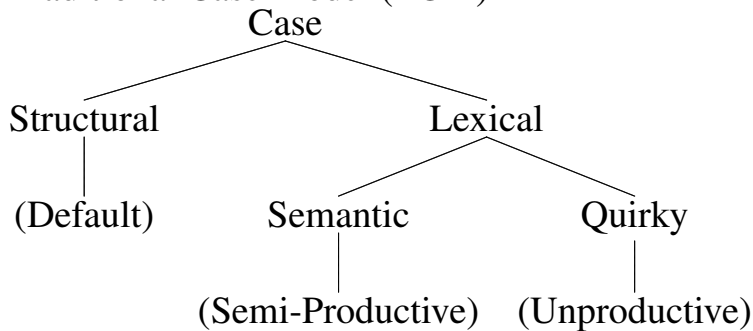
case – evidence of facts that are expected under the account that is proposed in this paper.

2.3 Case

2.3.1 Structural and Lexical Case

The distinction between the default structural case and the non-default lexical case, (2) repeated as (20), is descriptively and explanatorily pleasing since it allows us to capture case alternations between actives and passives in a simple and elegant manner as demonstrated for Icelandic in Zaenen, Maling, and Thráinsson (1985). Note that the literature does not always use the same labels for the categories we refer to as semantic and quirky case. For the purposes of this study we are not concerned with debates on the terminology used to account for those – our interest lies in whether and how such distinctions are motivated.

(20)   Traditional Case Model (TCM)

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                           Case
                  _____
                 |                        |
             Structural                Lexical
                 |                 _____
                 |                |               |
             (Default)        Semantic         Quirky
                                  |               |
                          (Semi-Productive)  (Unproductive)
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Structural case is assigned to arguments entirely based on their position in the structure of a sentence and thus the case of a particual argument alternates in a way that reflects its position. A structurally accusative object in an active will therefore appear in the nominative in a corresponding passive, cf. (21).

(21)   a. *Páll eldaði þorskinn.*
             Paul cooked the.cod.ACC
             'Paul cooked the cod'

         b. *Þorskurinn   var eldaður af Páli.*
             the.cod.NOM was cooked   by Paul
             'The cod was cooked by Paul'

Lexical case on the other hand is tied to lexical features of particular verbs and therefore a lexically assigned object case is preserved in the corresponding

passive. In Icelandic we see this pattern by observing verbs that take dative or genitive objects, cf. (22).

(22)   a. *Páll breytti uppskriftinni.*
           Paul changed the.recipe.DAT
           'Paul changed the recipe'

       b. *Uppskriftinni var breytt af Páli.*
           the.recipe.DAT was changed by Paul
           'The recipe was changed by Paul'

       c. *Páll saknaði ýsunnar.*
           Paul missed the.haddock.GEN
           'Paul missed the haddock'

       d. *Ýsunnar var saknað af Páli.*
           the.haddock.GEN was missed by Paul.
           'The haddock was missed by Paul'

Barðdal (2008) claims that the dichotomy between structural and lexical case should be rejected on the basis that semantic case is productive even if it does not apply by default. She refers to Pinker's Words and Rules model of productivity and says that the dichotomy predicts lexical case to be unproductive. Since this supposed prediction is not borne out she concludes that the structural vs. lexical distinction is not motivated and should be removed from linguistic theory. This argument is flawed. The series of evidence presented in support of the fact that semantic case is productive is obviously not compatible with Pinker's model – which must therefore be rejected. Once we have established that non-default rules/patterns in the grammar must be allowed to be (potentially) productive the incompatibility of the structural/lexical dichotomy with Pinker's model is irrelevant – Barðdal's productivity-based argument is really a case against Words and Rules – not the distinction between structural and lexical case.

Furthermore, we might add, there have been claims that the distinction between structural and lexical case is motivated on the grounds of the anatomy of the brain – more specifically that brain damage can affect structural case and lexical case independently of each other (Druks and Marshall 1995). While the original claim is based on a somewhat tricky analysis of linguistically interesting changes in the grammar of a patient of Broca's aphasia – the proposal

remains intriguing. To support the hypothesis by more solid empirical facts it is feasible to see the predictions borne out for a Broca's aphasic whose native language has a rich case system. It turns out that such a case was reported by Magnúsdóttir and Thráinsson (1990). The most frequent error made by the patient, a native speaker of Icelandic, was to overuse datives. If we assumed some kind of a fallback to a less marked case when processing difficulties arise this behaviour is unexpected – unless we assume that the structural case mechanism in the brain is damaged, which predicts that the least marked lexical case, dative, should be overused. Other errors in the speech of the patient were consistent with fallbacks to less marked forms, such as replacement of inflected verbs with the corresponding infinitive form. Thus we have neurolinguistic evidence that is nicely compatible with our abstract model of case, although we must admit that there is plenty of room for reasonable doubt regarding the analysis, as is the case for any empirical claim that relies on limited data.

The second distinction in (20), between semantic and quirky case, is based on the observation that some non-structural case assignments are predictable based on the semantics of verbs in question while in other cases, the quirky ones, the assignment has been claimed to be memorized per item. Since we are looking at the Icelandic case system in this paper we will now turn to what has been said and what can be said about the semantics of case with those data in mind.

2.3.2 Semantics of Case

Jónsson (2003) presents various observations about the semantics of subject case in Icelandic and assumes the division of lexical case into semantic and idiosyncratic case. This account goes far beyond the observation that oblique (non-nominative) subjects cannot be agents. He takes dative goals and experiencer subjects to be examples of semantically predictable case whereas accusative subjects and dative theme subjects are believed to be examples of quirky case. Before looking at some of the specifics of the Icelandic data it is interesting to get a picture of what kinds of semantic factors are believed to make a difference in a lexical semantic analysis of a case system, drawing on Jónsson (2003):

(23)   What kinds of semantic factors matter?

     a.   **Traditional "simple" thematic roles:** agent, patient, experiencer, goal, location, instrument etc.

     b.   **More specific semantic sets:** verbs denoting feelings, physical sensation, cognition or perception; hiccup-verbs; verbs of emission, psych-verbs

     c.   **Contrasts:** agent vs. non-agent; positive vs. negative feelings

     d.   **Gradient differences:** more vs. less agentive; stronger vs. less strong feelings

There remains no doubt that factors like the ones mentioned in (23) can be useful to describe how groups of verbs behave. But it is also obvious that the linguist is faced with considerable difficulties if she seeks to confirm a relation between such a description and what actually goes on in the brain of the speaker. Arguments can of course be built by relying on careful cross-linguistic comparative studies and such methods can for example provide a convincing case for the reality of the agent vs. non-agent distinction. When dealing with some of the other traditional "simple" roles one must be careful not to rely on circular reasoning where (Latin) case is used to motivate the roles and the other way around. And as we can see from the more specific semantic sets and further contrasts, categorical and gradient, it is clear that the traditional "simple" roles will not be enough. In an extended analysis of accusative subjects in Icelandic, Jónsson and Eythórsson (2008) divide the class of accusative experiencer subjects in Old Icelandic into five classes:

(24)   Five classes of accusative experiencer verbs in Old Icelandic

     a.   Verbs of physical discomfort

     b.   Verbs of lacking

     c.   Verbs denoting feelings

     d.   Verbs of cognition

     e.   Verbs with affected experiencers

Again there is no doubt that we have a useful description without knowing if those are actually the semantic factors that matter in the brain of the speaker. In the paper where this list is presented the accusative subjects are described as "structured exceptions" and the notion of "family resemblance" is invoked to explain sporadic productivity of accusative subjects in the history of Icelandic. The family resemblance account is inspired by the connectionist-based explanation Pinker (2000) gives for the very sporadic overirregularization of verbs where weak inflection is replaced with strong inflection. Under such a view there is not a rule for the irregular pattern being overapplied – but the reason for the "error" has to do with failed memory retrieval – which is not unexpected in connectionist psychology in cases of family resemblance.

If the explanation for the sporadic productivity of accusative subjects in Icelandic is of the nature described here, the origin of a change would be a mistake where a speaker retrieves case assignment information from a semantically similar verb or a set of verbs and this mistake is then acquired by other speakers. In §3.3 we will discuss an account of intra-speaker variation that refers to rule competition and probabilistic blocking and does not have to resort to memory retrieval errors to explain inconsistencies. In §4 further evidence will be presented in support of the view that speakers do actually use rules for minority patterns in case marking instead of listing the irregulars. We will actually claim, contrary to previous accounts in the literature, that all case marking is based on productive rules.

We must emphasize that the discussion of whether we know what really goes on in the brain of the speaker is not meant to undermine ideas of universal semantics that may be visible to the syntax in ways that affect the output of the grammar. We are merely pointing out that it is a significant methodological challenge to uncover the truth of such matters. The plausibility of an empirical claim that a particular semantic feature (or set of features) is relevant in syntax can of course be supported in various ways. Cross-linguistic generalizations can for example provide impressive arguments and an appeal to psychological plausibility is also important. We can argue that the classes in (24) are plausibly used by the syntax since they all describe very fundamental kinds of experience and should therefore have been already in place as relevant cognitive units when the language organ started to evolve in humans or their ancestors. In fact

those are so fundamental I am quite sure my dog recognizes all those classes of experiences despite not having a language organ in the human sense.

Once we have identified what kinds of semantic factors might be referred to in an account that aims to capture the sets of verbs on which the distribution of case is based, we can go on and ask what kinds of observations can be made about the distribution and what restrictions apply. The observations in (25) are from the description of subject case in Icelandic by Jónsson (2003).

(25)   What kinds of observations can be made?

a. The difference between semantic and idiosyncratic case is semantic predictability

b. Accusative case on subjects is always idiosyncratic

c. Dative Substitution and Nominative Substitution involve loss of truly idiosyncratic case on subjects

d. Idiosyncratic case is incompatible with productive suffixation (e.g. no accusative -st verbs)

e. All verbs denoting strong positive feelings take a nominative subject.

Item (25a) is actually more of a definition than an observation but nevertheless we should discuss what it actually means since all of the other observations depend on it. The key question is what semantic predictability means. In Jónsson (2003) such predictability is linked to a semantic class of verbs in the sense of (23) assigning particular cases to their arguments. In some cases simple roles are used and in other the more complicated sets are used. Furthermore, constraints along the lines of (25b,d,e) are proposed.

It is not obvious where to draw the line between a truly semantic case, structured exceptions and idiosyncratic case in the sense of Jónsson and Eythórsson (2008) – just how complicated does the description have to be to be demoted from a higher class to a lower class? Can semantic case refer to two semantic features, or three, or more? Are there some other criteria? What about a set of semantic features that captures only one verb – is that semantic case, a structured exception or idiosyncratic case? In our disussion we will assume that the important distinction should be between a productive rule and a list lookup.

It is important to draw a distinction between a productive rule and a list lookup because it immediately makes the empirical approach to finding out the truth more systematic. If the case assignment of a particular verb passes whatever tests we define to be evidence of productivity – then the case assignment is based on a rule – if not, it is a list lookup (idiosyncratic/quirky). Productivity can be measured in various ways as we will see in §4 – such as by applying semantic *wug*-tests. And now we can actually know that we are saying something about the speaker's brain. This is not something we are able to do with a description that is simply designed to hold for all the verbs in the Icelandic dictionary and the corpora available to us. If we restrict our research on the lexical semantics of case to verbs we have come across in E-language we are limiting our knowledge space in a similar way to a syntactican who does only look at the positive evidence she can gather from corpora. The productivity-based inquiry is then similar to extending the knowledge space to evidence that can be gathered using judgements from native speakers in experiments. We can know if the pattern we have observed is really a pattern in the brain or just a description that holds for our limited data set.

The updated approach will lead to substantial objections to (25b-e) on the basis of experimental evidence as well as natural data. We will show that the so-called structured exceptions are actually based on rules which means that (25b) is false and in fact we reject altogether the idea of truly idiosyncratic case. Our all-rules claim is an objection to the idiosyncracy label in all of (25b-d) and instead of viewing dative substitution and nominative substitution as a simple loss of irregularity, cf. (25c), we will explain those as stochastic blocking, which further explains considerable intra-speaker variation and in some cases the extension of the irregular pattern to the regular one, phenomena that are unexplained under the simple loss of irregularity approach. The statement in (25d) that does in fact refer to productivity will also be shown to be false on the basis of various counterexamples.

The need to introduce fine grained semantic distinctions as in (23b–d) and (24) strongly suggests that simple thematic roles are far from adequate as descriptive tools and the vagueness of subclasses such as "structured exceptions" leads us to a purely productivity-based approach. We should not worry to much about the inadequacy of the simple Latin-inspired roles to account for all the

facts. Allowing for more fine-grained semantic distinctions to be the basis for productive rules is fine if this is where the facts lead us. If the predictions of the theory are not borne out it is the fault of the theory, not reality.

By introducing complicated sematic sets in our rules we do of course raise concerns over a child's ability to learn such complicated rules and the psychological plausibility of the brain consistently dealing with some seemingly arbitrary set of semantic features. Are we perhaps suggesting another vague sense of sematic relatedness or semantic coherence? In fact there is evidence that however arbitrary the classes may seem, they are still classes, and the brain does treat them as such. It it not clear what is the best way to describe the categorical aspects of semantic coherence – but following many linguists in various traditions we will simply assume binary features for now. Since the purpose of this paper is not to describe the details of a particular case system we will refer the reader to the literature for such accounts, e.g. Jónsson (2003); Jónsson and Eythórsson (2008), but for example, the rule that assigns accusative case to the subject of the Icelandic verb *hungra* 'be hungry' might look like (26), cf. the references above for an extensive discussion of the Icelandic data.[8] Further implementation details can of course be constructed in one's favorite framework[9] but we propose a rule that refers to a set of features and results in the argument being realized in a particular case. Even if this looks like some kind of an arbitrary set of semantic features it may very well be that Universal Grammar gives preference to sets that form fundamental semantic classes at a general cognitive level. If so, 'physical discomfort' could easily be one of those, cf. the discussion above about my dog recognizing such a kind of experience.

(26)   IF [+subject,–agent,+experiencer,–control,+discomfort,+physical]
        THEN accusative

A rule like (26) is very different in nature from traditional ideas about the supposedly idiosyncratic case of such verbs where it has been assumed that the case information is memorized per lexical item. The rule in (27) represents how the

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[8]In Modern Icelandic the following verbs could by covered by this rule: *hungra* 'be hungry', *flökra* 'feel nauseous', *kala* 'become frostbitten', *kitla* 'be ticklish', *klígja* 'feel nauseous', *klæja* 'itch', *saka* 'be hurt', *svengja* 'be hungry', *svima* 'feel dizzy', *svíða* 'feel sharp pain', *syfja* 'get sleepy', *verkja* 'feel pain', *þyrsta* 'be thirsty'.

[9]Or not, if the framework is hostile to such rules.

case assignment of such verbs is traditionally modeled, where #512 is simply some arbitrary index number to illustrate the idea of a list lookup.

(27) IF verb #512
      THEN accusative

To support this view we can for example start by claiming uncontroversially that the human mind is quite clever at dealing with semantic relations in general. Even a young child can answer questions like (28).

(28)   a. What is the opposite of being stupid?

        b. Is a bakery a place that is more similar to a pharmacy or a bridge?

        c. What car names do you know?

The child can easily name Ferrari, BMW, Volvo or whatever the names of her favorite toy cars will be. Note that such questions can demand classification far beyond what we would ever give some special universal status in our theory of the language organ. If there are semantic features of such special status, and there probably are, those should be even more easily manipulated by the brain. Further support for the reality of complicated semantic classes as real units in the brain can be found in the study of aphasia. Obler and Gjerlow (1999:152) discuss patients whose brain trauma has damaged noun classes that seem quite arbitrary, cf. (29).

(29)   a. Body part names aphasia

        b. Fruit and vegetables aphasia

        c. Animal names aphasia

We can argue that if a class of sort X can be independently damaged due to brain trauma, then such a class is a real set that is present in the brain as a unit. From the point of view of the linguist, however, the most reliable evidence for the reality of a set of items is a productive rule that refers to such a set. In the following section we will present a model of productivity that will act as our explanatory device when we discuss evidence of the productivity of non-default case.

3 Accounting for Productivity and Variation

3.1 Three models

We have mentioned three different models of productivity and we will now briefly summarize the problems with the two we are going to reject before formalizing our case for the Variational Model.

(30) a. Words and Rules (WAR) (Pinker 2000)

 b. Construction Grammar (CxG) (Barðdal 2008)

 c. The Variational Model (TVM) (Yang 2002)

According to the WAR model, inspired by the English past tense, only the default is generated by a productive rule whereas other patterns are memorized per item and accessed by looking them up in a list. Our primary reason for rejecting WAR is therefore the need to account for productive non-defaults. Pinker's explanation of the very sporadic productivity of irregulars (non-defaults) in the data he works with (e.g. *sneak*; *snuck*) refers to memory retrieval errors inspired by the notion of family resemblance as portrayed in connectionist networks. No precise formulation is given for family resemblance – as far as one can tell "sounds similar" motivates overirregularization and overirregularization motivates what counts as "similar", and the discussion is mostly related to 'i'/'u' alternations in verbs like, *sting*, *string*, *sling*, *stink*, *sink*, *swing* and *spring*. The partial productivity of non-defaults is considered to be marginal and the reasoning for the occasional exception seems to be fuzzy, e.g. why does the family resemblance notion not trigger *think*;*thunk* and *blink*;*blunk* even if those seem closer to the so-called "gravitational center" of the family than for example *dig* and *win* (Yang 2002:88)?

It is perhaps not unexpected that productive irregulars get a marginal and fuzzy status in the discussion of the English past tense – even if this idea does not extend well to data whose productivity is gradient. The WAR model is however precise, explanatory and predictive when it comes to the general idea, which is the full productivity of defaults as opposed to the virtually non-existent productivity of irregulars. The explanation is that having a rule for the default saves plenty of storage space in the brain and in the case of the English past

tense this may very well be the only rule that does that. WAR proposes a very strong hypothesis about the nature of productivity and it is easy to imagine what a potential counterexample might be like. As we discussed in the §1 such data do exist, such as the German plural and lexical case in Icelandic, and those challenge the idea. The hypothesis is so boldly designed that WAR is not easily revised in a way that accounts for our problematic data – this would require a fundamental change of the proposal.

We must stress that we are not rejecting the idea that there is a difference between units of language that might be called words and rules. We are simply pointing out that the idea that only the default is productive does not extend well beyond the English past tense. When a theory has been proposed for why there might be rules for patterns that do not apply by default – we can without doubt learn a lot from Pinker's inquiry into the nature of rules and list lookups.

Barðdal's (2008) CxG approach states that productivity is a function of type frequency, coherence and the inverse correlation of the two, cf. (9). She provides a detailed discussion of various data that are consistent with this and it is probably correct that it supports a prodcutive rule if the context in which the rule applies is high in type frequency or coherent. This intuitively makes sense. This model is nicely compatible with productive non-defaults since they are expected if their context is frequent or coherent. The problem from an empirical point of view is that the proposal relies on the vague notion of "coherence" and does not provide any formal criteria for evaluating what is frequent enough or coherent enough to support a productive rule. It is very difficult to imagine what would count as a clear counterexample to the claim. Well, if a set of 1000 items is divided into subset A which has 999 items and subset B which has 1 item we could probably conclude that A must be frequent but B not. But what about 800 vs. 200 or 600 vs. 400 or in a smaller set 60 vs. 40? Would a high amount of coherence make the rule pattern productive even if its type frequency was low? Just how much coherence is needed to sustain a low frequency rule? There is no way to know unless the proposal is formulated in a way that makes clear predictions.

The idea behind a rule being supported by a frequent and coherent context could in principle have excellent explanatory power but the vagueness of the predictions undermines such explanations. The lack of a clear proposal for how

those variables translate into the child's linguistic comptence also reduces the explanatory value of the model. We must stress that those objections are not against the general direction of Barðdal's argument, but rather against the lack of clarity and falsifiability. If cognitive science is to be practiced on empirical grounds, according to the scientific method – such problems are serious because they make the way forward foggy and slow down our search for the truth. The weaknesses of the GxC model are evident when the possibility of a statistical prediction is mentioned in relation to a diachronic increase in the number of verbs that take dative objects:

(31)   The fact that the Nom-Dat construction has increased in type frequency from Old to Modern Icelandic of ca. 3% may suggest that the minimum type frequency needed for a category to be stable is around 30% of the types. Clearly more research is needed to establish that, but it is in accordance with the predictions of the present approach to productivity, based on type frequency and coherence, that such large categories will increase their type frequency in course of time. The fact that a category containing approximately 30% of the types is also productive sustains the validity of this approach.
(Barðdal 2008:155)

If we assume Barðdal's definition that productivity and extensibility are the same thing and apply her model of productivity as in (9) there is in fact no reason to expect that the ratio 30% has any independent relevance. If productivity is a function of type frequency **and** coherence, a percentage that only refers to type frequency does not tell us anything. According to the model a higher type frequency should be needed to sustain a productive pattern if the coherence of the context is lower and a lower type frequency should be fine if the context is more coherent. The main problem with (31) is that we do not have a way to measure coherence. And we do need a way to capture that because coherence is intuitively relevant and in very coherent contexts a rule should be able to be productive despite referring to a low type frequency set.

    Another problem with (31) is that the extensibility-based definition seems to have been replaced by "increasing in type frequency" or something like that. An increase in type frequency is of course the result of a pattern being extended

to new items faster than items of the class fall into disuse but this does not entail that all productive patterns increase in type frequency over time. A pattern may be extended to new items even if it loses items because they are attracted to other classes or fall into disuse faster than new occurances surface. Here Barð-dal seems to have shifted towards an E-langauge view of productivity which contradicts the definition we are working under.

The third problem involves what those 30% actually measure. Barðdal uses corpora to count the type frequency of verbs with the following subject/object patterns: Dat-Nom, Nom-Acc, Nom-Dat, Nom-Gen. The 30% value is calculated as the type frequency of one of those patterns divided by the total type frequency of those four types of verbs. But why should we be interested in that number and what is it supposed to tell us? It is well known, as Barðdal discusses, that the context for the productive Nom-Dat set of verbs is related to particular semantic contexts such as objects which undergo motion. If we have pinpointed a context for the pattern we should presumably be asking how frequently, for example, objects that undergo motion are assigned dative as opposed to objects that undergo motion in general.

The question is whether there is an actual pattern in the context we propose as linguists – or not. If a pattern defined over 10% of the items extends to any new item which enters the context we have an actual pattern. But a pattern which is true for 30% of the items without being extensible is merely an observation by the linguist as opposed to an actual pattern in I-language. The patterns Barðdal discusses are in fact actual patterns but that has nothing to do with the 30% ratio. It has to do with children being able to generalize the patterns over contexts that they recognize.

To summarize our findings in this chapter we must firstly reject the WAR model. It is unable to account for productive non-default rules because the so-called irregulars are given a marginal status that may only show partial productivity when the vague notion of "family resemblance" triggers memory retrieval errors. Secondly we are unable to take advantage of the fact that the CxG approach supports productive non-defaults because the model does not offer a falsifiable theory of productivity. Barðdal's CxG approach might provide us with falsifiability if a formal definition of "coherence" was added to the model but this can not be verified unless a precise proposal is made. What we need is

therefore a model that accounts for productive non-defaults in an explanatorily adequate way and makes falsifiable predictions. Thus we turn to The Variational Model of language acquisition. The nature of rule acquisition in this model has already been briefly described in (6). Using this approach we can explain productive non-defaults on the basis of a formal learning theory. The reason for us pursuing the Variational Model approach is illustrated in (32).

(32) WAR [+explains and predicts, –productive non-defaults]
      CxG [–explains and predicts, +productive non-defaults]
      TVM [+explains and predicts, +productive non-defaults]

In the following section we provide a more accurate description of how the TVM works before utilizing its explanatory power to shed light on the most famous variational aspect of Icelandic syntax, the so-called Dative Substitution.

3.2 The Variational Model

Here we will lay out some of the core aspects of The Variational Model (TVM) (Yang 2002, 2005, 2006, 2009) that are relevant to our discussion of productivity. In TVM the term *core* is used for the Principles and Parameters part of the grammar and *periphery* is used for rules that are learned from experience, cf. (13) repeated as (33).

(33) The two parts of the grammar:
      Core: A genetically endowed system of universal principles whose language specific aspects are decided by parameter values that are **selected** from predefined options during language acquisition.
      Periphery: Rules that are **learned** from the linguistic environment during language acquisition.

The periphery is not a completely random mess under this view but a system of rules that interact with UG, because the grammar as a whole is governed by universal structural principles. We will assume that the acquisition of lexical case is exactly a learning process of this sort – there are rules to be learned from experience as opposed to being selected from UG but those will be constrained by the structures made available in the grammar and expectations about some

fundamental semantic classes being the places to look for rules that govern argument structure.

TVM assumes that the organization of rules is governed by the Elsewhere Condition (Kiparsky 1973) but, as we will see, in a slightly modified manner:

(34) **Elsewhere Condition:** A rule R_1 which applies in context C_1 blocks rule R_2 in context C_2 if C_1 is a subset of C_2
English Version: Specific rules block general rules

Algorithmically the Elsewhere Condition can be portrayed as in (35).

(35) IF most specific context THEN apply R_1
ELSE IF very specific context THEN apply R_2
ELSE IF quite specific context THEN apply R_3
...
ELSE IF not so specific context THEN apply R_4
ELSE apply $R_{default}$

The difference between the standard idea of blocking and the so-called stochastic blocking employed in TVM is that blocking is predicted to potentially fail if the speaker does not recognize the context of a specific rule or if she has encountered conflicting evidence during language acquisition where some of the input is only compatible with the more general rule and some of the input is only compatible with the more specific rule. When the speaker has identified two productive rules, R_1 which occurs in specific context C_1 and R_2 which occurs in a more general context C_2, where the specific context is a subset of the general context – conflicting evidence will lead to rule competition. See Yang (2002:59–100) for details.

If a significant amount of evidence is only compatible with the general rule the specific rule will apply with a probability lower than 100%. When it does not apply a fallback to the more general rule is predicted. The details of how the rule competition works are not important for the current discussion but the short version is that when the learner comes across evidence that is only compatible with one of the rules she awards that rule by making it more probable at the cost of the rule that was not compatible with the input. Various implementations of such an algorithm could in principle work.

So how does the speaker know when a rule defined over a context should be learned as opposed to memorizing the relevant pattern for each item captured by the definition of the context? TVM assumes that the brain tries to optimize the organization of the rules for processing time and given some further assumptions, such as the one that word frequencies follow the Zipfian distribution, the model claims that a tolerance threshold for a productive rule can be mathematically defined (Yang 2005, 2009). If the class of items to which a rule R applies has the type frequency N and the amount of exceptions that must be memorized must not exceed the threshold M for the rule to remain productive – the following theorem predicts the conditions that constrain a productive rule:

(36) **Theorem:** R is productive if and only if (cf. the references above):

$$M < \frac{N}{\ln N}$$

This means that if the number of exceptions is lower than than the type frequency of the items captured by context of the rule, divided by the natural logarithm of this same type frequency we get a productive rule. If the number of exceptions exceeds what is allowed by the tolerance threshold, the rule is demoted to a per item rule or perhaps to a more specific context if such an option is available. Note that we should not worry too much about whether (36) gives exactly the correct value for the tolerance threshold – the main thing is that we now have grounds for systematic empirical work. We can prove that (36) is wrong and must be adjusted if we find clear counterexamples but as long as the general idea of a relatively few exceptions to a productive rule holds we can continue working on a precise model that makes clear predictions and explains those in terms of explicitly defined variables.

The reader may notice that the model handles productivity in a categorical way which may seem to contradict our claims of gradient productivity. We say that a rule is productive if and only if the exceptions are below the tolerance threshold. In fact productivity is both gradient and categorical under this view depending on what units of the description are under observation. Productivity is categorical per context within the grammar of a particular speaker but the gradience comes from the idea that contexts may be of varying degrees of specificness/generality. Thus, a productive rule can be said to be more productive if it

applies in a general context but less productive if it applies in a specific context despite the productive vs. non-productive distinction being categorical at the per context level.

To illustrate why it is important to have a formal way of allowing exceptions, but only to a limited degree, as in (36), we can consider a small thought experiment that has to do with memorization. Imagine you were asked to memorize all values of the function $f(x) = x$ where x is an integer and $0 \leq x \leq 1000$. This is an absurd idea because there is a simple rule that covers all the possible cases, $f(5) = 5$, $f(47) = 47$, $f(512) = 512$, etc. Now, imagine there are a few exceptions, so that $f(x) = x$ for all the integers except when x is in the set $\{34, 100, 112\}$ in which case $f(x) = 7$. Again, it is an absurd idea to memorize all the values for the function per item because we have a rule that covers most of the cases and it is much easier to use the rule and memorize the exceptions. This is the reason why a tolerance threshold for exceptions is needed in grammar. If it is easier for the brain to use a rule for the majority of the cases and memorize the rest than to memorize everything – this is what the brain does.

Then the question arises – does this help us at all? Could it possibly be a good thing for the linguist to give exceptions a formal status in the system as in (36)? Let us consider the case of Icelandic verbs that can be described using the context [–agent,+experiencer]. Those verbs mostly take dative subjects and the key word in that statement is **mostly**. There are exceptions to the rule, some of which can be accounted for by a more specific rule that assigns accusative case, but also a few where nominative is assigned, such as *harma* 'regret' and *kunna við* 'like'. Such exceptions are problematic for a grammar that does not account for exceptions and presumably those are the cause of Jónsson's (2003:150) comment that dative experiencer subjects are a complicated matter, even if the link between the experiencer role and the datives is clearly established in his analysis:

(37) Case assigned by general lexical rules will be referred to as semantic case. It is not a trival matter to formulate these rules, especially for dative experiencer subjects, and I will not attempt to do so here.

Here we will claim that it is actually trivial to formulate a single simple rule that assigns dative to experiencer subjects. The rule is as follows:

(38) IF [+subject,–agent,+experiencer]
      THEN dative

Exceptions to this rule, where we get nominative subjects, are memorized. Jónsson (1997–98) lists about 220 verbs that assign dative to their subject according to (38). According to (36) such a rule would allow for 41 exceptions without losing its productivity in the context we have proposed here. The accusative assigning verbs that match those features are not problematic since their context is a subset of the context in (38) and they are therefore predicted to block the datives. If we also count cases where the verb *að vera* 'to be' together with an adjective assigns dative case, such as *mér er kalt* 'I.DAT am cold', even more exceptions would be allowed. It is therefore plausible to assume that there is in fact only one simple rule which assigns dative to experiencer subjects in Icelandic.

We have now seen how TVM can in a psychologically plausible way explain a pattern in Icelandic in a quite simple and elegant manner. Whether the current version of the tolerance threshold will hold against future challenges is of course unsure, but by having a formal theory of exceptions our understanding of the data can be improved. In the following section we will show how the so-called Dative Substitution can be explained in a straightforward way as a manifestation of stochastic blocking in action.

3.3 Dative Substitution as Stochastic Blocking

Dative Substitution (DS) is a label which has been used for an ongoing change in Icelandic where an original accusative case on experiencer subjects is sometimes replaced with dative. From a theoretical point of view one of the most interesting aspects of this phenomenon is that we get extensive intra-speaker variation that is not systematically linked with any particular pragmatic situations or dialects. Jónsson and Eythórsson (2005) do in fact argue that DS must be a kind of variation within the same grammar as opposed to some kind of a dialect difference. We will adopt this view here and claim that DS is a clear case of Grammar Internal Variation as defined in (16). Under TVM this is the expected outcome for a linguistic environment where speakers encounter plenty of inconsistent evidence.

To illustrate this point we will look at the class of verbs of 'physical discomfort' which were mentioned in (26), repeated as (39). Again, we assume that the child acquiring Icelandic may have some help from UG in identifying 'physical discomfort' as a fundamental semantic class despite the fact that from the point of view of the linguist the set of features may seem rather arbitrary. It is probably necessary to appeal to such universal guidance since it would not be plausible to assume that the child randomly tries all the possible feature value combinations.

(39)   IF [+subject,–agent,+experiencer,–control,+discomfort,+physical]
        THEN accusative

The context in which the above rule applies is clearly a subset of the context for the dative experiencer verbs in (38). According to the Elsewhere Condition (35) we get the following hierarchy where the more specific rules block the more general rules:

(40)   IF [+subject,–agent,+experiencer,–control,+discomfort,+physical]
        THEN accusative
        ELSE IF [+subject,–agent,+experiencer]
        THEN dative
        ELSE structural case

According to TVM blocking could technically fail for two reasons. Firstly, the speaker could fail to identify the context in which the specific rule applies. In (40) this means that she would fail to identify one of the features, perhaps due to some uninteresting reason which causes processing difficulties (tiredness, dizzyness, etc.). Although this is technically possible it is not a very pleasing theory to account for a major linguistic pattern by referring to pragmatically rooted processing difficulties. Still, we can speculate that something like that, even if it happens only very sporadically, might have contributed to the origins of DS. Secondly, TVM predicts that the specific rule that assigns accusative case must apply with a probability lower than 100%. This is because the speaker sometimes hears sentences that are only compatible with the more general rule that assigns dative, cf. (41), in which case she punishes the accusative rule by lowering its weight.

(41) *Mér   hungrar.*
     Me.DAT be hungry
     'I am hungry'

When the blocking fails we get a dative subject. The frequency of such failures is correlated with the frequency of evidence in the linguistic environment that is only compatible with the dative rule despite occuring in the context of the accusative rule. TVM predicts that speakers will therefore alternate between accusative and dative even if there are no outside triggers present, such as pragmatic or social variables.

Although we have mentioned pragmatically rooted blocking failures as a potential contributor to the rise of Dative Substitution, we agree with Barðdal (forthcoming-a) that the main reason for the advance of DS in the 19th century and beyond must be the changes in type frequency of items belonging to the semantic classes that underly the patterns. As some of the semantic classes that formed the basis for accusative subjects in Old Icelandic shrunk speakers must have demoted more and more accusative verbs to item-based rules – a change that is still in progress. But does TVM tell us something more about this progression?

An intriguing twist enters the history of Dative Substitution in Icelandic if we ask what should happen next? As the classes that supported accusative subject in Old Icelandic, cf. (24), lose their ability to form the basis for productive rules we should gradually drift towards a system where children do no longer recognize notions such as 'physical discomfort' as relevant units in their language. The system will then be simplified from hierarchies like (40) to (42):

(42) IF [+subject,–agent,+experiencer]
     THEN accusative
     ELSE IF [+subject,–agent,+experiencer]
     THEN dative
     ELSE structural case

Instead of rule competition between accusative and dative rules where the context is different as in the earlier system, the most specific context has now disappeared and all experiencer subjects are covered by the same context. In a linguistic environment where some of the speakers have reached this stage for

some of the accusative classes this predicts that the accusative will, before it vanishes, extend to verbs that previously did only take dative subjects.[10] The child still hears the other speakers use accusatives but instead of interpreting that as a specific semantic class there is now only competition between datives and accusatives in the same context. As it turns out, it seems like some speakers have already reached this level for some accusative classes as illustrated by plenty of examples where verbs that traditionally did only take dative subjects can now also be used with accusative subjects, cf. (43).[11]

(43)   a. ***Mig*** *sýnist það líka.*
       Me.ACC appears it   also
       'To me it also appears to be like that'

     b. *En* ***mig*** ***finnst*** *tóbakið   ógeðslega gott.*
       But me.ACC thinks the.tobacco horribly   good
       'But I think the tobacco is very good'

     c. *Gaavuuuuuð,* ***mig*** *leiðist   óendanlega mikið.*
       Gooood,   me.ACC is bored infinitely   much
       'God, I am infinitely bored!'

     d. ***Mig*** ***líkar*** *litirnir.*
       Me.ACC likes the.colors
       'I like the colors'

This appears to be a very recent development. Such examples can easily be found on the World Wide Web but we are not aware of a single example in earlier written sources. This is not only an interesting development from the point of view of case marking since it also shows clearly that the constraint in (25d), that *-st* verbs can not take accusative subjects, does not hold in the grammar of those speakers. This is consistent with the interpretation that the accusative classes have vanished as special units in the grammar of those speakers but all that remains is a competition between two cases which are defined over the same context, namely experiencer verbs. This extension of the accusative is nevertheless most likely a temporary phenomenon before it disappears but whatever it is

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[10]Strictly speaking, we do not know whether the accusative vanishes, but the dative is more likely to win in this rule competition situation since the evidence that children are exposed to at this stage overwhelmingly favor the dative in this context.

[11]Those examples, and many more, were pointed out to me by Eiríkur Rögnvaldsson (p.c.)

that is happening it is essential that linguists will study this phenomenon carefully – because we clearly have an intriguing syntactic change happening right in front of our eyes.

The case study of DS as stochastic blocking in a system of rule competition is not supposed to be a comment on Icelandic data – however interesting those data may be. The main importance of such a discussion lies in the fact that we now have a systematic way of dealing with competing patterns in syntax, a way that allows us to make sense of data that would otherwise have to be carefully ignored to allow generative theories to do their usual categorical job. One of the mysteries in syntactic variation studies is a situation where two options, A and B, are both "grammatical" according to the native speakers even though A is, according to the same speakers, "more grammatical" than B. Such judgement patterns are no longer a mystery if we assume TVM, they simply reflect the fact that the child encountered more unambiguous evidence of A than she did of B:

(44)   **The "more grammatical" judgement pattern:** If native speaker intuition says that the semantically and functionally equivalent outputs, A and B, are both grammatical, but A is more grammatical than B – without any systematic correlation with external variables (pragmatic, social, etc.) – it means that unambiguous evidence of both the A and B analyses were encountered in language acquisition and unambigous evidence of A was more frequently encountered.

But even if there are signs of the accusative subjects gradually drifting out of existence, this does not mean that they are dead yet! Some of the semantic classes do still form the basis of productive rules as we will see in the following chapter and despite the fact that the general trend has been a gradual retreat of the accusative, "quirky", subjects, they have shown some signs of productivity in the history of Icelandic. Moreover, as we will see, there may be reason to believe that even the per item case assignment has the nature of a narrowly defined rule rather than a list lookup. In §4 we will provide evidence from various independent sources to support the hypothesis that all case assignment is based on productive rules – even if some of those are defined over a context that only captures a few verbs – or perhaps only one.

4 Productivity of Non-Default Case in Icelandic

4.1 Evidence for Productivity

What counts as evidence for productivity? Our definition in (1) assumes that productivity is the same thing as extensibility – and note that **extensible ≠ extended**, which means that a rule can be productive in I-language even if we see little or no conclusive evidence of this in E-language. But let us first consider examples where there is obvious evidence to see. If a language changes in a way where a pattern is extended to items that the pattern did not apply to at an earlier stage we get assistance from prescriptive grammarians to whom change is synonymous with corruption – although this not a very efficient method for finding out about productivity. As Pinker (2000:74) notes:

(45) But a rule of thumb in language is that any so-called corruption that occurs frequently enough for the guardians to notice it will turn out to have been common in the language for a century or more.

Dative Substitution is for example clearly an example of the "dative subject pattern" being productive in Modern Icelandic as noted by purists who use the term "Dative Sickness" for the phenomenon. But it would be rather sad if our only evidence for a grammatical pattern that is being productively extended was if someone told us that it was incorrect language use. Historical productivity can of course also, in principle, be a sign of the "proper" language use spreading out to new items. Our main goal in this chapter will be to explore whether accusative subjects are or have been productive in Icelandic despite their non-default minority pattern status in the grammar. While the productivity of dative arguments in Icelandic has been discussed quite extensively in the literature (e.g. Maling 2002; Barðdal 2008) – accusative subjects are rarely claimed to show signs of productivity.

Productivity of the most productive types of lexical case can be easily established without the need for sophisticated research methodologies. By the most prodctive types of lexical case we are referring to dative experiencer subjects and objects which undergo motion (e.g. Maling 2002:41). Objects which undergo motion are clearly linked to a rule that assigns dative as can be seen by

picking up a loanword from another language with the relevant semantic features. Let us for example borrow the verb *sjúta* 'shoot' from English. In (46) the accusative object can only be interpreted as a man who was shot in the traditional sense but the dative version can only mean that the man himself was the bullet (presumably shot from some kind of a human-shooting cannon) – if the man is the argument that undergoes motion we get dative case.

(46) *Ég   sjútaði   manninn/manninum*
      I   shot   the.man.ACC/DAT
      'I shot the man (traditionally/from a human-shooting cannon)'

In fact, if accusative subjects are mentioned in relation to productivity, it is usually to claim that they are not productive at all. Barðdal (forthcoming-a) claims that even if there are rules that capture the distribution of accusative subjects in Icelandic on the basis that those form semantically coherent classes they are not productive. Furthermore, she suggests that the semantic/thematic vs. quirky/idiosyncratic distinction should be replaced with a productive vs. non-productive distinction and maintains that productivity is not the same thing as having a rule:

(47) I have shown here that accusative case marking of subjects in Icelandic is also thematic in the sense that it targets specific lexical semantic classes of verbs, and hence that the term idiosyncratic is a misnomer in this context, again reflecting the misconception that rules must entail productivity and lack of rules entails lack of productivity.
      Barðdal (forthcoming-a)

This is a surprising opinion for it suggests that the I-language-based 'extensible' notion has been replaced with patterns that are 'extended' in E-language. Having rules that are defined over "lexical semantic classes of verbs" does entail extensibility in exactly those contexts, otherwise there would be no rules. If there is a rule that is defined over a context it follows that a novel item that enters the context can undergo the rule – thereby extending the set of items covered by the rule. If the context is narrowly defined, or for some other reason is not likely to attract new members, that is simply a fact about statistical tendencies in E-language but it has nothing to do with the productive vs. unproductive distinction.

It is unclear why 'extensible' has been abandoned in favor of 'extended' in the above quote. It may have to do with a shift in focus to the historical development of frequencies – but under our view of productivity those are simply the consequences of the rules differing in the scope of the context they capture. The narrowly defined rules are also productive in I-language and this can be brought out using psycholinguistic techniques such as *wug*-tests, where nonce items are presented to speakers and those items have properties that cause the participants to apply a rule even if they have never encountered the item before.

Barðdal (2008:101–118) does actually report such a *wug*-test where she uses nonce verbs with semantic properties that should trigger the most productive non-defaults in the Icelandic case system, dative subjects and dative objects. In this discussion the 'extensible' definition of productivity is clearly being used since the items being introduced are designed in a lab setting and those are not meant to say anything about the likelyhood of such items actually being added to the lexicon. The experiment supports the claim that dative subjects and dative objects are productive in Icelandic since a number of participants used datives according to the semantic predictions.

The status of the dative arguments in Icelandic is proof of the fact that not only the default structural case is productive. But it is interesting to push the idea of productive non-default case a bit further by putting the idea of unproductive quirky case to the test. In (43) we saw examples of the accusative being extended to verbs that only took dative subjects until, as far as we know, very recently. In the following section we will consider in more detail extensions of accusative subjects as observed in natural Icelandic data.

4.2 Evidence from Natural Data

As we suggested in the discussion about (43), repeated as (48) for convenience, examples of accusative extensions can be interpreted as a theoretically predicted kind of a final twitch before the accusative subjects vanish from the Icelandic language – those may indicate that the speakers no longer identify any semantic generalizations for accusative experiencer subjects whose contexts form subsets of the dative context resulting in rule competition between accusatives and datives in the same context. But can we find any evidence that the accusative verb classes that do form relatively coherent semantic clusters have the ability to attract new verbs?

Let us look for signs of living accusative subjects beyond the apparent death rattle exemplified in (48):

(48) a. ***Mig   sýnist*** *það líka.*
      Me.ACC appears it   also
      'To me it also appears to be like that'

  b. *En **mig   finnst** tóbakið   ógeðslega gott.*
     But me.ACC thinks the.tobacco horribly   good
     'But I think the tobacco is very good'

  c. *Gaavuuuuuð, **mig   leiðist** óendanlega mikið.*
     Gooood,   me.ACC is bored infinitely   much
     'God, I am infinitely bored!'

  d. ***Mig   líkar*** *litirnir.*
     Me.ACC likes   the.colors
     'I like the colors'

We can begin that quest by observing that Jónsson and Eythórsson (2008) have already pointed out what appears to be evidence of some sporadic productivity of accusative subjects in the history of Icelandic. The following verbs are claimed to have shown extensions of the accusative subject pattern:

(49) a. *hlakka til* 'look forward to', *kvíða* 'be anxious about' (nom/acc/dat)

  b. *hrylla við* 'be horrified at', *óra fyrir* 'dream of' (17th century?)

  c. *ráma í* 'vaguely recollect' (19th century)

  d. *kenna til* 'feel pain' (modern times)

Some of those may be genuine examples of a productive extension of accuasative subjects but there are various factors that should be taken into account when evaluating such a suggestion. The verbs in (49a) originally take nominative subjects but today they alternate between nominative, accusative and dative case. If they were first extended to the dative before the accusative version occurred we could hypothesize that the accusative version is some form of hypercorrection in response to Dative Substition. Note that the "proper" use of nominative for those verbs is trained in the same prescriptive exercises as the "proper" accusative that alternates with datives.

Jónsson and Eythórsson (2008) claim that the verbs in (49b) first occur in written sources in the 17th century. For *hrylla* this claim does not seem to be consistent with the facts. The dictionary of Old Norse Prose[12] states that there are four examples of the verb in its underlying corpus and the corpus does only extend to the year 1540. The verb *óra* is, just like *hrylla*, a rare lexical item and its apparent absence in the earlier written record may simply be a sampling coincidence. To give an idea of the frequency of those words the corpus on which the Icelandic Frequency Dictionary (Pind et al. 1991) is based contains 100 text samples, each of which contains about 5000 words, and *hrylla* occurs only twice and both of the examples are from the same text. The verb *óra* can be found in three of the texts, with one example in each of those. Since the stylistic nature of the Old Icelandic corpus disfavors experiencer verbs one should be very careful when using absence of examples as evidence of such verbs not having existed at that time.

In the 19th century, examples of *ráma í* 'vaguely recollect' start appearing and this is probably a genuine example of a new accusative verb. The verb is more frequent in the language than those mentioned above and if it would have been a part of the Old Icelandic vocabulary there should probably be some preserved uses in the medieval manuscripts or other written sources up to the the 19th century. The verb *kenna til* in (49d) is sometimes used in the modern language with an accusative subject instead of an original nominative and this may be a genuine extension as well although its credibility is somewhat undermined by the fact that it sounds quite formal and thus the change could be argued to be some kind of an hypercorrection effect under the influence of prescriptive grammar that aims to strengthen the status of the accusative subjects. A possible defense would be that the prescriptive influence should not interfere so much with a verb whose original subject case is nominative but just like in (49a) there might be an intermediate step with datives.

Of the examples in (49), the verb *ráma í* 'vaguely recollect' is probably the most conclusive evidence of prodcutive extensions of the accusative subject pattern. This suggests that verbs with such a meaning could assign accusative to their subjects using a productive rule in the 19th century. The verb *kannast við* 'be familiar with', pointed out to me be Hlíf Árnadóttir (p.c.), is interesting

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[12]The dictionary can be accessed online, cf. http://www.onp.hum.ku.dk/webmenue.htm

from various points of view. Firstly, it has a very similar meaning as (49c), which productively assigned accusative case in the 19th century, secondly, its novel extension to the accusative replaces nominative but not dative as in (49d) but judging from examples of its use in very informal blog and chat language we can practically rule out the "formal hypercorrection" explanation, cf. (50).

(50)   a. *Djöfull **kannast** **mig** **við** hann!*
        Devil   is familiar me.ACC with him!
        'Fuck, I totally know this guy!'

    b. *Ohh þið eruð svo yndislegir, og dí   hvað **mig***
        Ohh you are so wonderful, and Je[sus] how me.ACC
        ***kannast** **við** þessa þýnku!!*
        is familiar with this   hangover!!
        'Ohh you are so wonderful, and Christ, I am familiar with such a hangover!!'

    c. *Heyy **mig**   **kannast** **við** ykkur   í hvaða sóla*
        Hey me.ACC is familiar with you guys in what   school
        eruð þiið
        are   you
        'Hey, I know you guys! What school do you go to?'

    d. *júu **mig**   **kannast** eitthvað **við** þig :P langt síðan*
        yeah me.ACC is familiar somewhat with you :P long   since
        að maður heirt í   þér
        that one   heard from you
        'Yeah, I do kind of know you :P it has been a while since I've heard from you'

Note that the glosses do probably not do justice to the stylistic aspects of the Icelandic original but any native speaker would classify those as very informal. A third interesting aspect is that *kannast við* also violates the *-st* generalization mentioned in (25d) and since this seems to be a semantically based extension of the accusative rather than a collapse of the accusative/dative distinction we can propose that (25d) is probably just a description of some historical remains of a pattern rather than an actual constraint in the modern language.

    In this section we have presented various clues that suggest that a semantically based and productive accusative may not be entirely dead as a rule in

the grammar of Icelandic speakers. To make our claim stronger we will now turn to psycholinguistic experiments in the spirit of Barðdal's (2008:101–118) study – but our study will focus on accusative subjects, which were not tested in Barðdal's experiment.

4.3 Experimental Evidence

To test the productivity of accusative subjects in modern Icelandic a *wug*-test was designed where 19 participants were asked to select subject case for nonce verbs with typical semantic properties of accusative assigning verbs. For each nonce verb a definition was given without mentioning an existing accusative verb, as well as a sentence in which the verb occurred. The sentence was given with subjects in different cases and the format was forced choice so that even if the participants felt that the verb sounded strange they were asked to select the best option if such a verb with such a meaning existed. Control sentences with agentive subjects were included and for those nominative was categorically selected as expected – since non-nominative subjects cannot be agents.

The test included both verbs for which there is a nearly synonymous existing accusative verb and verbs that share semantic properties with other accusative signing verbs without there being any synonymous verb in the language. The results for the first of those two groups of verbs are given in (51). Note that we only show the accusative version of the subjects below. The nominative version of the sentence was given with person agreement but the non-nominative versions had a 3rd person singular verb like other impersonal verbs in the language. Some of the verbs in the experiments did not bear obvious morphological resemblance with Icelandic vocabulary (the *-úrar* verbs) but others did, to some degree. Mixing those is not methodologically ideal but we feel that the pilot study nature of the approach justifies some experimentation with different methods. Note that up until now the literature predicts that as accusative case on subjects is quirky, it is not extensible to new verbs at all.

(51)   Existing nearly synonymous verb

      a. *Mig*   ***núrar*** *nýjan síma*
         Me.ACC wugs new phone
         'I **have a wish** for a new phone' ≈ *langa* 'want'

         nom. 14 • acc. 5 • dat. 0

b. *Mig   **vúrar** pening til að geta keypt síma*
   Me.ACC wugs money to   can buy   phone
   'I **lack** money to be able to buy a phone' ≈ *vanta* 'need'

   nom. 6 • acc. 13 • dat. 0

c. *Mig   **ringlar** þegar ég sé svona flókin   dæmi*
   Me.ACC confuses when I   see such   difficult problems
   'I **become confused** when I see such complicated problems' ≈
   svima 'be dizzy'

   nom. 1 • acc. 18 • dat. 0

In (51) we have verbs that are more or less synonymous with verbs that all maintain accusative subject case in Modern Icelandic although all of them also occur sometimes with a dative variant due to Dative Substitution. The tendency to select nominative in (51a) may have to do with the verb *óska* 'to wish' which takes nominative. Similarly, those who select nominative in (51b) may have the verb *þurfa* 'to need' in mind. Almost all of the speakers select accusative in (51c), possibly because the semantically similar *svima* 'be dizzy' is a member of the 'physical discomfort' class which still has a number of members that share semantic features and take accusative subjects, cf. (26). Those examples show that speakers may select accusative case for a novel verb if a nearly synonymous accusative verb exists in the language.

The other part of the study involved coming up with nonce verbs that did not correspond to existing verbs but would nevertheless be captured by some kind of a rule that assigns accusative case. Since this part of the study is even more pilot-study-like it was not obvious how to design the verbs. The methodology that we decided to use was simply to ask our own linguistic competence to come up with a creative solution – more specifically we sat down and made up a list of words that according to our own intuitions should (or at least could) take accusative subjects. There remains no doubt that a more systematic approach would be more feasible but hopefully this study is a step towards an understanding of those phenomena which in turn may support better designs of future studies. The results for *wug*-verbs for which no synonymous verb exists are shown in (52).

(52) No existing synonymous verb

    a. *Mig   **kjaftstyppir** þegar fólk   talar svona illa um mig*
       Me.ACC mouthstops when people speak so   bad of me
       'I **am at a loss for words** when people speak so badly of me'

       nom. 2 ● acc. 16 ● dat. 1

    b. *Mig   **exerar**   þegar einhver gefur mér*
       Me.ACC experiences ecstasy when someone gives me
       hugulsama gjöf
       thoughtful   present'
       'I **experience ecstasy** when someone gives me a thoughtful
       present'

       nom. 10 ● acc. 8 ● dat. 1

    c. *Mig   **bjartsýnir**   þegar vinir   mínir hvetja*
       Me.ACC becomes optimistic when friends my   encourage
       mig áfram.
       me   forward.
       'I become optimistic when my friend encourage me'

       nom. 3 ● acc. 12 ● dat. 2 ● (two participants did not answer)

The verbs used could be described as referring to the experience of reaching some kind of a cognitive or physical state without having much control over what is happening. The first verb denotes negative experience whereas the second two denote positive experiences. This is not very far from the notions of 'physical discomfort' or 'cognitive states' sometimes used to account for the semantics of accusative verbs. For all of the verbs some of the participants select accusative but to varying degrees.[13]

    It is interesting to see that (52b,c) are accepted as possible accusative verbs by a number of speakers even if it has been claimed that verbs of strong positive feelings can only be nominative, cf. (25e). The effect that such verbs do not generally take non-nominative subjects can still be claimed to play a role in the judgments because nominative is much more often selected with (52b), which denotes a stronger positive feeling than (52c). We can interpret this by

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[13]One more verb in the negative experience class was tested but it was removed from th results because the example was flawed (it was frequently rejected by participants for for unrelated morphological reasons).

saying that there may not be a categorical constraint against non-nominative subjects with verbs that denote strong positive feelings but the distribution of the vocabulary happens to make such usage unusual and less acceptable.

Together with the natural data presented in the previous section the evidence presented here supports the claim that quirky case assignments such as accusative subjects are still productive in I-language for at least some speakers and some semantic contexts even if the pattern has been losing ground. *Wug*-tests of the sort that have previously confirmed the productivity of dative subjects and objects (Barðdal 2008:101–118) can also be applied to accusative subjects. More research is obviously needed to determine the nature of this productivity and to tease out the relevant semantic features in more detail.

The partial regularity of the semantics of accusative assigning verbs made Jónsson and Eythórsson (2008) choose the label "structured exceptions" for such semantic sets that can still be identified in the vocabulary of Modern Icelandic. They contrast such structured exceptions, which they relate to evidence of rules that are semi-productive in a historical sense, cf. (49), with genitive objects that are claimed to be "completely unproductive". In the following section we will see if our "all rules" theory of case can survive an encounter with genitive objects.

4.4 Analogy or a Narrowly Defined Rule?

We must admit that gentive objects in Icelandic are a very plausible counterexample to the claim that all case assignment is based on prodcutive rules. But we nevertheless believe that it may teach us something to ask if a pattern that appears to be genuinely tied to a single lexical item can be productive in some sense – and perhaps more importantly – if it can improve our understanding of the nature of the difference between a rule and a list lookup.

In §3 we presented our objections to a fundemental idea in the Words and Rules model (Pinker 2000). WAR states that the default pattern is generated by a rule but other patterns are retrieved from memory on a per item basis. Pinker discusses various psychological experiments that do support the idea that there is in fact a difference in nature betweeen rule application and memory retrieval. Our objection is not against the proposal that rules and memory lookups are different – we are only against the idea that only the default is generated by a rule. This brings us to the question: What is the difference between a rule and a

list lookup? We can propose a formal description of this difference:

(53)   A list lookup refers to a single item whereas a rule refers to some properties of an item. Any item that has the properties the rule refers to is captured by the rule.

Let us now imagine a possible implementation of how the Icelandic verb *sakna* 'to miss', which takes a genitive object, might be stored in the brain:

(54)   ID: 1024
Sound: /sakna/
Meaning: 'miss'

Now it is easy to imagine different implementations of operations that assign genitive to the object of the verb, one which is a list lookup (55) and one which is a rule (56) – according to our definition.

(55)   IF verb #1024
THEN genitive

(56)   IF (Sound=/sakna/) AND/OR (Meaning='miss')
THEN genitive

The rules are not merely different ways of saying the same thing because they make different predictions. The list lookup predicts that the irregularity associated with the verb will never extend to other verbs whereas the rule predicts that the irregularity may be extended to synonymous verbs or compound verbs that share their head with the verb. In the *wug*-test presented in the previous section we included two verbs that are nearly synonymous with *sakna* 'miss' and *gæta* 'take care of', both of which take genitive objects in Modern Icelandic, cf. (57). As in the case of the accusative verbs, a definition of the verbs was provided to the participants without mentioning the synonymous verb.

(57)   a. *Ég **gúra** hennar hræðilega síðan hún dó.*
I   wug   her.GEN terribly   since she died.
'I have **missed** her terribly since she died'

acc. 13 • dat. 0 • gen. 5 • (two participants did not answer)

   b. *Ég **fúra** hennar   meðan mamma hennar er í   vinnunni.*
     I   wug her.GEN while   mother her   is in work
     'I **take care of** her while her mother is working'

     acc. 17 • dat. 1 • gen. 1

Admittedly, the results do not indicate that semantically based extensions of genitive objects are as robust as the accusative extensions in the previous section. Still, we should not ignore the fact that five speakers actually did select genitive as the object case for the verb that is nearly synonymous with *sakna*. We should also note that the genitive extension may be undermined by the fact that the verbs *syrgja* 'mourn' and *passa* 'babysit' are also nearly synonymous with those verbs and they take accusative objects. It is possible that most of the participants interpreted the *wug*-verbs as more similar to the accusative object verbs than the ones that take genitive objects, or, given the choice between the alternatives opted for the less marked structural case.

To test the distinction between a rule and a list lookup under the definition we are using we can also use another method, which is to create compound verbs that share their head with an existing genitive object verb. In that case there is no chance of accidentally misinterpreting the properties the rule refers to as something else. Let us for example invent the verb *aftursakna* 'refer to' (literally 'backmiss'). This verb must take a genitive object, cf. (58).

(58)   *Fornafnið   aftursaknar frumlagsins/*frumlagið*
       The.pronoun backmisses the.subject.GEN/*ACC
       'The pronoun refers to the subject'

As it turns out, irregularities that are associated with lexical items in the world's languages are systematically distributed between list lookups and rules in the sense of (55) and (56). Case assignment of verbs, at least in Icelandic, is clearly based on a rule if we assume such a distinction, whereas the irregular plural in English is an example of a list lookup where the irregularity is lost when the noun becomes a part of a larger unit, cf. (59).

(59)   *We met two Mickey **Mouses/*Mice** in Disney World*

We might ask why the grammar uses those two different mechanisms to refer to irregularities that are associated with a single lexical item? It may have to do

with a distinction between systems where there are some useful generalizations to be captured by rules which vary in the specificness of the context they capture – and others where no optimization at all comes from constructing a system of rules beyond the default rule. A child acquiring Icelandic will soon figure out that it is useful to organize case assignment by employing a rule-based strategy – and then she will simply go for the most general generalization available for any pattern she comes across – its availablity being limited by some optimization strategy like the tolerance threshold proposed in TVM, cf. (36). A child acquiring the English plural will never come across a useful rule other than the default "add -s" and in such a case she will assume the Words and Rules hypothesis, that only the default is generated by a productive rule. But the mechanism the Icelandic speaker uses to figure out what case to assign to an argument must necessarily refer to something more general than an index number such as #1024 – or whatever the kind of a memory pointer the brain uses to access entries in the lexicon, otherwise the irregularity would not be preserved in compounds and *wug*-tests.

5   Conclusion

The so-called lexical case in Icelandic provides us with interesting data to study the nature of productive non-defaults in natural language. Some of the non-defaults, like dative objects, have been shown to be particularly productive despite accusative being the default object case in the language. In this paper we have pursued a somewhat radical extension of the idea that non-defaults can be productive in argument structure by proposing that all case marking is based on productive rules.

To explain our theory of an entirely rule based case assignment system we have proposed an analysis that takes advantage of the Variational Model of language acquisition (Yang 2002). This approach has provided us with explanations of the various levels of productivity present in the Icelandic case system and the amount of exceptions that are tolerated before they derail a productive rule. We have explained the substantial amount of intra-speaker variation regarding the so-called Dative Substitution as a manifestation of stochastic blocking.

To support the idea that all case marking is based on productive rules we have presented evidence from natural data as well as from psycholinguistic experiments. Extensions of the accusative to verbs whose subjects traditionally are nominative or dative have been described as (i) relatively chaotic extensions to the dative experiencer subject class for speakers who do not recognize any useful semantic generalizations for the accusative, cf. (43), and (ii) semantically based extensions for verbs that bear resemblance with the accusative verbs that still form semantic clusters in Modern Icelandic, cf. (50) and §4.3.

The question whether a child has the ability to recognize complicated semantic classes like the 'experience of physical discomfort'-class demands further research but we have argued that semantic notions that are important at a general cognitive level might be favored by Universal Grammar, thus giving the child clues for where to look. We propose that what seems to be some kind of an arbitrary set of semantic features may in fact be expected to have relevance in syntax.

Productivity is, in our view, gradient in language and in grammar in general but categorical at the level of a particular context in which a rule applies. The tolerance threshold for exceptions proposed in the Variational Model opens up the possibility to develop a theory of productivity that is categorical at such a level while sticking to precise proposals that can be falsified and systematically pushed further towards the truth. For cognitive science it is this kind of an approach that must be pursued to avoid drifting towards a field full of theories which are vague and difficult to falsify, however plausible they may sound. If such frameworks are assumed it is possible to go after strong hypotheses – such as the "all productive rules" theory we have proposed here – in the kind of a systematic way that is feasible in an empircal science.

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