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Experimental investigations of weak definite and weak indefinite noun phrases

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Abstract

Definite noun phrases typically refer to entities that are uniquely identifiable in the speaker and addressee's common ground. Some definite noun phrases (e.g. *the hospital* in *Mary had to go the hospital and John did too*) seem to violate this uniqueness constraint. We report six experiments that were motivated by the hypothesis that these "weak definite" interpretations arise in "incorporated" constructions. Experiments 1-3 compared nouns that seem to allow for a weak definite interpretation (e.g. *hospital, bank, bus, radio*) with those that do not (e.g. *farm, concert, car, book*). Experiments 1 and 2 used an instruction-following task and picture-judgment task, respectively, to demonstrate that a weak definite need not uniquely refer. In Experiment 3 participants imagined scenarios described by sentences such as *The Federal Express driver had to go to the hospital/farm*. The imagined scenarios following weak definite noun phrases were more likely to include conventional activities associated with the object, whereas following regular nouns, participants were more likely to imagine scenarios that included typical activities associated with the subject; similar effects were observed with weak *indefinites*. Experiment 4 found that object-related activities were reduced when the same subject and object were used with a verb that does not license weak definite interpretations. In Experiment 5, a science fiction story introduced an artificial lexicon for novel concepts. Novel nouns that shared conceptual properties with English weak definite nouns were more likely to allow weak reference in a judgment task. Experiment 6 demonstrated that familiarity for definite articles and anti-familiarity for indefinite articles applies to the activity associated with the noun, consistent with predictions made by the incorporation analysis.

Keywords

Psycholinguistics; experimental pragmatics; weak definites; weak reference; semantics

Definite reference has played a central role both in formal models of discourse and reference (e.g. Abbott, 2008; Gundel, Hedber & Zacharski, 1993; Heim, 1982; Roberts, 2003) and in psychological models of reference generation and comprehension (e.g. Clark & Marshall, 1978; 1981). Definite reference has also provided an important testing ground for understanding how speakers and listeners generate and interpret referring expressions in real-time language processing (Brown-Schmidt & Tanenhaus, 2008; Chambers, Tanenhaus, Eberhard, Filip & Carlson, 2002; Eberhard, Spivey-Knowlton, Sedivy & Tanenhaus, 1995;

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Fukumura, Van Gompel, Pickering & Harley, 2011; Gorman, Gegg-Harrison, Marsh & Tanenhaus, 2012; Heller, Gorman & Tanenhaus, 2012; Wu & Keysar, 2007).

To a first approximation, the referent of a definite noun phrase is assumed to be uniquely describable in the relevant referential domain of the discourse; for our purposes this domain can be construed as the common ground of the speaker and listener (Clark & Marshall, 1981; Stalnaker, 1979). For example, in the presence of two (or more) remote controls, a speaker cannot felicitously ask her addressee to *grab the remote*, unless one of them has been established as the uniquely identifiable referent, e.g. by a concurrent deictic gesture or by prior reference. While more developed notions such as “informational uniqueness” (Kadmon 1990; Roberts, 2003) are ultimately required to fully characterize the contribution of definiteness in semantics, for the purposes of this paper the intuitive notion of unique identifiability will be sufficient.¹

There are, however, some common definite noun phrases, such as *the hospital* in (1) below, that seem to violate these uniqueness constraints (Barker, 2005; Birner & Ward, 1994; Carlson & Sussman, 2005; Carlson, Sussman, Klein & Tanenhaus, 2006). Following Poesio (1994); we will refer to these as *weak definite noun phrases*, or *weak definites*.

Consider the following dialogue:

(1) Sarah: Where did they take the hurricane victims?

Otto: To an arena/to the arena/to the hospital.

Sarah: Which one?

Otto: I don't know.

Otto's answer, *I don't know*, is felicitous in response to Sarah's question when the antecedent of *one* is introduced by an indefinite article, as in *an arena*. It is not felicitous when the antecedent is introduced by the definite article *the arena*; in this case Otto's use of a definite noun phrase suggests that he is referring to a particular arena that has already been established as a part of the interlocutors' common ground. However, the same answer, *I don't know*, which seems an odd response following a typical definite like *the arena*, is natural when the antecedent is instead *the hospital*. The intuition is that despite having the form of a definite noun phrase, *the hospital* need not introduce or refer to a uniquely identifiable referent, though, of course, this standard referential reading may also be available.

In this paper, we use judgment data from behavioral experiments to explore some of the properties of weak definite noun phrases. We assume that weak definites arise as a result of an incorporated construction in which e.g. “hospital” occurs as part, and which is interpreted as an event of being in, or coming to be in one (i.e. hospital) for purposes of receiving medical care—the canonical purpose of a hospital stay. We examine four questions that arise from this incorporation framework:

1. Does behavioral evidence confirm the intuition that weak definite noun phrases do not uniquely refer, and if so, do the same nouns exhibit similar properties when paired with *indefinite* articles?

¹For example, if someone asks, “Is this the train to Newcastle?”, the purpose in asking is to find out which train in the context satisfies the description; obviously the speaker is unable to “identify” the train despite the use of the definite description.

2. As suggested by the incorporation framework, does a weak definite noun phrase evoke an event (e.g. hospital-visiting, bus-riding, radio-listening), and if so, is that also the case for the same noun phrase with an indefinite article?
3. Are there conceptual factors that play a role in promoting weak definite interpretations?
4. What, if anything, does the definite article contribute to the interpretation of a weakly referential noun phrase?

Weak definites: additional properties and a possible analysis

Examples of similar definite noun phrases that do not uniquely refer have been identified in a wide variety of languages other than English, including Germanic, Romance, and Celtic languages, and certainly more broadly than that, including possibly in languages such as Korean and Russian that have no definite articles (Lee, 2012). In English, weak definite readings appear to be restricted to specific nouns. For example in (2a) below, although *radio* allows a weak interpretation in a definite noun phrase, this is not necessarily true of related nouns like *record* in example (2b):

- (2) a. Benedict listened to the radio, and Tracy did too.
- b. Benedict listened to the record, and Tracy did too.

Example (2a) allows a weak interpretation in which Benedict and Tracy listened to different radios, but (2b) does not. While it seems plausible for Tracy to have listened to a different copy of the same record (i.e. a different token of the same album), it is not consistent with the sentence for Tracy to have listened to a record with different content; if Benedict had been listening to some recording of *Blood on the Tracks*, Tracy could not have been listening to *Modern Times*.

Although weak definite interpretations in English are lexically restricted, the noun is not the sole determinant of a weak interpretation. Restrictive modification, as with the adjective in (3), typically forces a regular definite interpretation:

- (3) Benedict listened to the new radio and Tracy did too.

Modifying *radio* with *new* emphasizes one property of a referent, which sets this radio apart from other possible radios. Thus the modified phrase supports only a typical definite interpretation. Weak definites are further restricted by the need to co-occur with, or be “governed by,” certain other lexical items, such as verbs and prepositions. For example, *look at the radio* or *park near the hospital* do not have weak readings despite the fact that the noun (*radio, hospital*) under other circumstances allows a weak reading.

The lexical restrictions and co-occurrence sensitivity of weak definite noun phrases raises the possibility that they are idioms, where a closed set of words and phrases lead to a richer meaning than their literal components would suggest. While we take “idioms” to be a part of a gradient class of collocations (Nunberg, Sag & Wasow, 1994; see also Goldberg, 1995), weak definites do not share all the characteristics of those collocations most commonly referred to as idiomatic. Like idioms, the particular identity of the noun is critical to accessing the enriched meaning. Unlike idioms, however, the noun’s regular meaning contributes to the whole: there is some hospital involved in (1) and some radio in (2), whereas for an idiom like *let the cat out of the bag*, there is neither a cat nor a bag involved. Furthermore, unlike idioms, synonymous contextual words in weak definite phrases often can be interchanged while preserving the enriched and non-unique interpretation, as in Example (4), where *took the bus*, *rode the bus* and *caught the bus* all allow weak interpretations. In contrast, this is not typically true for idioms, as is illustrated in Example

(5). The idiomatic interpretation of *bit the bullet* is not available for the related verbs *nibbled* and *chewed*.

(4) Jed took/rode/caught the bus.

(5) Roxy bit/nibbled/chewed the bullet.

Finally, although weak reference is incompatible with restrictive modification, weak definites can have certain types of modifiers in them nonetheless, unlike most idioms (Aguilar-Guevera & Schulpen, 2012).

While the availability of weak definite interpretations appears to be lexically governed in English, there are also some conceptual properties that seem to influence whether a specific noun is more or less likely to have a weak definite reading. Notable patterns seem to emerge when we consider the kinds of nouns that appear in weakly referential definite noun phrases; these nouns fall almost exclusively into one of several categories:

Mass transportation: e.g. bus, train, subway (but not airplane)

Mass communication: e.g. radio, newspaper, news, calendar, phone (but not book)

Service destination: e.g. hospital, doctor, movies, store, bank, bathroom (but not stadium)

Chore/routine/hobby nouns: e.g. dog, piano, dishes, trash, lawn (but not exercise)

Body and building parts: e.g. knee, eye, window, stairs, wall (but not bone)

This categorical overlap suggests that weak definites may share common conceptual features that contribute to their exceptional interpretations. For instance, the mass communication nouns that can support weak definite interpretations are objects that are used to facilitate the flow of current information. *Talking on the phone* has much more to do with having a conversation than using a particular piece of equipment, and phones themselves are relatively interchangeable as long as the parties on each end of the line are the same. By contrast, a book is reliant on the fixed content that has been published. Picking up either *Infinite Jest* or *Middlemarch* may both involve *reading*, but the experience will be quite different.

Weak definites have some of the same properties as scripts, which involve conventional activities (Shank & Abelson, 1977). However, some noun phrases that evoke scripts, such as *the restaurant* in ... *went to the restaurant* do not allow for a weak definite interpretation. Nonetheless, like scripts, nouns that allow for weak definite interpretations overwhelmingly tend to invoke conventional activities (also see Barker, 2005).

If a verb preceding a weak noun describes an action or event that differs from the conventional activity associated with that noun, then only a regular, referential interpretation seems to be available. This is illustrated in the example (6b), which contrasts with the example in (2a), repeated here as (6a).

(6) a. Benedict listened to the radio and Tracy did too

b. Benedict examined the radio and Tracy did too.

In the example in (6a), a typical radio-listening event is described, and a weak interpretation is licensed—radios are conventionally designed to be listened to in a way they are not designed to be examined. So in Example (6b), where there is no weak reading, intuition suggests that Benedict and Tracy must be examining the same radio.

In sum, it would seem that some noun phrases, in addition to having a standard interpretation, have an interpretation available that appears to violate the uniqueness presuppositions characteristic of typical definites. These weak definites are lexically restricted, at least in English; however, they appear to be distinct from idioms, because the weak definite interpretation can occur with a variety of verbs. Conceptual factors also seem to play a role in determining which nouns can have a weak definite reading, and in what context: the event described must be conventional and not reliant on the idiosyncrasies of a particular referential token in order for a definite NP to lack uniqueness presuppositions.

At present there is not a consensus linguistic analysis that accounts for the presence of the definite article in weak definite constructions. One solution is to treat the definite article as a syntactic marker, without semantic import. Vergnaud and Zubizarreta (1992) and Longobardi (1994) provide some precedent for this approach. Some support for this view comes from the fact that weak definites often lexically alternate with a “bare singular” construction in English (Dayal, 2011a; Stvan, 1998), yet the two constructions seem to mean almost exactly the same thing. For example, to be *in jail* without the article means almost the same thing as to be *in the slammer*, which has the definite article (and is more colloquial); neither phrase requires unique reference and both are used almost exclusively to describe convicts serving time, not simply people visiting or working in a prison. Moreover, whether a weak definite or a bare singular is used sometimes differs across dialects. In American English, to be *in the hospital* has the same meaning as the British English, to be *in hospital*. And for many speakers, the weak reading of *on the television/radio/stage* has the same meaning as to be *on television/radio/stage*. These observations are consistent with the hypothesis that the definite article contributes nothing to the meaning, being a pleonastic element inserted for purely grammatical purposes. A second alternative, pursued by Aguilar-Guevara and colleagues (Aguilar-Guevara & Zwarts, 2010), is that the weak definite noun phrase is a generic, denoting a kind of thing and not an individual.

A third alternative which will provide the framework for our work is that weak definites are “incorporated” structures. Incorporation is a process found in many languages whereby two words in a phrasal grammatical relationship are fused to form a unit that has the status of a word (Baker, 1988; 1996; Mithun, 1984; see also Massam, 2001). The most detailed studies have concerned verbs forming incorporated units with their objects and other arguments (“noun-incorporation”), but prepositions may form units with their objects as well. In incorporated structures no articles appear; only the bare nominal form of the object is expressed. The semantics of noun-incorporation is fairly well described (Chung & Ladusaw, 2004; Dayal, 1999; 2011b; Farkas & de Swart, 2004; Mathieu, 2006; van Geenhoven, 1998). There is general agreement that incorporated structures have the truth-conditional semantics of narrow-scope and usually number-neutral indefinites (being neither singular nor plural). There is also some precedent for attributing the semantics of incorporation to structures that do not create word units, as in “pseudo-incorporation” (Dayal, 2011b; Massam, 2001) or in forms that appear similar to weak definites (Mathieu, 2006).

An incorporation framework that likens weak definite constructions to incorporated structures suggests an explanation for properties that appear characteristic of weak definites.² Many grammarians have emphasized the implied “habituality” of the action expressed by an incorporated form (i.e., it is something of a type one usually does in the normal course of things); many also note that numerous incorporated forms give rise to what we will refer to as *semantic enrichment* or an *enriched interpretation*. The term semantic enrichment as we use it is inspired by Levinson’s (2000) use of the term “pragmatic enrichment” to describe

²Although it is rare, weak definite reference can occur in subject position in constrained contexts (e.g., *The hospital is a place to go if you’re sick*). We set aside these cases, which we acknowledge cannot be accounted for with an incorporation analysis.

similar phenomena. However, we do not adopt Levinson's term since it has Gricean overtones we do not intend, and we believe for the case of weak definites that our term is the more accurate. In particular, we do not wish to imply that semantic enrichment creates "extra," more complex meanings of weak definites that arise from online computations associated with a semantic or pragmatic process. Rather, a semantically enriched interpretation can be viewed as a *construction* property, in the sense of Goldberg (1995), and for our purposes, helps characterize differences between the conventional meanings of the weak versus regular definites. We note that a frame analysis would be a related alternative (Zwarts, 2012).

Consider the following example of incorporation. To "kill reindeer" in Chukchee (Dunn, 1999) means what one expects, but the fused, incorporated form roughly equivalent to "reindeer-kill" means that one is killing reindeer as a part of food preparation, which is the most common purpose for killing the reindeer in that culture. While English does not have incorporation in the formal morphological sense, we believe all of the described semantic characteristics attributed to incorporated forms are also attributable to weak definites. In other words, there is a reason to think that weak definites (and corresponding bare singulars) are interpreted as if they are incorporated structures. This means that their key lexical items appear as constituents of the calculated meaning. For instance, *take the train* on its weak reading has *train+take* as a part of its meaning, which is interpreted as one would an incorporated form.

An incorporation analysis also provides a potential explanation for why the definite article does not seem to make its customary contribution in these constructions. In particular, the semantic composition does not correspond to the surface syntactic composition. Consider a few examples. If we represent the meaning of the definite article as DEF and lexical items as their primed counterparts, a regular definite (e.g. "read the book") would to a first approximation have a syntax roughly like:

$$[vpread [NP [A_{\pi}the] [Nbook]]]$$

and be interpreted as follows:

$$read' (DEF (book')) .$$

In contrast, a weak definite such as that occurring in the weak reading of "read the newspaper" would have a similar syntax,

$$[vpread [NP [A_{\pi}the] [Nnewspaper]]]$$

but a different compositional structure:

$$DEF(read' (newspaper'))$$

This compositional structure appears unusual, but it has several promising properties that capture salient features of weak definites. First, the noun phrase is no longer semantically definite; rather, the noun "newspaper" is combined directly with the verb, as it is in incorporation structures in languages where the combination of N and V is overt in the syntax/morphology. As mentioned earlier, the characteristic semantics of the object is that of a narrow-scope weak indefinite. And, to a first approximation, this is an appropriate

description of the truth-conditions of weak definites in English. This kind of interpretation causes difficulties for any analysis in which the definite is associated with the noun phrase, but follows naturally from our presumed analysis.

Second, since the V (or, the P in such cases as “(be) in the hospital”) and the N form a constituent by themselves without intervening material, the dependency between them is more transparently stated than in a theory in which extra material is included. In English, in particular, it expresses the requirement that the two items must be adjacent. Finally, whereas the definiteness is not associated with the NP, it *is* associated with the V-N (or P-N) combination. In this case, it expresses something like a “familiar” type of activity, one whose cultural currency is independently established and encoded in the grammar in this way. This notion of “familiarity” is a commonly noted feature of incorporation in many languages. This does not mean, of course, that just any activity that is familiar to a given individual, or even large groups of individuals, is necessarily going to be expressed this way; instead, the language will encode some such familiar activities this way and it is only partially predictable which ones will be selected. We conceive of these structures as an example of name creation—in this case the “naming” of “familiar” activities. This approach provides us with at the beginnings of a principled approach for understanding why the definite article may appear in some instances (“(be) in the slammer”) but not in others ((be) “in jail”), as with proper names. (See Schwarz (2012) for a detailed working out of something very close to this hypothesis.)

This analysis also suggests the possibility that the indefinite article (e.g. “a/an”) might play a similar role, with the incorporated structure in its scope, resulting in a possible class of weak *indefinites*. Weak indefinites have not to the best of our knowledge been commented on in the linguistics literature. However, this is not surprising. Whereas weak definites differ from standard definite noun phrases in that they need not uniquely refer, weak indefinites would be similar to other indefinite noun phrases in most semantic respects.

Experimental investigations of weak definites and indefinites

We now turn to an experimental investigation of weak definites. In our experiments we use judgment data in a series of behavioral experiments to systematically explore hypotheses about the properties of weak definites that we outlined above. Experiment 1 used an instruction following task to provide behavioral evidence that confirmed the intuition weak definite noun phrases do not share the uniqueness constraint associated with regular definite noun phrases. Experiment 2 introduced a sentence verification task to compare regular and weak definites with indefinite counterparts.

Experiments 3 and 4 focused on semantic enrichment. Experiment 3a asked whether a weak definite noun phrase is more likely to evoke an event involving the noun-type (e.g. hospital-visiting, bus-riding, radio-listening) than a regular noun phrase (i.e. whether weak definites exhibit semantic enrichment). Experiment 3b asked the same question for weak and regular indefinite noun phrases. Experiment 4 manipulated the verb that preceded a definite noun phrase to ask whether enriched interpretations were reduced when the verb does not license a weak definite interpretation.

Experiment 5 explored the hypothesis that there are certain conceptual properties that help determine whether a weak definite interpretation is likely to be available for lexicalized concept. We introduced novel lexical items in science fiction contexts, which we predict will or will not be likely to induce a weak definite interpretation.

Experiment 6 tested the hypothesis that weak indefinites would be interpreted as referring to less familiar events than weak definites. This provides a preliminary assessment of whether the definite article does, in fact, contribute to the meaning of a weak definite noun phrase.

Experiment 1

Experiment 1 examines whether weak definites carry the same uniqueness constraints as regular definite NPs. If so, we expect that in a situation where a particular referent matching the description has previously been introduced into the discourse, listeners should interpret the definite NP as referring to that object; if, on the other hand, weak definites do not refer uniquely, then listeners should be willing to interpret a weak definite NP as referring to another object matching the description that has not been previously introduced. We created situations in which we can infer participants' interpretations by asking them to act out scenarios by moving magnetic pictures around on a metal board.

Method

Participants: Eighteen members of the University of Rochester community participated in the experiment for pay. Participants all had normal or corrected-to-normal vision and were native speakers of American English.

Design and Materials: Participants listened to scenarios containing both a first and second mention of either a weak definite or regular definite noun phrase, as in (7):

(7) Rudy is a very literary guy. Today he wrote in his diary.

Then, Rudy read the newspaper/book.

This afternoon, Patty read the newspaper/book too.

Twelve nouns with weak definite readings (e.g. *newspaper*) and readily depicted referents were chosen from examples in the literature. For each weak definite noun, a similar noun without a weak definite interpretation (e.g. *book*) was chosen as its regular definite match; twelve scenarios like those in (7) were created so that the critical noun could either be a weak definite noun, or a matched regular definite. A full list of stimuli is presented in Appendix A.

Scenarios were pre-recorded with a naïve male speaker who was instructed to maintain a naturalistic and non-contrastive prosody. The first part of each scenario referred to a distracter object in the visual display (e.g. *diary* in Example (7)); the second part referred to the critical noun using a definite noun phrase; the third repeated that critical definite noun phrase. Participants were instructed to act out the narrated scenario as it unfolded by using magnetic images on the metal board. Each part of the scenario was recorded as a separate sound file so that the experimenter could wait until the participant had completed an action before playing the next part of the scenario. To avoid influence, the experimenter was seated at a computer facing away from the participant and was watching the participant's actions over a camera feed. Two randomized lists of scenarios and a reverse-order (backwards) version of each were created for a total of four lists of items. Each list contained four fillers and 12 critical scenarios, half involving weak definites and half involving regular definite control trials.

Following work by Brown-Schmidt & Tanenhaus (2006; 2008), which demonstrated that listeners assume that areas with visual boundaries are distinct referential domains, we created two implicit domains on our magnet boards by painting each half a different color. Each referential domain contained magnets with images of a person (a male on one side, and a female on the other), a non-identical token of a distracter object, and a non-identical token

of the critical noun. For example, each character might have a different newspaper or book. Without this domain restriction, the task would have strongly favored the regular definite interpretation: nearly any noun phrase that can be interpreted as a weak definite can also be interpreted as a regular definite, and pilot results suggested that participants would have a strong bias to select and manipulate an object they had previously moved. Figure 1 shows a schematic version of the setup of the magnets and metal board.

Our domain restriction design manipulation proved to be very strong; in pilot work, we found that participants were reluctant to cross domains by moving an object from, for example, the yellow side of the magnet board to the green side of the board. Therefore, we included some fillers that required objects to cross domains, such as a filler that referred to each person playing *the game*, where only one *game* token was present on the entire metal board. This allowed us to implicitly indicate to participants that the magnetic characters and items were not bound to one particular color domain on the board. One filler used a weak definite to refer to an item that only had one token present in the scene and another used a regular definite in the same way; this ensured that the presence of only one token of an object in the display did not systematically correlate with our experimental manipulation. The remaining two fillers referred unambiguously to items present in the visual scene without the use of a definite noun phrase.

Procedure: Participants were instructed to use the magnets to act out the narratives as they heard them. They were given three practice trials at the beginning of the experiment, and if they had no questions afterward, the experiment began immediately. Sessions were video recorded, so that subjects' actions could be coded and analyzed later.

Results and Discussion—In 73 percent of the trials with weak definite noun phrases, participants selected the *new* token as the final referent, which corresponds to a non-unique interpretation of the definite phrase. In contrast, participants selected the *new* token only 34 percent of the time with regular definite noun phrases. We used a mixed-effects linear regression model with subject and item as random effects to predict whether participants would choose the *new* token or the previously selected referent based on the type of noun phrase, and found that participants were significantly more likely to choose the *new* token for scenarios containing weak definites ($\beta = 1.97$, $SE = 0.39$, $p < 0.0001$).

Our results confirm the predicted difference between weak and regular definite noun phrases. By choosing the *new* token for weak definite noun phrases, participants indicated that they did not interpret the weak definite as requiring a unique referent. Instead, it seemed that participants preferred to replicate the event-type (e.g. doing newspaper-reading with whichever newspaper was present in the character's domain) rather than selecting one unique token to use throughout the enactment of the scenario (e.g. consistently manipulating a particular one of the two newspaper magnets). It was surprising, however, that participants selected the *new* token as frequently as they did for the regular definite noun phrases. The most likely explanation for the relatively high proportion of *new* tokens selected for regular definites is that the implicit domain restriction we created using the colored backgrounds was extremely effective; it discouraged our participants from crossing domains despite our efforts to encourage them to do so with our use of fillers. In post-experimental briefings, many participants reported that they felt hesitant to cross domains, even on those filler trials that left them with no other choice. Overall then, our results are consistent with the hypothesis that weak definites do not require a unique referent.

Experiment 2

Experiment 2 examines the referential properties of weak definites using a task that does not depend on domain restriction. In a series of scene-verification judgments, participants were asked to rate the naturalness of a description for a picture that contained either two people involved in the same event with the same object (e.g. two characters riding a single bus) or two people involved in different events with distinct objects (e.g. two characters riding two different buses); we call these one- and two-token scenes, respectively. If weak definite noun phrases do not refer uniquely, two-token scenes should be judged to be more natural when paired with a description containing a weak definite than when paired with a description containing a regular definite. One-token scenes were included to rule out the possibility that effects were simply due to the plausibility or familiarity of the events (bus-riding versus bicycle-riding) and how they were depicted. We also compared the ratings of descriptions containing matched (singular) indefinites with those of descriptions containing regular and weak (singular) definites in a first attempt to tease apart the role that the definite and indefinite article might play in constructions that allow weak definite interpretations.

Method

Participants: Thirty-three members of the University of Rochester community participated in this study for pay. All were native speakers of American English with normal or corrected-to-normal vision. Two participants were excluded from analysis for reversing the seven-point ratings scale, as determined by their responses to the filler items.

Design and Materials: Experiment 2 used a 2×2×2 design, crossing the number of tokens depicted in the scene (one or two) with the type of article (definite or indefinite) and with the type of noun (regular or weak). We will call the condition where a weak noun is expressed with the indefinite article a “weak indefinite.” Descriptions were constructed using a conjoined noun phrase subject, as in (8) below:

(8) Dean and Anne rode a/the bike/bus.

The conjoined noun phrase was used in order to emphasize the simultaneity of the described activities, so that participants would not be confused by seeing both characters present in the same picture. The descriptions were paired with illustrations that showed either one or two tokens of the critical noun (e.g. *bike* or *bus*). An example of each type is shown in the left-hand and right-hand panels of Figure 2.

In the one-token conditions, we expect that all noun/article combinations should be rated highly; it is perfectly felicitous for *a bike*, *the bike*, *a bus* or *the bus* to describe a scene in which there is only one bike, or only one bus. It is in the two-token conditions that we anticipate differences will arise. Specifically, we predict that participants will rate two-token scenes as worse matches for regular definite descriptions. For example, *Dean and Anne rode the bike* is not an ideal description for a picture showing Dean and Anne each riding a distinct bicycle, since in such a scene, the definite noun phrase cannot refer uniquely. However, if weak definites, as we hypothesize, do not refer uniquely, weak definite sentences should be preferable matches for two-token scenes and thus rated higher, since the lack of a unique referent should not matter.

For the regular definite noun phrases, the indefinites serve as a check on the strength of the manipulation. We expect that for nouns that allow only a regular definite interpretation, indefinites would be rated as better matches than definites for two-token scenes, whereas no difference is predicted between indefinites and definites for nouns that allow weak reference. Fillers were constructed by creating sentence/scene pairs for which there was

either a very clear semantic match, or a very clear mismatch. A full list of critical items is presented in Appendix B.

Procedure: Scenes and sentences were presented simultaneously on a computer monitor. Participants were instructed to rate the appropriateness of the written descriptions for each picture on a seven-point scale, with seven being the most appropriate. Participants were given three practice trials during which they could ask questions of the experimenter before beginning the actual experiment.

Results—As expected, when only one token of the critical noun was pictured, all descriptions were rated as being highly appropriate (with averages of 6 or higher). For the two-token pictures, the ratings depended upon both noun type (weak or regular) and type of article (definite or indefinite). In a linear regression model with number of tokens, article type, and noun type as random effects, we found a significant three-way interaction between number of tokens, article type, and noun type ($\beta = -0.46$, $SE = 0.15$, $p < 0.01$). The three-way interaction arises because, as predicted, effects of article type and noun type arise only in the two-token pictures.

We then conducted analyses using only trials with two tokens pictured. As anticipated, regular nouns received lower naturalness ratings than weak definites; the weak definite noun phrases (e.g. *rode the bus*) received the highest average acceptability rating (mean rating = 4.82). Weak indefinites (e.g. *rode a bus*) were rated only slightly lower than weak definites (mean rating = 4.71), and still lower were regular indefinites (e.g. *rode a bike*) (mean rating = 4.24), with regular definites (e.g. *rode the bike*) being least acceptable (mean rating = 3.67). We used a mixed effects regression model to predict the rating given to the description/picture pair, with article type and noun type as fixed effects and participant and item as random effects. Participants were significantly more likely to give a two-token scene a high rating when it was paired with an indefinite article ($\beta = 0.72$ $SE = 0.058$, $p < 0.0001$) and significantly more likely to give a two-token scene a high rating when it was paired with a weak noun ($\beta = 0.72$ $SE = 0.058$, $p < 0.0001$). We also found a significant interaction between article type and noun type ($\beta = -0.72$ $SE = 0.086$, $p < 0.0001$). Overall, our results indicate that nouns allowing weak reference are generally more acceptable with two-token pictures than nouns that do not allow such an interpretation, and that this difference is greater among definite than indefinite noun phrases. Regular definites are significantly less acceptable with these scenes than regular indefinites are; however, this is not true for weak nouns, where definites are numerically, but not statistically, better than indefinites for describing two-token scenes.

Discussion—Our results provide further support for the hypothesis that weak definites do not refer uniquely in the way that regular definites do. The results for the indefinites paint a more complex picture. When nouns only allow a regular definite reading, we observe the expected difference between definite and indefinite noun phrases. The similarity of the results for weak definites and indefinites provides a first hint that there might indeed be weak indefinite noun phrases.

Weak indefinites are rated as slightly more acceptable with two referents than are regular indefinites and they are given ratings similar to those of weak definites. When the noun can take a weak reading, it does not seem to matter much (for this task) whether the noun phrase is definite or indefinite. Recall that one of the novel predictions of the incorporation analysis is that even when paired with an indefinite article, nouns that allow for a weak definite interpretation might be preferentially interpreted as evoking an event of a conventional sort rather than an individual. That is, in the sentence *Jerome and Sandy rode a bus*, the activity of bus-riding rather than any specific bus-entity may be evoked, in much the same way that

corresponding weak definites (e.g. *the bus*) appear not to uniquely refer. We further explore this hypotheses and the relationship between weak definites and weak indefinites in Experiment 3.

Experiment 3

The results from Experiments 1 and 2 provide support for the hypothesis that weak definites do not uniquely refer. The results do not directly address the question of what interpretations comprehenders assign to weak definites. One hypothesis, which is consistent with Experiments 1 and 2, is that weak definites describe an event or activity type, rather than refer to an individual discourse referent. As a result, weak definites convey information associated with that activity. When we say someone is *in the hospital*, we seem to convey not only that they are physically located in a hospital, but also that they are there getting medical treatment. In fact, the most colloquial weak definites (such as *the slammer* (i.e. prison) in (9)) show enrichment so salient that it becomes difficult to cancel or override the enriched interpretation, as demonstrated in the contrast between (9a) and (9b). In (9a), which is completely felicitous, the second clause is consistent with the enriched interpretation (i.e. serving time). In contrast, (9b), where the second clause strongly favors a regular definite reading, is distinctly odd:

(9) a. The plumber went to the slammer, because he didn't pay his taxes.

b. The plumber went to the slammer, because a pipe burst in cellblock 4.

Experiment 3 explicitly tests the enrichment hypothesis by building on this observation to examine whether the conventional associations of an event, such as going to the hospital *to get medical treatment*, will override the specific properties normally associated with agents, such as the mailman *delivering mail*.

With regard to weak definites, there appear to be two main categories of enrichment involved: some weak definites (e.g. *play the piano*, *read the newspaper*, *walk the dog*) seem to convey that the activity is a commonly exercised activity, while others, particularly the ones denoting destinations (e.g. *go to the store*, *go to the hospital*, *go to the bank*) express enrichment related to the typical service received at that location. We chose to restrict our efforts to this latter set of weak definites for pragmatic reasons: scenarios in which people visit a destination for a non-canonical reason are more plausible than similar scenarios for regularly exercised-activity weak definites. For example, a mailman going to a store to deliver mail rather than to shop is not odd in the way that a person taking out the trash to show it off to the neighbors (and not for the sake of disposal) is odd. For our items, we chose agents with strongly associated prototypical activities (e.g. mailman, cab driver, pizza guy, etc.), as in (10).

(10) The FedEx driver had to go to the farm/hospital.

In (10), when the destination is a regular definite (*the farm*) we might infer that the FedEx driver was making a delivery to the farm (making deliveries is a typical activity for a FedEx driver). But if, as we hypothesize, weak definites serve to introduce semantically enriched meanings related to conventional events associated with the noun, when the driver's destination is a weak definite noun phrase (such as *the hospital*), comprehenders might instead infer that the FedEx driver needed medical treatment and was not making a delivery to the hospital. In this way, weak definites might influence what listeners understand such sentences to represent: listeners' assumptions based on the agent might be overridden by the enriched meanings of weak definites, which could in turn affect the underlying mental representation of a described event.

Experiment 3a Method

Participants—Eighteen members of the University of Rochester community participated in the experiment for pay. All were native speakers of American English. Data from two participants were excluded because of computer malfunctions.

Design and Materials—Experiment 3a compared weak definites and regular definites in an interview-style task, in which participants were asked about their interpretations of sentences like the one in (10). Our experimental items were constructed by pairing a random noun/subject from a list of agents that have well-known prototypical activities with a random destination goal from a list of weak definite places. A matched regular definite destination was chosen to be the basis of comparison for the weak definites. To control for ordering effects that might arise from repeatedly answering questions about similar sentences, four lists were created by dividing the original list in half: the second list had the same items in each half, but in reverse order within each half, while the third and fourth lists were reversed versions of the first two. Filler items were constructed using other agents associated with prototypical activities; these were embedded in sentential contexts that did not favor one elaboration over another (e.g. *The grad student went to the coffee shop*, with the question Was the grad student studying in the scene you imagined?).

Procedure—The participant was seated at one computer within the lab, and a research assistant, who served as the “interviewer,” was seated at another computer. The participant and the interviewer were able to see and talk to each other, but could not see each other’s screens. Participants were instructed to read the sentences presented to them on their computer screen and visualize the scene that the sentence described. The interviewer then asked the participant a yes/no question to establish whether or not the participant had imagined a scene in which the agent of the sentence was engaging in their prototypical agentive role. The interviewer recorded each yes/no answer as it was given. The interviewer then asked the participant to describe the scene she had imagined. This open-ended description was recorded as an audio file and later transcribed by the same research assistant who played the role of interviewer. An example trial is presented in (11):

(11) Text on Screen: The Fed Ex driver had to go to the farm/hospital.

RA: Was the Fed Ex driver making a delivery in the scene you imagined?

[Subject responds *yes* or *no*]

RA: Describe the scene you imagined.

[Participant responds by describing the scene in her own words]

This set-up allowed us to assess whether the use of a weak definite as the destination would result in an enriched reading that “cancelled out” inferences about the typical activities of the agent. That is, we could examine whether delivering packages or getting medical treatment emerged as the stronger inference. By eliciting open-ended responses from participants, this experiment also allowed us to obtain information about what the enriched meanings of weak definites, if there were any, actually involve. A full list of stimuli is presented in Appendix C.

Results—Participants were more likely to answer “no” (indicating they did not imagine the agent engaging in his or her prototypical activity) when they read sentences with weak definites than when they read sentences with regular definites (71% “no” responses vs. 40% “no” responses). We used a mixed effects logistic regression model to predict whether a participant would answer “no” using noun phrase type (weak or regular) as a fixed effect

and subject and item as random effects, and found that this difference in response was significant ($\beta = -1.4$, $SE = 0.4$, $p < 0.001$).

In order to confirm that the yes/no data corresponded to the prototypical activities and events associated with the agents and destinations in our items, we instructed an RA who was blind to the experimental manipulations to annotate the descriptions for three properties: mention of the agent's typical activity (e.g. delivering mail), mention of the agent's typical "accessories" (e.g. parcels, mailbag, etc. for a mailman), and mention of a motivation that related to the destination in the sentence (e.g. being sick for *hospital* and buying fresh produce for *farm*). We then used three mixed effects logistic regression models to predict whether a participant would answer "yes" to the critical question using each property as a fixed effect and subject and item as random effects; we found that when participants mentioned the agent's activity in their description, they were significantly more likely to answer "yes" ($\beta = 6.05$, $SE = 0.71$, $p < 0.0001$); a similar significant effect was found for mention of the agent's accessories ($\beta = 3.99$, $SE = 0.50$, $p < 0.0001$). When participants mentioned a motivation that related to the destination in the sentence, we found they were significantly *less* likely to answer "yes" ($\beta = -4.48$, $SE = 0.65$, $p < 0.0001$).

Discussion—Our results demonstrate that after reading a sentence containing a weak definite destination, participants were more likely to say that the agent was not performing their conventional role or prototypical activity in the scene they imagined, and after reading a sentence containing a regular definite, they were more likely to say that the agent was performing their conventional role. This pattern is consistent with the hypothesis that weak definites evoke a canonical activity type, and that this enrichment often overrides event biases that may be conveyed by the sentence's agent.

The descriptions given by participants provide further evidence that enrichment drives the difference in "yes" and "no" responses between weak definites and regular definites. For example, our annotations of the responses indicated that when participants answer "no" to the direct question asked in (11), they almost always give descriptions in which some typical motivation for the activity of hospital-going is mentioned (i.e. "the driver got sick", "the driver hurt himself"); these responses were most common with weak definite destination nouns. "Yes" responses in our data are almost always associated with descriptions in which typical associations with the agent are mentioned (i.e. "the driver had to make a delivery", "the driver was dropping off a package"); such responses were more likely to occur when the destination noun did not allow a weak interpretation, such as *the farm*.

Experiment 3b

Recall that the incorporation framework predicts that there should also be weak indefinite noun phrases. If that is the case then, nouns that can take a weak definite interpretation are also more likely to be interpreted in an enriched manner when paired with the indefinite article. Experiment 3b examines the interpretations of weak indefinites by using the same method as was used in Experiment 3a.

Method

Participants: Sixteen members of the University of Rochester community participated in the experiment for pay. All were native speakers of American English.

Design and Materials: Experiment 3b used the same design and materials as Experiment 3a, except that the definite article in each item was replaced with the indefinite article.

Results—We see a similar pattern of results for Experiment 3b as we did in Experiment 3a; overall, participants gave more “no” responses with weak indefinites than with regular indefinites. (71.1% and 49% “no” responses, respectively). As in Experiment 3a, we used a mixed effects logistic regression model to predict whether participants would answer “yes,” using noun phrase-type (weak or regular) as a fixed effect and subjects and items as random effects, but found only a marginal effect of noun phrase-type ($\beta = -1.05$, $SE = 0.5$, $p < 0.06$). However, when we combine the results from Experiment 3a and 3b and analyze them in the same fashion, with article type (either definite or indefinite) as an additional fixed effect, we do not find a significant interaction between noun phrase-type and article-type.

Discussion—When participants read a sentence with a “weak indefinite” they were more likely to say that the agent was *not* performing their canonical role in the scene they imagined. This is consistent with the idea that these weak nouns might be preferentially interpreted as conveying an enriched meaning, even when paired with the indefinite article, lends further support to the hypothesis that both weak definite and indefinite nouns phrases have the semantics of an incorporated structure. The descriptions given by participants also lend support to this idea, since they show the same pattern as in Experiment 3a: when the participant responds with “no” to the direct question, he or she almost always includes information in their description relating to the activity associated with the destination noun, just as in Experiment 3a.

Experiment 4

Experiments 3a and 3b demonstrated that both weak definite and weak indefinite noun phrases frequently express meanings that are enriched by conventional knowledge about the activities associated with particular nouns. One possible alternative interpretation of these results is that the enriched interpretations are due solely to the destination nouns in our stimuli, rather than being generalizable to weak definite (or indefinite) constructions. It is possible that participants would be just as likely to offer an enriched interpretation for a sentence in which our destination nouns are paired with a verb that excludes weak reference. In order to rule out this possibility, we sought in Experiment 4 to compare the interpretations given for weak definite sentences with interpretations for sentences that were identical except for the choice of verb.

Methods

Participants: Twenty naïve adult speakers of English volunteered to participate in the study for payment via Amazon Mechanical Turk.

Design and Materials: The sentences used in Experiment 4 had the same form as those used in Experiments 3a and 3b: a subject was chosen from a list of agents with known canonical activity-associations, and a destination goal was selected from our list of weak definite noun phrases. We then created matched sentences that were identical except for the choice of verb. As we noted in the introduction, weak definites allow for more contextual variety than idioms, but only when verbs and modifiers are not incompatible with weak reference. Thus it was necessary to construct sentences with alternate verbs that discouraged weak reference. For example, it would not make sense to compare interpretations for *The UPS man went to the store* with *The UPS man stopped at the store*, since *stopped at the store* is also a weak definite for many speakers of American English. We therefore chose to use *parked at the store* in our alternative sentence, since it conveys arrival at a destination just as do our weak definite constructions, but does not allow a weak definite interpretation. We created filler sentences using both verbs (*went to* and *parked at*) by drawing from an additional list of agents with known prototypical activity associations and a list of destination nouns that do not allow weak reference.

We created two lists of nine pairs of sentences to be posted as HITs on Mechanical Turk. The lists contained alternating critical (five total) and filler (four total) trials. Participants saw either the *went to* or the *parked at* version of each sentence first during each trial in a within-subjects design. Our two lists differed in terms of which version of the sentence was presented to the participant first on each trial; if the participant saw the *parked at* version of the sentence first on List 1, then a participant on List 2 would see the *went to* version of the sentence first. For each sentence pair, we developed two possible answers for a question designed to probe the participant's interpretation of the sentence: one that favored an agent-centered rationale for visiting the destination (e.g. *The UPS man was making a delivery.*), and one that favored a destination-centered rationale for visiting the destination (e.g. *The UPS man was running errands.*); we modeled these explanations on the responses of participants in Experiments 3a and 3b. The full set of items is given in Appendix D.

Procedure: On each trial, the participant was shown either the *went to* or *parked at* version of a sentence and was asked to imagine s/he was reading this sentence in a book. She was then asked to rate which she thought was a more likely explanation of what was happening in the scene from which the sentence was drawn, and offered the two alternatives described above: an agent-centered or destination-centered rationale. Next, the participant was shown a version of the same sentence with the alternate verb and asked whether the change in verb made the destination-centered rationale more or less likely. This pair of two-alternative forced-choice questions was designed to allow us to investigate whether participants were equally likely to offer a destination-centered rationale for a sentence containing one of our destination nouns in a weak definite construction as for one that did not have a weak-definite compatible verb.

Results—Participants were more likely to choose the destination-oriented rationale in critical trials when the first sentence used a weak definite construction (*went to the store*) than when the first sentence used a verb that was not weak-definite compatible (*parked at the store*); the former were given a destination-oriented rationale 62% of the time while the latter were given a destination-oriented rationale only 28% of the time.³ We used a mixed effects logistic regression model on our critical trial data to predict whether a participant would choose the destination-oriented rationale using the verb (*went* vs. *parked*) as a fixed effect and subject and item as random effects, and found that this difference in response was significant ($\beta = 1.43$, $SE = .42$, $p < 0.001$).

We likewise found that participants more often responded that a destination-oriented rationale was more likely when *parked at* was switched to *went to* in the second question (84%) than when *went to* was switched to *parked at* (46%). We used a mixed effects logistic regression model to predict whether a participant would respond that the destination-oriented interpretation was more likely after a switch in verb using the initial verb (*went* vs. *parked*) as a fixed effect and subject and item as random effects. This difference in response was also significant ($\beta = 2.29$, $SE = 0.53$, $p < 0.001$).

Discussion—The results of Experiment 4 suggest that our findings in Experiment 3a were not simply due to associations participants had with the destination nouns we used, but to the weak definite construction as a whole. In Experiment 3a, we found that participants focused on aspects of the destination, rather than the agent, in interpreting sentences with a weak definite. In this experiment, we demonstrate that the construction—not simply the

³We think it is unlikely that this difference is simply due to differences in *park* and *went* rather than their interaction with weak definites. The differences between *went to* and *parked at* were much weaker for our filler items; sentences using *went* were given a destination-oriented rationale 43% of the time while sentences using *parked* were given a destination-oriented rationale 33% of the time. This observation is only suggestive because we did not compare *went to* and *parked* within the same filler item.

noun—matters: explanations rooted in conventional associations with the destination were more plausible when the destination noun appeared in a weak definite construction than when the same noun occurred in a similar context that excluded weak reference. Participant judgments in the secondary “change” task (in which participants were asked whether a change in verb phrase made the destination-focused explanation more likely) provide further evidence that sentences with weak definite constructions evoke a greater focus on the canonical associations of the goal than the agent.

In this experiment, the verbs in question both convey arrival at a destination; the key difference between *went to the store* and *parked at the store* is that the latter conveys a specificity about the manner of arrival that causes the weak interpretation to be unavailable. Crucially, though, the pairs of sentences we compared in this experiment have the same agents and destinations and differ only in terms of the verb phrase. If our findings in Experiments 3a and 3b were driven by associations participants had with the agent and destination nouns irrespective of construction, we should not have found a significant difference in preference for destination-associated vs. agent-associated interpretations in the current study. The fact that we did, and that, in particular, weak definite constructions evoked destination-related elaboration while the same nouns in regular definite phrases evoked agent-related elaboration, lends further support to our hypothesis that weak constructions convey enriched meanings relating to prototypical or conventional activities associated with the noun, as suggested by the incorporation framework.

Experiment 5

Recall that weak-definite-capable nouns appear to belong to a fairly small number of conceptual categories: those relating to mass communication or mass transportation, hobbies, chores, and other routine activities, service destinations, and body and building parts. Notably, these categories appear to have in common the possibility of interchangeability of tokens in context where weak interpretations are found. The enriched meanings of weak definites typically do not rely on token specificity. When one needs medical treatment, for example, any hospital is likely to offer the same set of services and thus the unique identity of the hospital is unimportant; by contrast, in contexts that do not involve the canonical hospital-going activity of getting medical treatment (such as delivering flowers to the hospital), unique identifiability does matter. In other words, you may be able to get an X-ray at any hospital, but to deliver lilies to the correct customer, you must find Highland Hospital. The same is true for other categories of weak nouns such as mass transportation, where the regularity of the route is more critical than the particular vehicle involved, so long as a typical transit activity is being described (and not a flat tire, hijacking, or other anomaly). Existent weak definite nouns demonstrate a notable regularity of context and interchangeability of token; they are about familiar types, in other words, and not tokens.

In Experiment 5, we probe the conceptual properties and potential origins of weak definite noun phrases and investigate whether novel words representing novel concepts can demonstrate weak reference when the regularity of context and interchangeability of referential token are manipulated using an artificial lexicon embedded within a longer story. The novel words and contexts were introduced in a short science fiction story. This allowed us to ask questions about the conceptual basis of weak definite nouns while avoiding any biases arising from lexical status, frequency of use and appearance in collocations.

Methods

Participants: Eight naïve adult speakers of American English from the Rochester community volunteered to participate in the study for payment.

Design and Materials: We created a short science fiction narrative about life on the planet Mars that was, with the exception of select novel words, written in English. The genre of science fiction was chosen because it provides a plausible context for introducing novel words that denote unfamiliar concepts. Using unfamiliar concepts is necessary to reduce the likelihood that artificial words would be understood as translations of familiar English nouns, which could be encoded for their ability to convey weak referential interpretations. Therefore the Martian backdrop of our short story has the advantage of supporting a context in which totally new objects and ideas are likely to appear. Our novel words were purportedly Martian lexical items that referred to alien concepts.

Two types of critical novel concepts were introduced in the body of the story: “weak-valenced” and “regular-valenced.” Weak-valenced concepts highlighted the semantic properties associated with weak reference discussed earlier: regularity of context and purpose, and interchangeability of referential token. For example, the concept *VLERTER* was introduced as a tiny utilitarian room that humans living on Mars routinely must enter to be hosed down with a special protective skin coating to compensate for the lack of atmospheric protection from ultraviolet rays. This is the exclusive purpose of vlerters, which are widely dispersed among both residential and commercial buildings in Mars City and can be used interchangeably for the same purpose. Regular-valenced concepts, on the other hand, appeared in a variety of descriptive contexts, and individuality of the referent was emphasized by the content of the story. For example, the concept *VEN* was introduced as a comfort device that can provide a range of palliative care, including heat, ice, softness, or hangover cure, depending on the needs of the user at a particular moment in time. The full story is presented in Appendix E.

We avoided introducing either type of noun in a context that unambiguously forced a weak interpretation. Uniqueness was plausible in all contexts in which a novel word was paired with the English definite article. Thus, participants were not trained to accept weak reference through exposure to phrases that required a non-unique interpretation. Participants’ acceptance of weak reference with the novel nouns after exposure therefore gives us an indication of both whether new weak definites can be created in the lexicon, and whether our hypothesized conceptual features are associated with weak definite interpretations.

Procedure: Participants were informed that they would be reading a short science fiction story, and that they would be asked to answer comprehension questions both during and after they completed the story. They were also told that the story would introduce several unfamiliar words, which would be underlined the first time they appeared. Four brief comprehension question blocks were dispersed throughout the story in order to encourage participants to read the material closely.

Immediately after completing the story, participants performed a linguistic judgment task in which they rated (on a scale from 1 to 7) the acceptability of unambiguously weak interpretations in anaphoric expressions such as the one given in (12) below:

(12) Ash was outside all day long, and needed to do a radiation cleanse when he got home. In the Gaeltacht, Padraig also decided today was a good day to take protective measures from the sun’s rays. Ash used the vlerter, and so did Padraig.

Because readers know that Ash’s home is far away from the Mars City Gaeltacht, the final sentence in each of these scenarios must be given a weak interpretation in order to be an acceptable summary of the preceding text.

After completing this judgment task, participants performed a semantic rating task in which they evaluated the valence of our novel words. This task required participants to rate (on a

scale from 1 to 7) the appropriateness of statements that were constructed to target the conceptual properties we manipulated in the experiment, as in (13) and (14):

(13): Vens are a personal item: everyone's is special to them.

(14): Vlerters are ubiquitous in Martian buildings, and all serve the same function.

This rating task allowed us to evaluate whether the novel weak nouns truly possessed the intended qualities of interchangeability, etc. The semantic rating task was performed after the linguistic judgment task so that it would not influence participants' judgments about weak reference or the meaning of the novel words. A complete list of the critical judgment scenarios, as well as valence assessment statements, is presented in Appendix F.

Following the semantic rating task, participants were asked to rate their confidence that they had learned and understood each novel word, and then write a one-word English definition for each of the novel words they had encountered. This assessment allowed us to address the potential concern that participants might treat the novel words as direct "Martian" translations of English weak definites. If the artificial lexicon, in tandem with the story, successfully described truly alien concepts, then the charge to provide one-word definitions of the novel words should be difficult for participants, and should provoke a variety of responses.

Results—In our linguistic judgment task, participants rated the weak-definite interpretation more highly for weak-valenced novel words than for regular-valenced novel words; mean acceptability was 4.1 for regular-valenced words and 5.0 for weak-valenced words. These patterns were consistent across participants and items with the exception of one weak-valence noun, *vurrit*, a type of vehicle. Examination of the definitions given by participants for this noun revealed a divide in how this noun was interpreted: some participants had conceptualized it as a mass-transit vehicle, while others had conceptualized it as an individually operated vehicle. Closer scrutiny revealed that the valence rating for this word was 4.6 out of 7—which is approximately the middle of the scale. In other words, subjects were divided in their understanding of this word, and overall, the mean valence rating was not on the weak side of the scale as intended. Thus, we excluded *vurrit* from the analyses that follow, focusing on all remaining nouns whose conceptualizations and valence appear relatively consistent across participants.

To establish whether our conceptual manipulations affect the acceptability of weak interpretations, we used a mixed effects linear regression model to predict the rating given to the forced (i.e. unambiguously) weak sentence in the linguistic judgment task, with the intended valence of the novel noun (weak or regular) as a fixed effect and participants and items as random effects; this showed that participants were significantly more likely to give a sentence containing a weak-valenced word a high rating as a summary of a scenario requiring a weak interpretation ($\beta=1.17$, $S.E.=0.33$, $p<0.001$). Using the same type of model, we also predicted the rating given to both the weak-valence and regular valence nouns in the semantic-rating task, and found that participants were significantly more likely to give a high rating to weak-valence nouns when the probe question involved weak-valenced conceptual features ($\beta= 2.5$, $S.E.=0.9$, $p<0.01$), and more likely to give a low rating to weak-valence nouns when the probe question involved regular-valenced conceptual features ($\beta=-3.77$, $S.E.=0.7$, $p<0.001$).

In order to verify that the results for the novel Martian words were not simply due to the properties of a potential English translation that participants may have understood for each novel word, we instructed an RA who was blind to the experimental manipulations to annotate each English translation for whether it could appear in a weak definite noun phrase

in English. We then used a mixed effects regression model to predict the rating given in the linguistic judgment task, with the English translation (weak or regular) as a fixed effect, and participants and items as random effects, and found that whether the given translation was weak or not did not have a significant effect on the rating given ($\beta=0.83$, $SE=0.48$, $p=0.897$).

Discussion—Our results demonstrate that new nouns that allow weak referential interpretations can be created using an artificial lexicon and a story that manipulates the conceptual features of the novel nouns and the contexts in which they occur. This finding suggests a possible etiology for the weak definite nouns in English, and provides a basis for future study of weak reference and related phenomena that successfully avoids potential confounds with frequency and co-occurrence statistics.

The conceptual features we explored in this study—interchangeability of token and regularity of context and purpose—appear to play a major role in determining whether a particular noun can license a weak interpretation. This is consistent with our hypothesis that weak definites evoke a conventional event or an activity, rather than an individual discourse referent. It is precisely those situations in which the identity of the token involved is unimportant but the purpose that token plays or context in which that token appears is highly constrained that seem most likely to be described in weak definite noun phrases.

Experiment 6

The incorporation framework predicts that nouns that appear in weak definite phrases also have weak indefinite readings in the same sentential contexts, and the data from Experiment 3b, and to a lesser extent Experiment 2, support this hypothesis. The typical reading of a definite noun phrase expresses a property involving some uniquely identified individual and thus clearly differs from the typical reading of an indefinite noun phrase. The weak reading of definites, however, is truth-conditionally very similar to that of a regular indefinite. What then, if anything, does the definite article contribute to the meaning of a weak definite?

As we pointed out in the introduction, if the weak construction has something close to the semantics of a regular indefinite, it begins to look like the definite article is contributing nothing, or else (perhaps) contributes the value of an indefinite instead. However, the incorporation hypothesis suggests that definite and indefinite articles make their normal contributions if we assume that the compositional structure is $ARTICLE(take(train))$. That is, the semantic effect of the article depends upon the content of the incorporated interpretation, including relevant contextual material, and not just the interpretation of the noun.

As noted earlier, it is generally agreed that definiteness has the semantic effect of making reference to either discourse-old or unique or “familiar” entities (Heim, 1982; Kadmon, 1999; Roberts, 2003) and that indefinites introduce new and “unfamiliar” entities. So, on this account is not *the train* that is familiar (or unfamiliar), but rather the action of train-taking that is known within the common ground. On this view, the distinction between *take the train* and *take a train* should then reduce to a subtle one: whether the instance of train-taking is implied to be a “familiar” instance (such as something one does regularly) or an “unfamiliar” instance (that is, a train-taking that is outside one’s familiar habitual realm). Experiment 6 was designed to provide a preliminary test of this hypothesis by probing to see whether we could elicit a familiarity difference between weak definites and weak indefinites.

Methods

Participants: Twenty-four naïve adult speakers of English volunteered to participate in the study for payment via Amazon Mechanical Turk.

Design and Materials: We created scenarios in which two different locations were established for a fictional “speaker,” with one location being their usual or home location, and another being a location they visited less frequently. In the final sentence of each scenario, this speaking-character in a text-based narrative uttered either a weak definite or its indefinite counterpart, as in the following example:

Kent lives in coastal North Carolina with his parents. One of his favorite pastimes is collecting seashells, and he picks them up whenever he has the chance. Twice a year, the family travels to coastal Florida to visit his grandparents.

Kent wrote an email to his friend, saying: “I went to the beach last weekend.” *Where do you think he was?* [Listed along a scale from the less to the more familiar location]

1. Definitely in Florida
2. Probably in Florida
3. Maybe in Florida
4. Probably in North Carolina
5. Definitely in North Carolina

If instead he had written, “I went to a beach last weekend.” Would he be:

1. More likely to be in Florida
2. Less likely to be in Florida

In order to provide a concrete test we make the assumption that in a familiar location, activity would be more familiar. As shown in the above example, participants were asked to give their interpretation of Kent’s “utterance” using a 5-point rating scale. They were then presented with a version of the sentence with the determiner switched and asked whether this alternate sentence conveyed that the speaker was more or less likely to be in his secondary location. This final two-alternative forced-choice “switch” question allowed us to probe participants’ intuitions about the distinction in meaning conveyed by the definite versus the indefinite article when used in a weak construction. Four counterbalanced lists of six scenarios like the one above were created and listed on Amazon Mechanical Turk, with four participants completing each list. The full set of materials is given in Appendix G.

Results—We find a significant difference in responses to the first question depending on whether the initial utterance contained a definite weak construction or its indefinite counterpart: the mean rating for initial weak definites was 3.7, whereas the mean rating for initial weak indefinites was 3.1, indicating that the weak definite was rated as denoting the activity in the more familiar, or primary, location. We used a mixed effects linear regression model to predict the answer given to the first question, using condition (definite or indefinite in the initial utterance) as a fixed effect and subjects and items as random effects, and found that this difference was statistically significant ($\beta = -0.604$, $SE = 0.1765$, $p < 0.001$).

Among responses to the second “switch” question, we also find a significant difference between those scenarios in which the switch was from a weak definite to a weak indefinite, and those in which the switch was from a weak indefinite to a weak definite. In the former case, participants chose “1” (the answer corresponding to being more likely to be in their less usual location) 85% of the time, while in the latter case, participants chose “1” only

35% of the time. In other words, a shift from an indefinite to a definite was interpreted as indicating the protagonist was more likely to be in the familiar location, whereas a shift from a definite to an indefinite was interpreted as indicating that the protagonist was more likely to be in a less familiar location. We used a mixed effects logistic regression model to predict the answer given to the switch question, using condition (definite or indefinite in the initial utterance) as a fixed effect and participants and items as random effects and found that this difference was statistically significant ($\beta = 2.44$, $SE = 0.51$, $p < 0.0001$).

Discussion—As suggested by the incorporation hypothesis, weak definites and weak indefinites differed in familiarity. Participants were more likely to respond that the speaker was probably in their expected or primary location when the initial sentence contained a weak definite than when the initial sentence contained a weak indefinite. When participants were asked about the difference in meaning conveyed by a switch from definite to indefinite, they usually reported that this article switch made it more likely that the speaker was in his secondary location. By contrast, when asked about a switch from a weak indefinite to a weak definite, participants typically reported a greater perceived likelihood that the speaker was in his primary location. Taken together, these data suggest that participants intuit that the use of the definite article in a weak definite noun phrase conveys an element of expectedness or familiarity, while the use of an indefinite article with the same noun conveys a lack of familiarity or typicality which pertains to the greater context of occurrence rather than the activity type itself. This indicates that at least some aspects of meaning typically conveyed by the definite article are maintained in weak definite noun phrases, and that while both weak definites and weak indefinites convey similar enriched meanings centered on conventional events or activities, they evoke subtly different interpretations related to the standard semantics of the definite and the indefinite article.

General Discussion

We began this article by outlining four questions about weak definite noun phrases and their weak indefinite counterparts that are suggested by an incorporation framework. First, we asked whether behavioral evidence would confirm the intuition that weak definite noun phrases do not uniquely refer and, if so, would the same nouns exhibit similar properties in indefinite noun phrases. Experiments 1 and 2 provided clear evidence that weak definite noun phrases do not uniquely refer in the same way as regular definite noun phrases. Experiment 2 also provided some suggestive evidence weak indefinite noun phrases might differ from regular indefinite noun phrases.

Second, we asked whether a weak definite noun phrase evokes the enriched meaning associated with an incorporated structure, in particular an event involving the noun-type (e.g. hospital-visiting, bus-riding, radio-listening), and if so, is that also the case for similar indefinite noun phrases. Experiment 3 provided evidence for enriched interpretations for both weak definites (Experiment 3a) and weak indefinites (Experiment 3b). In particular, when an agent associated with prototypical activities (e.g. a Fed Ex delivery person) was paired with a regular definite or indefinite location noun phrase, than participants interpretations focused on activities associated with the agent. In contrast, interpretations of weak definites and indefinites focused on typical activities associated with the location.

The third question was whether novel nouns that share some of the properties of classes of nouns that license a weak definite interpretation would also license weak reference. Experiment 5 used a science fiction story to introduce novel nouns that either shared or did not share properties common to one class of weak definites. As predicted, the novel nouns that shared properties of existing weak definite nouns were more likely to receive weak definite interpretations.

The fourth and final question focused on what the definite and indefinite article might contribute to the interpretations of a weak construction. The incorporation analysis predicted that the uniqueness/familiarity aspect of definiteness might apply to the (incorporated) event. This prediction was supported by the results of Experiment 6, in which an event described by a weak definite was judged as more likely to occur in a familiar setting than the same event introduced with a weak indefinite.

Taken together these results confirm observations in the linguistic literature that there is a class of definite noun phrases, weak definites, which do not exhibit the properties that are widely assumed for definite noun phrases. Moreover, these results suggest that weak definites have properties that are consistent with an incorporation analysis. In particular, weak definites can support semantically enriched meanings related to the typical or conventional activities associated with the noun as a type. These similarities to the semantics of incorporated structures have been noted in the linguistics literature. However, we also provided novel evidence for the existence of weak indefinites. Weak indefinites are expected under an incorporation analysis; however, to our knowledge they have not been noted in the linguistic literature. Finally, we provided preliminary evidence that the form of the article contributes to the meaning of weak noun phrases. Weak noun phrases convey familiarity of activity. However weak definites and weak indefinites differ in terms of the “expectedness” or familiarity of the context of these activities. We note, however, that our explanation for the properties of definite and indefinite articles assumes that the semantic effect of the article depends upon the content of the incorporated interpretation, and not just the interpretation of the noun. That is, the compositional structure of a weak noun phrase, such as *take the train* is DEF(take(train)). In future research it will be important to develop and evaluate linguistic arguments about this analysis.

We described the importance of conceptual features relating to regularity of context or purpose and interchangeability of tokens in establishing weak definite interpretations. Moreover, we demonstrated that the conceptual properties of particular nouns and the contexts in which they occur has a strong effect on whether a novel noun denoting a novel concept will be given a weak referential interpretation. This suggests a possible origin for the set of lexical items that carry weak referential interpretations in English: such interpretations appear to arise when these lexical items are regularly used in contexts in which non-referential familiarity or habituality, rather than referential uniqueness, is emphasized. In English, it appears that the weak referential interpretation is conventionally carried only by a relatively small set of nouns in particular sentential contexts, but it should be possible to find weak interpretations involving other nouns, if the conceptual properties of both the noun and the context in which it occurs favor the weak referential interpretation. Whether the conceptual foundations of weak noun phrases can be related to incorporation is a question we leave open for future research.

As an aside we note that the distinction between weak and regular definite noun phrases might provide some explanation for otherwise puzzling and equivocal results from the sentence processing literature. As linguistic input arrives, listeners rapidly integrate that input with the preceding context to generate expectations about the upcoming input. We see striking evidence of this in studies demonstrating anticipatory eye-movements using the visual world paradigm (Cooper, 1974; Tanenhaus, Spivey-Knowlton, Eberhardt & Sedivy, 1995). For example, in a seminal study, Altmann and Kamide (1999) found that as listeners hear a verb, they generate anticipatory eye-movements to a likely theme or patient (also see, Boland & Blodgett, 2001). Similarly, Chambers and colleagues have demonstrated anticipatory eye-movements to objects that contain the appropriate affordances for prepositions, for example directing gaze in advance to a container such as a can rather than a

plate when the preposition *inside* is used (Chambers, Tanenhaus, Eberhard, Carlson & Filip, 1998; Chambers et al., 2002). Definite articles, however, seem to be an exception.

For example, Chambers et al. (2002) found that in a display with two jars, listeners are confused when there are two potential referents for an instruction that uses a definite noun phrase (e.g. *put the cube in the jar*) but not when the instruction uses an indefinite noun phrase (e.g. *put the cube in a jar*). Thus listeners clearly were sensitive to the uniqueness constraints associated with the definite article. Nonetheless, when there was one unique potential container, such as a bowl and two potential containers of the same type (e.g. a large and a small can), listeners showed no tendency to fixate the unique container upon hearing *the*. This same pattern seems to hold for all of the visual world studies of which we are aware. Listeners do, however, make anticipatory eye-movements based on coarticulatory information carried in the vowel of a definite article (Salverda & Tanenhaus, 2012), which rules out a simple explanation based on the fact that articles are short and sometimes difficult to identify in running speech. Taken together this suggests that for listeners, some elements of uniqueness assumptions are not but rather by the article in conjunction with a carried solely by the definite article *the* construction.

In sum, the current studies have provided experimental support for a cluster of properties for weak definite noun phrases that are consistent with an incorporation framework. Some of these properties, such as weak reference, were well documented in the linguistics literature. Others, such as the demonstration that constellations of conceptual properties can result in novel weak definites, could not have been documented using standard linguistic methodology. In addition, we provided suggestive evidence for the existence of weak indefinites. We do not view the current work as a behavioral test of a particular linguistic analysis or theory, akin to tests of the “psychological reality” of competing linguistic analyses. Although the incorporation analysis provided a guiding framework, we note that there may well be other frameworks that involve construction or frame meanings that would be consistent with our results. Rather, we view the current work as example of an approach to experimental semantics and pragmatics that, while informed by formal theories within linguistics, seeks to explore phenomena that provide basic data that complement standard linguistic data.

We also note some of the limitations of the current studies that will require future research. First, as we have acknowledged the incorporation analysis needs to be further developed and evaluated. Second, the constraints of our experimental designs necessarily restricted many of our studies to a subset of weak definites, for example, locations, and means of transportation. Therefore it remains to be seen whether the broader class of weak definites also exhibit similar properties. Third, the familiarity differences between weak definites and indefinites represent only a first foray into what the definite article contributes to weak definites. Nonetheless, we would argue that both the results we have presented and the methods we have explored, provide a useful foundation for further work on weak definites and other forms of weak reference.

Acknowledgments

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Appendix A

(1) Jane is feeling silly today. Have her wear a hat.

weak: She wants to impress her friends with how talented she is. Have Jane play the saxophone. Now have Bill play the saxophone too.

regular: She wants to impress her friends with how talented she is. Have Jane play with the ball. Now have Bill play with the ball too.

(2) Carrie hasn't been doing so well. Give her a teddy bear.

weak: Now take Carrie to the doctor. Take Robert to the doctor too. regular: Now take Carrie to the teacher. Take Robert to the teacher too.

(3) Jason does chores to earn his allowance. Today, he brushed his teeth first. weak: Then Jason walked the dog. This evening, Beth walked the dog too.

regular: Then Jason played with the cat. This evening, Beth played with the cat too.

(4) Fiona likes to help out around the house. Make her fold her clothes.

weak: Have Fiona take out the trash. Now have Craig take out the trash too. regular: Have Fiona wash the vegetables. Now have Craig wash the vegetables too.

(5) Amos goes out a lot. This morning, he went to a cafe.

weak: Later, Amos went to the movies. Tonight Trish went to the movies too. regular: Later, Amos went to the concert. Tonight Trish went to the concert too.

(6) Raylene has the day off, so she wants to run around town. Take her to a museum.

weak: Then take Raylene to the store. Now take Jerry to the store too.

regular: Then take Raylene to the tower. Now take Jerry to the tower too.

(7) Martin used his weekend to run errands. First, he bought groceries.

weak: Then Martin went to the bank. After lunch, Jill went to the bank too. regular: Then Martin went to the church. After lunch, Jill went to the church too.

(8) Krista has a bad habit of letting things get out of hand before she gets help. Take her to her bus stop.

weak: Now take Krista to the hospital. Then take Jack to the hospital too.

regular: Now take Krista to the school. Then take Jack to the school too.

(9) Ricky is notorious for disrupting any quiet environment. First he spilled a glass of milk.

weak: Then Ricky talked on the phone. Kara talked on the phone too.

regular: Then Ricky talked on the megaphone. Kara talked on the megaphone too.

(10) Lana is obsessed with music. Have her buy a Beatles poster.

weak: Now let Lana listen to the radio. Let Cedric listen to the radio too. regular: Now let Lana listen to the record. Let Cedric listen to the record too.

(11) Rudy is a very literary guy. This morning, he wrote poetry in his diary.

weak: Later, Rudy read the newspaper. This afternoon, Patty read the newspaper too.

regular: Later, Rudy read the book. This afternoon, Patty read the book too.

(12) Leo lives about a mile away from school. He grabbed his backpack on the way out the door.

weak: Then Leo rode the bus. Mia rode the bus today too.

regular: Then Leo rode the bike. Mia rode the bike today too.

Appendix B

Regular Nouns:

1. (1) Tim and Katrina went to a/the teacher.
2. (2) Crystal and Nick read a/the book.
3. (3) Elaine and Evan went to a/the church.
4. (4) Jordan and Sam rode a/the lawnmower.
5. (5) Zach and Celine went to a/the fountain.
6. (6) Max and Maresa played a/the game.
7. (7) Earl and Susan went to a/the museum.
8. (8) Ryan and Sarah played with a/the cat.
9. (9) Dean and Anne rode a/the bike.
10. (10) Jed and Martha looked at a/the yard.
11. (11) Austin and Patty took a/the car.
12. (12) Thomas and Andrea sat in a/the chair.

Weak Nouns:

1. (1) Martin and Diana read a/the newspaper.
2. (2) Andrew and Whitney went to a/the doctor.
3. (3) Terri and Stephan went to a/the bank.
4. (4) Robert and Hannah sat in a/the corner.
5. (5) Brett and Beth went to a/the beach.
6. (6) Jerome and Cindy rode a/the bus.
7. (7) Jacob and Kathy rode a/the train.
8. (8) Keith and Kaitlyn played a/the piano.
9. (9) Domenica and Gerry went to a/the store.
10. (10) Benedict and Traci walked a/the dog.
11. (11) Nick and Patricia mowed a/the lawn.
12. (12) Amos and Trisha took a/the streetcar.

Appendix C

Experiment Three-A: Critical Scenarios and Target Questions (Regular Definite, Weak Definite, Question)

1. (1) The UPS driver had to go to the church.
The UPS driver had to go to the store.
Was the UPS driver making a delivery in the scene you imagined?
2. (2) The pizza delivery guy had to go to the lawyer.
The pizza delivery guy had to go to the doctor.
Was the pizza delivery guy delivering pizza in the scene you imagined?
3. (3) The florist went to the monument. The florist went to the beach.
Was the florist delivering flowers in the scene you imagined?
4. (4) The mailman went to the courthouse.
The mailman went to the library.
Was the mailman delivering mail in the scene you imagined?
5. (5) The cab driver had to go to the museum.
The cab driver had to go to the bank.
Did the cab driver have a passenger in the scene you imagined?
6. (6) The FEDEX driver had to go to the farm.
The FEDEX driver had to go to the hospital.
Was the FEDEX driver making a delivery in the scene you imagined?

Experiment Three-B: Critical Scenarios and Target Questions (Regular Indefinite, Weak Indefinite, Question)

1. (1) The UPS driver had to go to a church.
The UPS driver had to go to a store.
Was the UPS driver making a delivery in the scene you imagined?
2. (2) The pizza delivery guy had to go to a lawyer.
The pizza delivery guy had to go to a doctor.
Was the pizza delivery guy delivering pizza in the scene you imagined?
3. (3) The florist went to a monument. The florist went to a beach.
Was the florist delivering flowers in the scene you imagined?
4. (4) The mailman went to a courthouse.
The mailman went to a library.
Was the mailman delivering mail in the scene you imagined?
5. (5) The cab driver had to go to a museum.
The cab driver had to go to a bank.
Did the cab driver have a passenger in the scene you imagined?
6. (6) The FEDEX driver had to go to a farm.
The FEDEX driver had to go to a hospital.
Was the FEDEX driver making a delivery in the scene you imagined?

Appendix D

1. Kristi lives and works in Red Wing, MN with her husband and two small children. Her children love to tag along on errands with her. They usually shop locally, but sometimes Kristi knows they won't find what they need in town, and they travel to the Twin Cities to run their errands instead.

This afternoon, Kristi told her kids, "We're going to a store."

2. Andrea works in Menominee, a small midwestern town, and takes a particular interest in local politics. She loves to stay on top of current events, and reads newspapers any chance she can get. She occasionally travels to NYC for work. No matter where she is, she stays in touch with her friends online.

Yesterday, when Andrea's friend messaged her during lunch, Andrea wrote back and said "I'm reading the newspaper."

3. Ezra lives in Ohio. His parents ask him to help out with all kinds of chores, including taking care of their pets, which Ezra particularly enjoys. A few times a year, he travels to Missouri visit his cousins, who also have pets.

Last night, Ezra missed a call from a friend. He called back and said "I was walking a dog."

4. Kent lives in coastal North Carolina with his parents. One of his favorite pastimes is collecting sea shells, and he picks them up whenever he has the chance. Twice a year, the family travel to coastal Florida to visit his grandparents.

Today, Kent wrote an email to his friend, saying: "I went to the beach."

5. Mike lives and works in Owanda, Iowa. He travels abroad a few times a year.

Mike sent a friend an e-mail, saying: "I got really bad stomach pains and had to go to the hospital."

6. Stef works in an Energy company in Portland. She typically commutes to work by bus and takes buses whenever she can. On occasion she travels to different cities as a consultant. She always keeps a daily diary, where she writes down her activities.

She wrote in her diary: "I took a bus to work today."

Appendix E

I always managed to get myself to school in the mornings until I became a PhD student. Now the brightly colored vurrut number 47 picks me and two other students up almost every day. Now that 30's the new 21, why not give us an embarrassing ride along with all that education? Seriously, the thing looks like a jet-propelled Radio Flyer wagon. If my field were sociology or intellectual history, or maybe even xenopsychology, my sellout book would be *The Infantilization of the Intellectual*. But that's not my field.

Marty, our own personal soccer mom, just started driving this year (I actually hate to call it "driving," since it's more like "pushing" or "rolling") and he hasn't quite gotten the hang of how to maneuver the vurrut, so I always buckle up. It's a good idea anyway with the low gravity, since one small bump can really send you flying. The shoulder straps and my protective outerwear make me, I'm sure, resemble a toddler in a snow suit, strapped into a Bugaboo, incapable of scratching my nose and on the brink of having to pee. All the jostling

around doesn't help. It also doesn't help that I overslept, thanks to this being a chondrin, and I almost broke my neck getting out of my hunkel in a hurry to meet Marty. Special environmental conditions aside, I start my day the same way every graduate student does: by asking myself what the hell I'm doing here. Fortunately, I can crank the volume on my ossiphone to drown out my inner dialogue, which is sounding like a broken record even to myself lately. I listen to Irish language ossicasts on my commute, since Ireland just built a hood one kilometer down the Third Spoke. If you knew anything about MC real estate, you'd be raising your eyebrows. The Third Spoke isn't as developed as the First or Second Spokes, but it has 24 hour water and power, and filochut capsules jet pretty frequently from there to the City Center. The only other small country with as big a hood is Israel, which has basically spearheaded development of the entire Ninth Spoke. No surprise there. But this kind of a land- grab isn't typical of the Irish.

New Connemara represents an enormous commitment to the preservation of the Irish language. For well over a century, the Irish government has distinguished districts in Ireland where Irish is the predominant language. But an influx of Polish immigrants, upper-middle class English speakers looking for vacation homes, American television shows, et cetera, have diluted these Gaeltacht areas. Since everything in MC is strictly regulated, the Coimisiún na Gaeltachta can control the population and, to some extent, the linguistic exposure in New Connemara.

I can feel the air change as Marty pushes the clunky vurrit through the tunnel and into the campus bubble. Gates University is the most terrestrial hood besides the City Center. You can breathe freely throughout campus, and all indoor areas are gravitized to normal. The nicest part, though, is the grass. I never knew how much I'd miss grass. And while many of the hoods here have AstroTurf (the name turned out to be pretty appropriate), here at Gates, the Department of Agricultural Engineering has used our campus as a terrestrial lab space. We have a beautiful arboretum that even has a controlled squirrel population, but the grass is my favorite. At least once a week, free from the protective glipper required outside of hoods, I flop down on the grass in the main quad. There is never rain, no weather at all in fact aside from the delightful breeze from the air circulators, and the temperature on campus remains steady and comfortable year-round. If you can ignore the lack of smog and insects, it's practically California.

I don't have time to be homesick today, though. Marty dumped me off on the quad, and I walked straight to my office in Mason Hall, a square latex building (seriously), red like everything else here, with artificial brick-like molding that gives the building an authentic old Earth factory feel. "Greetings, Earthling!" said my officemate, Anssi.

"Doesn't that ever get old?"

He looked at me over the rim of his glasses for a second and pretended to think about it.

"Not really."

"Fuck off," I smiled. Anssi keeps me sane.

"I never use it on Katya, because Russians are a whole 'nother class of alien, as far as I'm concerned," he mused.

"Agreed. You're here early. Have you fed the gang?" I started peeling off my outermost layer of clothing, which was a thin, shiny glipper that I'd ordered in Revlon red. It looked a little like a mylar balloon, only the material thankfully didn't crinkle when you walked.

"Just getting around to that. I made a new chart, this one with boxes for when we give these

guys light.” He handed me a printed calendar grid with a glossary of special symbols at the bottom. Like all Gates students, we are required to share an office with a small animal population. Anssi, Katya, and I were assigned crawfish this year, and the adult female’s eggs had just hatched.

“Shouldn’t Livestock Engineering be giving you feeding charts?” I asked. I stood next to Anssi by the tank and peered in. Big Mama was hiding behind a giant chunk of shimmery areostike, and a few of the baby crawfish were clinging to a plant. The water in the tank had started to look like weak tea.

“Those guys are in over their heads monitoring all the populations. I thought I’d pick up some of their slack,” said Anssi. He opened the lid to the tank and sprinkled in some tiny food pellets and turned on the nutrition laser. Big Mama stuck her head out from behind the log to investigate.

“I don’t think they’re that backed up. Don’t tell me you plan on doing some experiments of your own in here.” Interaction with animals, while required for psychological as well as practical reasons, was also strictly regulated. Anssi looked at me and said nothing.

“Anssi, I’m serious. You’ve told them Big Mama’s eggs hatched, right? Anssi?”

Silence.

“他妈的, this is on you if something goes wrong. At least clean the tank before it starts to reek.”

“Are you kidding? If we wait a while longer, the water will be interchangeable with the department coffee. That’ll save us a few trips downstairs per day.”

“Dude, hey. How’d your meeting with Ash go?” Yuqing looked up at me from one of the comfy seats in the corner of the campus Starbucks. Yuqing was another student in my department, and we shared an advisor, Ash Everett.

“The usual,” I sighed and plopped down in the chair next to her. For the record, I don’t take plopping down for granted anymore: it can only really happen in gravitized enclosures. “I reminded him of what I’ve been working on for the past four years, he dodged all my questions about potential postdoc placements, and then he made some incredibly genius comment that will take me all month to interpret.”

“If he meets with me at all, I count that as a success.” Yuqing began writing a list of some sort on her wrist with a gel pen.

“廢話! You’re so full of it. You’d find away to count a publication in *Cosmos* as a failure,” I said, referring to the premiere interplanetary science journal.

“You’re probably right, dude, but I have his meals to compete with.” Our advisor’s got an appetite, and is a little bit of a space cadet, no pun intended. “I mean, how could I be worth his time? Bill Gates himself would have to have seen 2500 marks lying on the AstroTurf before it would have been worth his time to bend over and pick it up. With Ash, it’s more like 50 marks, but for us, every ment counts. Did you eat lunch? I just beast two grit muffins. If I’d known you were coming, I’d have saved one.”

“Lunch with the Pod People? Nope,” I said, referring to our cliquish group of classmates, most of whom were MC locals. “But don’t worry, Anssi had some extra noodle salad so I ate that. He keeps that bottle of sriracha in our office, so it was pretty tasty.”

“You mean that spicy Asian crap with the rooster on the bottle? My dad used to love that shit.” She wrinkled her nose but didn’t look up.

“Sriracha, yeah. He bartered for it at the Chinese yeshag on the Second Spoke. It must have come off one of the recent grocery shuttles. I’m more of a Cholula or Tobasco girl, but I haven’t managed to find any around here.”

“These aliens don’t know a thing about spice. Still, it’s amazing how Anssi’s not part of the MC social amoeba,” she said as she pulled back her sleeve to continue writing her list of things to do. It was a good point. There was a small number of people my age who had grown up here, and Gates gave those students priority in admissions. The oldest native on record was, in fact, only three years older than I was. He’s not a grad student, though. He’s too busy enjoying his celebrity status and making money participating in experiments, like most of his cohort. MC was the only metropolis for tens of thousands of miles, so people’s attitudes could be very provincial.

“I don’t know. Anssi’s different.”

“Stella, what the hell are we doing here?” Yuqing had put down her pen. “Do you mean Mars or do you mean grad school?” I asked.

I strapped in the vurrit for my ride back to my flat on the Eleventh Spoke and waved goodbye to Nelly, the night pusher. Mars City is laid out like a giant wheel, with the City Center in the middle. The City Center, like Gates, is climate controlled and gravitized to near-normal levels, although it doesn’t look as fancy or terrestrial. No grass. No AstroTurf even, except for in Highland Park, which is the only public sector of MC built to simulate seasons. Sounds fancy, but it just amounts to having an ice skating rink in the “winter” and an outdoor pool in the “summer.” Only the rich could afford to join the high-priced ski trips to Olympus Mons, the tallest mountain in the Solar System. Of course there wasn’t really snow on it, but the resorts there imported the stuff from the poles, and since it never melted, they could control the snow levels with virtual impunity. Twelve commuter filochut pipes protrude from the City Center along the Spokes infrastructure, and since private vehicles are expensive and restricted on Martian soil, most hoods have built up around the Spokes.

Gates, as well as most of the North American sponsored hoods, is on the Twelfth Spoke. I take the little vurrit to work instead of public transit like the filochut because I live two kilometers up the Eleventh Spoke, which is a hodge-podge of utility buildings, Eastern European apartment hoods, and university subsidized student housing. The undergrads are guaranteed two years of housing on campus in the dorms, but after that they typically join us graduate students in the Oldenburg hood in Upper Eleven. I could take an inbound 11 filochut capsule down to the City Center, then transfer to an outbound 12 capsule to get to campus, but Marty and Nelly push their family’s vurrit directly between Oldenburg and Gates twice an hour, six am to ten pm. (They earn a little extra cash from the University for their services, and it saves me loads of time. Even if it is a little embarrassing.)

Not that time works the same way here as it does back home. The time difference is something I’ll never get used to. Days here are longer by about half an hour, so every hour has 61 instead of 60 minutes. To cover the rest of the loss, we have a sort of time adjustment every two months called the chrondin where the clocks reset. I still wear the Earth watch my mother gave me when I graduated high school, which only confuses me more, but most clocks here are thankfully satellite-linked, so I don’t have to keep track of the time changes or chrondin schedules myself. The Pod People give me grief about my early bedtime. I never have adjusted to the longer days. It just means a little more time curled up in my hanging slumber hukkel.

Nobody locks their doors in this hood--there are more surveillance cameras than plasma screen TVs--so I walked into my flat and once again removed my outer layer of protective clothing. When I first arrived at Gates, the guys in my department told me that I should embrace low-gravity sports as a way of coping with the environmental change, and the girls suggested I enjoy adding a whole new layer of fashion to my wardrobe. Truth is, I don't much like sports or shopping. They suck even more on Mars.

I don't relish dressing up in an overpriced glipper just to look like a mylar balloon. Or playing baseball when every hit is a home run. Life in a space colony is not the progressive utopia you imagine. It's also not a tech-savvy bastion of erotically androgynous geniuses wearing sleek synthetic fibers. My apartment can be gravitized with the flip of a switch, but I'd kill for a gas range and a toilet that didn't choke on everything. The reddish dust gets everywhere and screws with circuitry and ball bearings and sinuses. Your boogers are full of Mars at the end of the day. Also the sun is really dim, since Mars is 1.5 times farther away from the sun than Earth. Which means 2.25 times less light, or sunbathing in twilight. And all your clothes take on this rusty hue. Supplies and consumer goods are rationed, so everything in my apartment has a DIY look. More Gismo than Martha Stewart. We use a lot of Elmer's liquid glass on Mars, and we wear Carhart's new Stellar Endurance line. Think Teflon-coated carpenter jeans. Not cool. And we still haven't managed to cosmify bowling. (On the other hand, I do have the most amazing sleep skein ever, called a ven. I got it from my friend Nav. A heavy weight, and yet effortlessly light, the ven comforts and consoles, almost like a meditation experience. Even if you're drunk, sick, or both, my ven makes it all worthwhile, at least until the next morning. My ven could kick the ass of whatever favorite teddy bear, hot water bottle, or blankie you might have.)

Mister Biscotti started crawling up the bars of his cage the second I walked in the door. He's my foster hamster, from one of the Livestock labs. This RA who works there has a crush on me, so he lets me keep Mister Biscotti here in my flat, although technically he's university property. I take him out of his cage every night and let him run around the floor in this plastic pink ball. He loves running in his ball. I went to the cage and stuck a yogurt treat through the bars, which he promptly fit inside his cheek before scurrying into a toilet-paper roll. Biscotti and my ficus bonsai are the only living things I have to come home to at the end of the day. Not that they're the only living things in my building. The upstairs neighbors screw a million times a week, and the girl across the hall cooks a lot of questionably smelling food, so there's life here. I just don't connect with much of it.

My yanawang remote receiving glove buzzed around my thumb. I watched an alpha-memo from Anssi unfold along my index finger: "Am watching the crawfish. There is no joy in my life." I don't have a great reply, so I crawl up the ladder and into my hanging hukkel and go to sleep early, tangled up with my ven.

The next day on the vurrut ride I make some progress with Irish. The voice of the avuncular narrator reminds me that I should focus on what I *can* say, not on what I can't. His voice makes me think of dew and grass and coral beaches, miles of peat bog covering layers of human existence. Earth, if not Ireland. And he tells me to listen, again, to the following dialogue. A woman asking a man whether he wants coffee. Yes, please. Milk? Sugar? No, thank you.

The best language learning tracks are repetitive like that. You hear a dialogue that describes some quotidian interaction, then you hear parts of it slowed down, repeated, over-pronounced, ad nauseam. When you're so bored that you want the vurrut to explode with you in it just for fun, then you know you've learned something. So I contemplate suicide and smile when Seamas tells Una for the fifth time that he would not like sugar, but milk would

be fine. My kind narrator, Fearghal, comes on at the end to offer more encouragement, and I think I actually say “Slan!” to him out loud when he signs off, because Marty chuckles.

I de-mylar in the office and shove my glipper into a drawer. Anssi hasn’t arrived, so I take some time alone with the baby crawfish. At first glance, they don’t exist, but after I hold still in front of the tank for a minute or two, they shyly creep out from behind a hollowed-out log. They’re tiny, translucent, and crescent-shaped, like toenail clippings from an infant. I drop some shrimp pellets into the tank and check Tuesday AM off on the chart Anssi’s made. The giant pellets hurtling toward the areostike gravel were enough to startle most of the hatchlings back into their hukkels, which are suspended inside the hollow log.

It looks like Katya’s been here recently. Her workspace is so immaculate that I notice every slight change. This time, I can see that her computer monitor has been repositioned and her zen rock garden has been rearranged. Seriously, she’s got this tiny sandbox on the side of her desk that has a few round stones in it, along with a miniature rake. I think the gimmick is that you can meditate while you rake the sand. She also has a ven in her office chair. Which isn’t a bad idea, come to think of it. My part of the office is a wreck, and I wouldn’t know the difference if a burglar had rummaged through my stuff looking for a few marks. (That’s what the currency here is called, by the way--the Mars Buck, or marks. It currently trades about three to the dollar.)

Anssi’s space is the Hollywood version of mine. My desk is messy in a tedious way: unsorted journal articles, un compelling graphs of pilot data, crusty coffee mugs, faded photographs from back home. His stuff has character, shows-and-not-tells that he is a paragon of post-exodus indie geekery. Cock sauce and peanut butter on the shelf next to antique copies of the Dungeon Masters Guide and Nabokov. Even a copy of the Bible in Tok Pisin. He has a laser etching pen next to his keyboard, and his screen saver is a scrolling display of the largest prime number ever discovered, which is over thirteen million digits long. Under his desk is a case with a spackler inside it. Spacklers are technically woodwind instruments, but since they are rooted in the ground, performance takes on a visual quality as well. The red Martian dust gets propelled up the main pipe and shoots out in various patterns, all depending on the notes you play. The spackler was the first instrument to be created on Mars, and it’s taken on a special folk status here. Only Anssi would manage to squeeze a spackler under his desk. If there’s no joy in his life, it isn’t because his office is drab.

The Department of Geopolitical Psychology has about thirty grad students at any given time, and eight tenure-track faculty members. It’s meaningless to count, though, since everyone at Gates collaborates with people in other departments. Everything and everyone in MC strives to be multi-purpose. If you can’t be both a doctor and a lawyer, then you’d better at least be intersex. As the name suggests, our department tows the line. Mars, the big red frontier, is a hotbed of geopolitical conflict, and many students have a background in international relations, environmental analysis, or xenopsychology. Ash’s lab is a little different: we’re linguists. Psycholinguists, really. MC isn’t just a physical land-grab. English took over Earth decades ago, mediated somewhat by the sheer mass of China, and English got an early start here as well. But many of the settlements along the MC spokes are heritage enclaves. Hebrew has an enormous presence, for example, in the Israeli sectors. Mandarin is ubiquitous, so it doesn’t hurt that I minored in Asian languages. But my thesis work is on New Connemara, hence the Irish language podcasts. New Connemara represents the largest extraplanetary settlement proportional to its Earth base, in terms of both size and population. And unlike English, Chinese, or even Hebrew, Irish was not exactly thriving back home. I’m doing longitudinal work that charts the growth of the language community and the bleed into other language groups here in MC. The thing is, I don’t believe the story that New

Connemara is just a cosmic Gaeltacht, offering a space for native speakers within its confines. I suspect there's an active language-spreading policy in place, and I want to find out the details and, more importantly, track its success. Yuqing works on a similar project with Chinese. Lately this involves her sitting with elderly Mandarins drinking tea and playing majiang. Sounds like a pretty good gig to me, but it drives her nuts. She says she left Earth to escape that scene. Fair enough.

"They've assigned you a priald," Ash poked his head into my office and startled me.

"Sorry, what?"

"Padraig O'Cinneide. Will be your priald, when you begin your field work. Designated to show you around, answer any of your questions, and probably attempt to control what you see there in New Connemara." Ash chipped away some paint on my doorframe with his thumbnail. Eye-contact was somewhat rare with my advisor. I guess he saves it for special occasions or something.

"The Irish don't want me wandering around their compound alone or what?"

"Having a priald will make your job a little harder, but this shouldn't come as a surprise. Nobody appreciates an academic. You'll learn that soon enough."

"I think I'm there, Ash."

"Then I'm doing my job."

"Dude, the SAS conference submission deadline is today. AND my ven is at the cleaner's, so I'm sleeping like ass. I'm going crazy here," said Yuqing. I could see the faint shadows of yesterday's skin list creeping out from under her sleeve. "Do me a favor and get me a misto?"

"Sure, whole or skim?" I set down my messenger bag in the chair next to hers and glanced at the line: short. We try to time our Starbucks breaks to minimize contact with the undergraduates.

"Man, skim. I'm too lazy to be anorexic, but I'm not looking to be a heifer."

I returned a few minutes later with two mistos--heifer-style for me--and breathed a sigh of relief. I was in a happy place: full gravity, warm cup, friendly face. The Pod People are mostly caffeine free, so they're unlikely to show up here. Coffee on the whole is an expensive and bitter Earth novelty to anyone who grew up here, and a priceless comfort to those of us who did not. "Here, drink up," I said as I handed Yuqing her misto. Her face mirrored my own relief for a split second.

"Thank God, dude, I really need this. I have five hours until the deadline." After savoring the first sip, she immediately put her game face back on.

"SAS is in Nanjing this year?" The Social Architecture of Speech conference is a big one for us, but like most academic conferences, it happens on Earth.

"Yeah, and I have to be there. Well, not BE there, but you know." We had the option of sending a collaborator from a closer university or of delivering the talk ourselves via kinewang, the multi-sensory interplanetary network (6S inter-internet) receiving glove, a fancier yanawang, which fits on your hand and allows you to impose a holographic cast, called a mianmian, of your presentation. Sending your mianmian to Earth via kinewang

costs about as much as a plane ticket from New York to Los Angeles. And that's if you own your own kinewang, or have access to one, which we thankfully do in Ash's lab.

"Proxy or Hollywood-style?"

"Hollywood, def. I want the glory. Ash can pay for it. He's so totally my intellectual sugar daddy. I'm writing up my stuff on the spread of Taiwanese lexical items among Sino-Martian teenagers."

"Taiwanese words? Here on Mars?" The stalemate over the issue of Taiwanese independence continued back home, with Taiwan functionally-but-not-officially self-governing, but only Mainland delegations had been allowed to engage in extra-terrestrial colonization.

"Yeah, these kids go to great lengths to be rebellious. I guess they found some shit on the inter-internet. The Taiwanese word for 'big boobs' or something. Seriously, kids, even I managed to find cooler ways to rebel. It's a stupid side project, but maybe it will get accepted."

"I wish my main squeeze were as cool as your side project." I meant it.

"Oh man, I can't have this fight with you today," she rolled her eyes. "I have to write the abstract."

"What fight?"

"The one where we argue about which of us is more academically screwed."

"There is no fight, Yuqing, because that person is always me."

"Always *I*. And at least Ash likes you. You guys, like, grok or some shit."

"*Always I* sounds douche-noob, FYI. I do have lower expectations than you, and more experience with space cadets and foodies like Ash. But I am way in over my head with this Irish thing. They've assigned me a priald."

"They don't want you bumbling around the Gaeltacht unsupervised, huh? Afraid you will contaminate their brainwashing dens?"

"Muinphiars? They're not brainwashing dens, they're linguistic cleansing treatment centers," I rolled my eyes. "If they're threatened by me, I'm actually kind of flattered. I've got to get a hold of this Padraig guy, though, to figure out what kind of a leash he wants to keep me on."

"Padraig O'Cinneade? He is your priald? He can put me on any kind of leash he likes," she winked. She had set down her misto and pushed aside a notebook.

"How do you know him?"

"You know Vinotas?" She was referring to an annual graduate student soiree.

"I know what it is, but I've never been. I figured it would be a kind of pathetic meat market, where you could get a low-gravity headache, eat synth cheese and crackers, and protect your friends from desperately hooking up with the first engineer that comes along. I've never understood why you go every year."

“Yeah, Vinotas is totally that lame. I just know the one year I don’t go will be the year something amazing could have happened to me. Besides, there is one redeeming factor, dude, and that is the Padraig O’Cinneade factor. He’s def the most interesting thing to come out of the Neuroeconomics Department.”

“Is he a redhead? With a name like that, it seems likely.”

“You got a problem?”

“No, it’s a very precious mutation.” I had a problem.

“Don’t worry, when you meet Padraig, you’ll want to be a baby factory for alien mutants.”

I’m not sure which is more annoying: Padraig O’Cinneade himself, or his harem of jealous Moiras from the Third Spoke Gaeltacht. Good, sweet Fearghal from my ossicasts, who by the way is probably bald and not at all red-headed, did not prepare me to converse with a gaggle of teenage girls. And I tried greeting my chaperone in Irish, but he cut me off immediately and told me that, in his role as priald, he was happy to accommodate an Anglophone. The clenched mandible behind the smile indicated that he’d go to great lengths to avoid hearing me butcher his native tongue. So English it would be, except for when we were visiting any of the linguistically sterile muinphiars, where all young Gaeltacht citizens go for routine cognitive linguistic therapy.

In muinphiars, Padraig told me, I would be allowed to take notes but not to speak at all. I resisted my urge to ask him whether my breathing might also disrupt the careful linguistic cleansing that happens in muinphiars, but then I remembered what Ash said about academics and how they’re never appreciated. I also knew full well that very few outsiders were allowed in the muinphiars at all. Ash sure could pull some strings.

The Coimisiún na Gaeltachta has closed-circuit monitors on every corner of the hood, but that’s practically the norm in MC. What stuck out was that somehow the Gaeltacht had furnished itself with real grass and was almost as lush as the Gates campus. “Do you have a real bog too?” I asked Padraig. He didn’t seem to hear me, but the Moiras following us snickered, and I buried myself in my notebook.

A very soft sort of music was playing over speakers mounted near the cameras. I listened carefully and barely made out the sonorant tones of what sounded like a Gregorian chant. Mental note to ask Anssi whether he knew anything about the folk music scene in New Connemara. As a pack, we made slow progress touring the grounds of the hood. Padraig led, I stumbled along in his wake, and the gaggle fluctuated in size behind us. Padraig met several acquaintances along the way and stopped to converse. In Irish, of course. After the first two or three such encounters, I gave up trying to understand what was being said. Despite his reluctance to talk to me, Padraig was a definite extrovert who was happy to talk to everyone else.

The best part about this new field assignment? The filochut commute. When I first got to MC, filo rides were awkward, because the pneumatics give you a gleeful sensation deep in your diaphragm, and most riders can’t help smiling a little. Kind of like infants who smile when they’re gassy. Shooting through the Spoke pipe network in a small capsule with a bunch of smiling Martians is more disconcerting than you might think. But now that I’m used to it, I really like that cabin pressure can trick my body into feeling happy for a few seconds. In that moment, I don’t just feel content, I feel elated to the core to be here.

Since I had to change filo capsules at the main station, I decided to walk around the City Center for a bit, and maybe grab some xiaolongbao for dinner. Like I said, the City Center's no Gates, but it does have moderately decent gravitation, a Starbucks with free inter-internet, and an Ex-Urban Outlet, for all your overpriced glipper needs. There's also a pretty vibrant night market scene. The biggest market is the one here in the City Center, but you can find yeschags all over the place. Strolling their streets is practically the number one leisure activity here on Mars. They each have their hood or Spoke specialties, but yeschags are all fundamentally the same: you can count on seeing hand-made crafts, pirated DVDs, spackler busking, knock-off clothing, and street food. An iron-oxide mineral dug from the harsh Martian soil, called areostike, had replaced old earth crystals in the mysterious gypsy yeschag culture, so you could buy cheap areostike pendants or meditation crystals or whatever. There are plenty of ramalamadingdong hippies on Mars. But I go to yeschags for the street food, not the areostike. The Gates Student Handbook warns us not to eat at yeschags, since many of the vendors don't have a food distribution license. You hear horror stories about people falling ill with the Martian runs, which is exactly what it sounds like, and other communicable diseases wrapped in your favorite contraband dumpling. But there's no easier, cheaper, or more delicious place to pick up the latest Earth blockbuster and a quick bite. Most things are less than a mark, fifty cents a pop. Unlike the Pod People, many of whom were raised on vitamilk and nutrijerky, I require flavor to survive.

And the yeschags are about the only place where you can get flavor in MC. The City Center Yeschag has oyster omelets, daikon sausage, coffin sandwiches (bread stuffed with delish), pear milk, and even flavored condoms. All manner of crops and livestock are in very short supply here, as you might imagine. Shipments from Earth take between one and four years, depending on the current interplanetary distance, and are frankly too expensive to waste on food, which is considered a luxury and not a necessity among the locals. Attempts to farm and ranch on-planet are still in experimental stages, and it's usually the fruits of these experiments that get used, illegally, in yeschag fare. But to have hot, juicy dumpling sauce drip down your face and onto your glipper? Don't think I haven't eyed my own crawfish once or twice as a potential snack.

Not that I'd do that to Anssi, who is, like most Martians, a vegetarian. He uses more condiments than your average Pod Person, but his diet is still maybe the most alien thing about him.

I stashed a bit of pomelo and gave it to Mister Biscotti when I got back to the Eleventh Spoke hood. Mister Biscotti sniffed at my fingers, which probably still smelled like pophoppers. Then he crawled gingerly onto my palm and picked up the citrus in his front paws before shoving the treat into his cheek pouch and scurrying back into his cage. Just then, my yanawang thumb buzzed. I can't afford mianmian projection or a kinewang glove for 6S casting, but no grad student could survive without at least a yanawang for 2S connections. The 2S glove gives you all local (i.e. planetary) audio-visual access, and also has a biweekly data upload from Earth.

Don't even ask me how much I pay for service--it's on par with rent, and you know renting an apartment on Mars ain't cheap. The glove receiver buzzed again--probably that Padraig or a wangamarketer. I hit the little red "ignore" jewel on the tip of the yanawang pinky and considered hopping into my vlerter.

Depending on your outdoor exposure, and the current planetary-to-sun distance, every few days on Mars you need to cake yourself in a special compound that counters the effect of solar radiation. Every public establishment is required by Martian statute to have a vlerter, and private vlerters get inspected pretty regularly to make sure they're functioning correctly.

I stripped off my glipper and a few marks and ments fell out of the pocket in the inner lining. Fuck it, I'll pick them up later. Then I peeled off my Calvin Kleins (how terrestrial of me) and stepped into the tiny closet. Traveling to and living on Mars is instant exposure therapy for any degree of claustrophobia you might have: you either get over it really quickly, or you go crazy. So the looming porous walls of the vlerter didn't bother me, and neither did the loud pulsing noise of the prad shooting out at my skin. I know all grad students are a tad masochistic, but I kind of like the sting of the vlerter. The dry substance, which is called prad, has to be propelled with enough force to penetrate your pores, and then a special binding liquid comes out as a mist to seal it all in. The first few months I was here, I felt dirty all the time, like I was suffocating in prad, but now I'm used to it. Imagine having makeup all over your body. Or being airbrushed before, not after, your photo is taken. Some people get special vlerter compound, like chromo-prad or luci- prad, which gives them multicolored skin and things like that. Every nightclub in MC has at least two or three blacklight-sensitive people running around trashed. And you can actually get high just from licking them. Back on Earth, we used to dye patterns on our skin with flavored KoolAid, which seems lame by comparison. It didn't prevent cancer, and we could never get a really even tone out of it, but it was something we just did, at sleepover parties or in the high school locker room.

I stepped out of the vlerter and threw on a robe, and then walked back out into the living room and saw the message light blinking on the yanawang I'd tossed aside. Must have been whoever buzzed earlier. I sat down, slid the yanawang onto my hand, and hit the "play" jewel.

"Hi Stella," said the unmistakable voice of Padraig O'Cinneade. "I wanted to do my part as your priald and follow up with you at the end of our first day together. I'm looking forward to working with you on your project. I'm about to start a 36-hour muinphiar treatment, so I won't be available via yanawang or kinewang. But we'll set up our next meeting after that. Oh--don't forget that we have a chroundin coming up. I know Earth folks have a hard time keeping track."

As if I'd ever cast my mianmian to him. All in all, his message was strangely charming, even though he managed to bring up both my other-planetness and my linguistic shortcomings in such a brief message. But I hadn't think about how speaking English to me was going to contaminate him. A 36-hour muinphiar stay? The Gaeltacht was more strict about linguistic exposure than I realized.

And then another message. Someone must have called while I was getting hosed down by the vlerter. "Heya Stellz," crooned the voice of my brother. His voice always knocks the wind out of me. The Earth data dump must have happened while I was getting dusted. The audio message would have been recorded by Laz earlier in the week and then uploaded. "Shane got your package. And he's just at a point when he can open things with a little help from me and Lana. He'll be the only kid in day care with a real Martian glipper. Did I tell you those are getting trendy here? I'd have you send one for Lana, but God knows they'll be out of style by the time it arrives. Shane talks about his Aunt Stella a little bit now, but before you let it go to your head, you should know that he also babbles about the plumber, the gas attendant, and even Miss Rose. You remember, that large soprano at church? She kind of blows his mind. Anyway, I don't have a lot to say. Mom still pretends you might walk off the next UFO and need to be fed, but she's really proud of her space cadet. We're all saving up to cast a family mianmian at Christmas." Most people think language research is about understanding what people say, or what they write, or even just understanding language independent of humans. But one thing I've learned is that what people don't say can be just as informative as what they do say. For instance, Laz had no message for me

from Lana, even though I remember having thrown some areostike earrings in that parcel for her, and he didn't say anything at all about Dad. In other words, there had been no progress back home on Earth: Lana still hated me, and Dad was still gambling...

Appendix F

Weak definite judgment questions

(1) Yuqing got picked up this morning at her Sixth Spoke apartment by a vurrit driver named Harriet and rolled to work. Stella got picked up by Marty's vehicle in front of her Oldenberg flat and rolled to work.

Yuqing rode the vurrit to work today, and so did Stella

(2) Anssi's family ran out of the special protective anti-radiation dust. Coincidentally, Ash's lab also ran out today too. Ash's lab manager bought new prad for the lab from a catalog, while Anssi's mother purchased some prad from a friend.

The lab manager bought the prad, and so did Anssi's mother

(3) Ash was outside all day long, and needed to do a radiation cleanse when he got home. In the Gaeltacht, Padraig also decided today was a good day to take protective measures from the sun's rays.

Ash used the vlerter, and so did Padraig

(4) Yuqing presented at a conference that took place on Earth by broadcasting a mianmian of her talk. That same day, Laz decided to splurge on a high-tech, live action Christmas message for Stella.

Yuqing cast the mianmian, and so did Laz

(5) Katya wanted to pick up a few snacks at a market in the City Center. Over in the Ninth Spoke, a pack of Moiras felt like browsing the latest selection of pirated DVDs available in their neighborhood.

Katya went to the yeschag, and so did the Moiras

(6) Ash needed to let his wife know that he would be home late from the office. Anssi wanted to make a date with a girl he met at Vinotas.

Ash talked on the yanawang, and so did Anssi

(7) When Yuqing began doing research in the Mandarin hood, she was assigned a liaison. When Stella started to investigate the spread of Irish in Mars City, Padraig was in charge of showing her around.

Yuqing was assigned the priald, and so was Stella

(8) Last month, Ash's daughter celebrated a birthday, but people got confused about the time change and ended up being late. Then a few weeks later, Stella overslept and missed an important meeting when the Martian calendar was being reset.

Ash's daughter's birthday was during the chrondin, and so was Stella's meeting

(9) Padraig heard too much English and sought treatment on campus. After one of the Moiras returned to the Gaeltacht from a week long camping trip with some friends, her parents sent her for linguistic treatment in the Hood.

Padraig got sent to the muinphiar, and so did one of the Moiras

(10) Ash was invited to present at a conference in Amsterdam and wanted to cast a mianmian since he couldn't be there. Padraig got a talk accepted at a workshop in Limerick, and his department agreed to pay for him to cast a mianmian as well.

Ash presented on the kinewang, and so did Padraig

(11) Katya decided it was time to clean the crawfish tank and all its contents, including the chunks of mineral. Meanwhile, Nav thought her favorite crystal gypsy earrings were looking a little dingy.

Katya cleaned the areostike, and so did Nav

(12) Stella wanted to go from her flat in the Third Spoke to the City Center to buy new clothes. Anssi planned to go from campus to his aunt's house in the Fifth Spoke hood.

Stella took the filochut, and so did Anssi

(13) Ash ate lunch in a hurry and dropped food on his glipper. Stella spilled coffee on herself in Starbucks.

Ash soiled the glipper, and so did Stella

(14) Yuqing got drunk and wanted something to help her sleep off her hangover in her hukkel. Anssi pulled a muscle and needed something to help soothe his pain while he sat in the office.

Yuqing used the ven, and so did Anssi

(15) It was late on Saturday night, and many people in Oldenburg decided it was time to go to sleep.

Stella climbed into the hukkel, and so did her neighbors

(16) Pod people love the performing arts, which play a big role in the annual Feast of Martius, where the Gates Campus Audio-Visual Orchestra performs one big routine. Both Anssi and Padraig performed in the routine.

Anssi played the spackler, and so did Padraig

Valence assessment statements

1. (1) Vurrits can only be operated on predetermined, public routes.
2. (2) Prad comes in many different types.
3. (3) Vlerters are ubiquitous in Martian buildings, and all serve the same function.

4. (4) Mianmians allow the viewer to see a holographic image in real time.
5. (5) Yeschags are all pretty similar: if you've seen one, you've seen them all.
6. (6) Yanawangs critically allow the user to communicate with anyone in Mars over the local network.
7. (7) Prialds are assigned to serve specific, unique liaison functions.
8. (8) Each calendar chroundin is observed for a different and special reason.
9. (9) Someone needing linguistic treatment could go to any available muinphiar for care.
10. (10) To talk to someone on Earth, any kinewang will do, if you have the money.
11. (11) Areostike pieces all look almost identical.
12. (12) Filochuts only operate along the Spoke lines in Mars City.
13. (13) Glippers are interchangeable: they all look and fit the same.
14. (14) Vens are a personal item: everyone's is special to them.
15. (15) It's a little weird to sleep in someone else's hukkel.
16. (16) Spacklers are all played the same basic way.

Appendix G

Critical Items

1. Imagine you are reading a story. You've just read this sentence:

The cab driver parked at the bank

Which do you think is more likely?

1. The cab driver is picking up a passenger in this scene
2. The cab driver is doing his banking in this scene

What if instead of reading the first sentence, you'd actually read:

The mailman went to the bank.

Would that make it more or less likely that the cab driver was doing his banking (as opposed to picking up a passenger) in this scene?

1. More likely
2. Less likely

2. Imagine you are reading a story. You've just read this sentence:

The UPS man went to the store.

Which do you think is more likely?

1. The UPS man is making a delivery in this scene

2. The UPS man is running errands in this scene

What if instead of reading the first sentence, you'd actually read:

The UPS man parked at the store.

Would that make it more or less likely that the UPS man was running errands (as opposed to making a delivery) in this scene?

1. More likely

2. Less likely

3. Imagine you are reading a story. You've just read this sentence:

The scientist parked at the beach.

Which do you think is more likely?

1. The scientist is collecting data in this scene

2. The scientist is on vacation in this scene

What if instead of reading the first sentence, you'd actually read:

The scientist went to the beach.

Would that make it more or less likely that the scientist was on vacation (as opposed to collecting data) in this scene?

1. More likely

2. Less likely

4. Imagine you are reading a story. You've just read this sentence:

The Fedex driver went to the hospital.

Which do you think is more likely?

1. The Fedex driver is making a delivery in this scene

2. The Fedex driver is receiving medical attention in this scene

What if instead of reading the first sentence, you'd actually read:

The Fedex driver parked at the hospital.

Would that make it more or less likely that the Fedex driver was receiving medical attention (as opposed to making a delivery) in this scene?

1. More likely

2. Less likely

5. Imagine you are reading a story. You've just read this sentence:

The mailman parked at the library.

Which do you think is more likely?

1. The mailman is delivering mail in this scene
2. The mailman is checking out a book in this scene

What if instead of reading the first sentence, you'd actually read:

The mailman went to the library.

Would that make it more or less likely that the mailman was checking out a book (as opposed to delivering mail) in this scene?

1. More likely
2. Less likely

Fillers

1. Imagine you are reading a story. You've just read this sentence:

The grad student went to the diner.

Which do you think is more likely?

1. The grad student is studying in this scene
2. The grad student is getting dinner in this scene

What if instead of reading the first sentence, you'd actually read:

The grad student parked at the diner.

Would that make it more or less likely that the grad student was getting dinner (as opposed to studying) in this scene?

1. More likely
2. Less likely

2. Imagine you are reading a story. You've just read this sentence:

The cable guy parked at a fancy house.

Which do you think is more likely?

1. The cable guy is installing cable in this scene
2. The cable guy is going to a party in this scene

What if instead of reading the first sentence, you'd actually read:

The cable guy went to a fancy house.

Would that make it more or less likely that the cable guy was going to a party (as opposed to installing cable) in this scene?

1. More likely
2. Less likely
3. Imagine you are reading a story. You've just read this sentence:

The chef went to the reception hall.

Which do you think is more likely?

1. The chef is catering an event in this scene
2. The chef is a guest at an event in this scene

What if instead of reading the first sentence, you'd actually read:

The chef parked at the reception hall.

Would that make it more or less likely that the chef was a guest at an event (as opposed to catering an event) in this scene?

1. More likely
2. Less likely

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We investigate definite noun phrases that ostensibly lack uniqueness presuppositions.
We show weak definites are interpreted non-uniquely and evoke familiar activities.
Weak (in)definites convey an enriched interpretation to comprehenders.
Conceptual properties can lead to creation of new weak definites in the lexicon.
We apply a novel analysis of weak definites as cases of noun incorporation.

Figure 1.
Experiment 1 Schematic: A two-toned magnetic board with a male and a female agent, and non-identical tokens of both the critical noun and the distractor noun.

Figure 2.
Experiment 2 Schematic: A one-token and a two-token screen display, respectively.