Gradable nouns as concepts without prototypes*

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For anyone who has ever taken an undergraduate course on conceptual semantics, the following story should sound familiar. Once upon a time, people held to a Lockean, 'classical' view of concepts, according to which the meaning of words like *bachelor* or *bird* can be broken down into a list of necessary and sufficient criteria ('an unmarried man', or 'a feathered, winged creature that lays eggs') and concept membership was a simple, black-and-white matter of meeting all these criteria. Then, in the 1970s, Eleanor Rosch and her colleagues proved this view wrong with a series of psychological experiments, so that nowadays we all believe that concepts are *prototypes* - abstract embodiments of the quintessential bachelor or the most 'bird-like' bird - and concept membership is graded, determined by the degree of resemblance to such prototypes.

But of course, things quickly turn out to be more complicated than this. Membership of concepts like ODD NUMBER is still decided on the basis of definitional criteria - the number 12 is clearly non-odd, despite its high similarity to odd numbers like 11 and 21. Neither is is possible to maintain a clear boundary between concepts with prototype structures and concepts with definitional structures: membership of a concept like GRANDMOTHER, for example, is clearly a black-and-white matter, but at the same time we do possess a notion of the 'quintessential grandmother' - say, a grey-haired, twinkly-eyed lady who spends her days knitting, petting cats and handing out homemade biscuits. In addition, people like Armstrong, Gleitman, and Gleitman (1983) have argued that graded typicality judgements do not necessarily reflect the underlying conceptual structure at all: in a series of studies, they show that even concepts like EVEN NUMBER yield graded typicality judgements, despite the fact that all their participants agreed that no even number could be 'more' or 'less' even than any other even number. Finally, Osherson and Smith (1981) note that reducing concepts to typicality structures predicts the wrong meanings for complex concepts: assuming that the meaning of PET FISH has to be compositionally derived from the meanings of PET and FISH, the classical approach simply defines a *pet fish* as an entity that meets both the criteria for PET and the criteria

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for FISH, while the prototype approach wrongly predicts that membership of the concept PET FISH should be determined by the degree of resemblance to something like a furry, cuddly herring (see also Fodor & Lepore, 1996; Hampton & Jonsson, 2012; Kamp & Partee, 1995; Storms, Boeck, Hampton, & Mechelen, 1999, and many others). In short, it seems a full theory of conceptual cognition needs elements of both Prototype Theory and the classical theory, as well as an account of the way membership judgements are influenced by factors unrelated to prototypicality (e.g. Armstrong et al., 1983; Barsalou, 1987; Kamp & Partee, 1995; Malt & Smith, 1982; Prinz, 2012).
One of the most influential papers offering a concrete hybrid model of the classical and prototype theories of conceptual cognition is Kamp and Partee (1995). Kamp & Partee assume that not all concepts are associated with prototypes; also, those that do are not reduced to their prototypes, but may combine a typicality structure with 'classical', definitional membership criteria.

In this paper, I explore the Kamp & Partee typology of concepts from a linguistic perspective. By empirically investigating the conceptual semantics of 'gradable nouns' like *idiot, nerd, genius* or *sports fan*, I will provide support for several of Kamp & Partee's claims: (1) Not all concepts that have graded membership have a prototype, and vice versa; (2) prototypicality is defined in terms of what I will call 'maximal embodiment' of a concept, and if such maximal embodiment is not possible (because some of the properties that are central to the concept can have potentially infinite values) the concept will lack a prototype. Furthermore, I will claim that the class of nouns that are linguistically gradable (which I will define as 'denoting a predicate with a degree argument', as evidenced by their ability to appear in constructions like (1)) correspond precisely to those concepts that have graded membership but lack a prototype.

(1) a. Sally is a huge sports fan.

b. James is an incredible nerd.

The paper is structured as follows. In section 1, I will introduce a (slightly modified version of) Kamp & Partee's typology of concepts. I will present some linguistic evidence that this typology has a direct correspondent in the semantics of the corresponding natural language expressions, in particular the well-known distinction between *absolute* and *relative* gradable adjectives. I hypothesise that relative adjectives like *tall* and *old* correspond to gradable concepts without prototypes, while absolute adjectives like *open* and *clean* correspond to gradable concepts with prototypes. Furthermore, I claim that nouns like those in (1) fall into the former conceptual class.

In section 2 I move on to the meat of this paper: an experimental investigation of the conceptual semantics of gradable nouns, intended to test the hypothesis that their corresponding concepts lack prototypes. I present evidence that what appear to be prototypicality effects with these nouns (such as Albert Einstein representing the quintessential GENIUS) are correlated with both familiarity and emotional attitude, and propose that they are better analysed in

	-P	**+P**	
		-PE	**+PE**
+V	tall, not red	adolescent	red, chair
-V	inanimate, odd number	grandmother, bird	n/a

terms of 'accessibility', where certain instances are seen as representative of a concept not because they embody the associated properties to a higher degree, but because they are more salient for some reason. (In other words, while we can straightforwardly predict membership ratings for instances of BIRD based on these instances' resemblance to e.g. a robin or blackbird, we cannot predict membership ratings for geniuses based on their degree of similarity to Einstein.) I also present evidence that the properties that are most strongly associated with concepts like NERD and GENIUS are inherently 'limitless' properties, in the sense that it is always possible to come up with an instance of the concept that embodies these properties to an even higher degree; following Kamp & Partee's reasoning, this points towards the absence of a prototype.

Finally, section 3 will reflect on the implications of our experimental findings for the various questions I started out this paper with, and on the Kamp/Partee typology itself; I will also discuss some remaining issues and point out some directions for future research.

1 Kamp and Partee's typology of concepts

In a well-known paper, Kamp and Partee (1995) provide a tentative typology of concepts that is based on three semi-independent criteria: (i) whether a concept is vague or sharp ([±V]), (ii) whether it does or does not have a prototype ([±P]), and (iii) whether its extension is or is not determined by prototypicality (±PE]). The following table, adapted from Kamp & Partee, shows examples for each category: 'Vagueness' is the property of having an inherently imprecise meaning van Rooij (2011); thus,*tall* is vague because it is impossible to define an exact boundary between things that are tall and things that are not. In contrast, 'sharp' defines properties, like *odd* or *even*, whose meaning can be precisely defined: a number is either odd or even, and no number can be more odd or even than another one.

The distinction between [±P] and [±PE] concepts is Kamp & Partee's answer to some of the questions raised in the introduction to this paper. They combine aspects of both the classical theory of concepts and prototype theory by assuming that concepts *have* prototypes but are not reduced to them: so, concepts can have both a prototype structure and 'classical', definitional membership criteria. [-P] concepts do not have prototypes at all (more on the reasoning behind this later). For those concepts that have a prototype ([+P]), resemblance to this prototype usually determines concept membership, but not necessarily so. For natural kinds like BIRD and other concepts like ADOLES-

CENT, concept membership is essentially definitional: one is an adolescent if and only if one is neither young enough to be a child not old enough to be an adult, and one is a bird if and only if one has bird DNA. Nevertheless, instances of ADOLESCENT and BIRD can easily be rated according to their resemblance to an abstract prototype, whose properties might have little in common with the definitional criteria that define membership (for example, self-centeredness and an overpowering smell of Axe body spray as typical properties for ADOLESCENT).

Kamp & Partee also assume that the prototype of a concept C is defined as the abstract entity which is most C-like, i.e. most embodies the dimensions of C; I will call this the *maximal embodiment* interpretation of prototypicality, and examine it in a bit more detail in section 2.2. Kamp & Partee argue that it follows from this that TALL cannot have a prototype: tallness has no upper bound, so there is no entity (not even an abstract one) which is *most tall*.[1] The other reason that concepts like TALL do not have a prototype in Kamp & Partee's typology is that "it can be applied to an indefinite variety of things" - what counts as tall in a human is not the same as what counts as tall in a skyscraper.

1.1 Vagueness and gradability

In the following sections, I will examine the relation between the different concept classes proposed by Kamp & Partee on the one hand, and several linguistic properties of the corresponding natural language expressions on the other. In the present section, I will look at linguistic gradability; in the next section, at the difference between nominal and adjectival concepts.

An (adjectival) predicate like *tall* is gradable if it can hold of an object to a greater or lesser degree; linguistically, this is reflected by their ability to appear in degree constructions like the following:

(2) John is { 6 feet tall. / very tall. / taller than Bill. }

In order to account for the semantics of this predicate, an influential approach (e.g. Cresswell, 1976; Heim, 2000; Kennedy, 1997; von Stechow, 1984, and many others) assumes that they denote relations between entities and degrees ('degree predicates'), as follows:

(3) $\mathbf{tall}_{d,et} = \lambda d \lambda x[\mathbf{tall}(d)(x)]$

[1] Peter Gärdenfors (e.g. Gardenfors, 2004) argues that prototypicality is represented as centrality in a conceptual space. Given that a conceptual space represents similarity, the center of such a space has the property of bearing simultaneously the most similarity to all other points in the space, and the least similarity to all points outside it (cf. Rosch & Mervis, 1975, for experimental results that suggest the same). But in the case of a limitless property (like tallness), there is no such point - for any given instantiation of TALL, for example, there is always another one that bears even less resemblance to the contrasting concept of SHORT (put plainly: something or someone may always be taller). So the conclusion that TALL cannot have a prototype follows also in Gärdenfors's approach.

Degree constructions like the one in (2) involve a comparison between the degree to which a given entity possesses a certain property and some other degree d'; the value of d' is provided by expressions like *six feet* or *than Bill*, or by a so-called *standard degree*. For example, the sentence *John is tall* is usually analysed in terms of a covert comparison between John's height and a standard degree s_{tall}, which is contextually determined and roughly represents the average height of John's peer group.

(4) $[\![\textit{John is tall}]\!] = \exists d[\mathbf{tall}(d)(j) \wedge d > s_{tall}]$

Another class of gradable predicates involves standard degrees that are fixed rather than contextually determined Cruse (1980); Kennedy and McNally (2005). This is the class of *absolute* predicates (in contrast to predicates like *tall*, which are called *relative*): predicates like *open*, *empty*, *safe* and *transparent*. Relative and absolute adjectives show distinct linguistic behaviour, for example in the type of modification they are compatible with: relative adjectives do not allow endpoint modifiers like *completely*, while intensifiers like *very* or *incredibly* are marginal with many absolute adjectives (Bolinger, 1972):

(5) a. Sally is incredibly/*barely/*completely/*maximally tall.

b. The window is *incredibly/barely/completely/maximally open.

A common approach to the relative/absolute distinction assumes that the former lack both a minimal and a maximal value[2], while the latter have either or both. If an adjective has minimal or maximal values, its associates standard degree coincides with one or the other (Kennedy and McNally 2005; see also Cruse 1980; Kennedy 2007; Rotstein and Winter 2004). For example, the statement *the glass is empty* is true if and only if the glass is maximally empty; in contrast, the statement *the door is open* is true if and only if the door has a non-zero degree of openness (Yoon, 1996). If an adjective has neither a maximal nor a minimal value, its standard degree has to be determined by context.

All in all, we can distinguish four classes of adjectives in this way:

(6) a. Relative adjectives: neither a minimal nor a maximal value (*tall*, *intelligent*, *old*)

b. Absolute adjectives with both a minimal and a maximal value (*open*, *closed*, *empty*, *transparent*)

[2]The idea that relative adjectives have no minimal value may seem strange if we consider adjectives like *tall*, *old*, *cheap* or *fast*; after all, we have clear mathematical notions of zero height, zero age or zero speed. However, zero does not appear to be part of the *linguistic* set of degrees corresponding to these adjectives: for example, I find statements like *# My house is extremely slow* or *# I am going faster than that house* to be quite anomalous. Put differently, having a speed, height, or age of absolutely zero is the same as having no speed, height or age at all (Lehrer, 1985). But for any speed, height or age greater than zero - even for a tiny value - we will always be able to imagine someone or something who is, for example, only half that age or height or moves even slower. In other words, the linguistic scale of 'tallness' asymptotically approaches zero (so to speak) and, hence, is usually considered unbounded on both sides.

c. Absolute adjectives with a minimal but no maximal value (*dirty*, *dangerous*, *sick*)

d. Absolute adjectives with a maximal but no minimal value (*clean*, *safe*, *healthy*)

(Note that, for each member of the classes (a) and (b), its antonym is a member of the same class, whereas the antonyms of the adjectives in (c) are members of class (d) and vice versa.)

The Kennedy/McNally approach to the relative/absolute distinction allows us to established our first link between the semantics of gradable expressions and the Kamp/Partee typology. Recall the two reasons for Kamp & Partee to propose that concepts like TALL do not have a prototype: there is no limit to tallness, and its interpretation is context-dependent. In the above approach, these two properties are tied together: all and only all completely unbounded properties have a standard that is determined by context.

The properties of relative adjectives like *tall*, *wide* and *intelligent* clearly place them in the [+V-P] class. How do the concepts denoted by absolute adjectives like *open* and *empty* fit into Kamp & Partee's typology?

First, for those adjectives (like*open*, *empty* and *clean*) that have maximal values, it makes sense to assume that their corresponding concepts have prototypes. Neither of the reasons Kamp & Partee give for TALL's lack of a prototype apply to a concept like OPEN: it can be maximally embodied (once an aperture of some sort reaches a certain level of openness, it simply cannot get any more open), and its meaning does not vary with context the way *tall* does: regardless whether we are talking of doors, mouths, or boxes, *open* retains the same core meaning. A seven-foot human counts as tall, a seven-foot giraffe does not; but doors, mouths and boxes that feature an inch-wide aperture all count as open.

On the other hand, at least part of Kamp & Partee's reasoning about TALL does extend to the concepts (like *dirty*) denoted by adjectives that have minimal but no maximal value: like height, dirtiness is an unbounded property, and cannot be maximally embodied. I will therefore assume that, like relative adjectives, absolute adjectives that lack a maximal degree correspond to concept without prototypes.

Whether absolute predicates are sharp or vague is controversial (e.g. Burnett, 2014; Kennedy, 2007; Lassiter & Goodman, 2013; Lewis, 1979; Sassoon, 2012; van Rooij, 2011). On the one hand, as suggested above, the boundary between things that are P and things that are *not* P seems quite clearly defined with absolute adjectives: even a slightly open door counts as *open*, not as *closed*. On the other hand, there are many examples in the literature of presumably vague uses of absolute adjectives: for example, while the sentence "The restaurant is full tonight" could mean that the restaurant is serving the maximal number of guests, it also has a salient interpretation that can be paraphrased as something like "The restaurant is fuller than expected", where the standard is supplied by context (e.g. the usual number of guests for this restaurants on this particular night of the week) (Rotstein & Winter, 2004). So, depending on which side of

	-P	**+P**	
		-PE	**+PE**
+G	tall, not red, dirty	adolescent	red, chair, open, clean
-G	inanimate, odd number	grandmother, bird	n/a

the debate we pick, we may classify absolute adjectives with maximal values as either [-V+P-PE], on a par with concepts like GRANDMOTHER and BIRD, or as [+V+P+PE], on a par with concepts like RED and FURNITURE.

Is OPEN more like GRANDMOTHER or more like RED? An important parallel between OPEN and RED is that there is a close link between their prototypes and their membership criteria: the prototype of RED captures what it means to be red, and the prototype of OPEN captures what it means to be open. In contrast, as we have seen, the prototypes of GRANDMOTHER and BIRD are independent of what being a grandmother or a bird means: being a grandmother just means being a woman who has grandchildren, not having grey hair and twinkly eyes and being fond of knitting.

I propose the following way out in order to avoid making a commitment on the vagueness of absolute adjectives, which is not really my concern here. Instead of distinguishing concepts on the basis of vagueness ([±V]), I will distinguish them on the basis of (conceptual) gradability: a concept is gradable ([+G]) if it expresses a property that can hold of an object to a greater or lesser degree. This includes all [+V] concepts like TALL, ADOLESCENT, RED and FURNITURE, and also includes OPEN and EMPTY, but it excludes [-V] concepts like ODD NUMBER and GRANDMOTHER.

To sum up: the fact that all the examples Kamp & Partee give of [+V-P] concepts are relative adjectives is not a coincidence. If we define a prototype of a concept C in terms of maximal embodiment of C, it follows that only naturally bounded concepts can have a prototype: for unbounded concepts, no instantiation could ever be *most C*. On the linguistic side, we see this conceptual (un)boundedness reflected in the structure of the degree scale associated with the adjective corresponding to the concept.

1.2 Gradable nouns

In the literature on gradability and degree, the usual examples are adjectives (and adverbs) - however, it has often been observed that other lexical categories may be gradable as well (e.g. Abney, 1987; Bolinger, 1972; de Vries, 2010; Doetjes, 1997; Kennedy & McNally, 2005; Morzycki, 2009; Sassoon, 2007). For example, there exists a class of nouns that behaves exactly like the relative adjectives (modulo independent syntactic differences) - for example, they can be modified by precisely those adjectives that, in adverbial form, modify degree in adjectival predicates:

(7) a. Bill is enormously stupid.

b. Bill is an enormous idiot.

(8) a. Sally is incredibly nerdy.

b. Sally is an incredible nerd.

Moreover, it can be shown that these nouns denote degree predicates by exploiting the observation that such predicates are monotone in the following sense (Heim, 2000):

(9) **Monotonicity of degree predicates**
A function f of type $\langle d, et\rangle$ is **monotone** iff
$\forall x \forall d \forall d' \big[f(d)(x) = 1 \wedge d' < d \rightarrow f(d')(x) = 1\big]$

This monotonicity is detectable in several ways; for example, it is responsible for the following contrast (Katz, 2005; Nouwen, 2009):

(10) a. John is surprisingly/unexpectedly/incredibly tall. (degree reading)

b. John is unsurprisingly/expectedly/credibly tall. (no degree reading)

The reasoning here is as follows. As demonstrated by the entailment pattern in (11), evaluative modifiers like *surprising* are downward monotone: they reverse the entailment relations in their scope.

(11) a. Mary read a romance novel ⇒ Mary read a book.

b. It's surprising for Mary to read a romance novel ⇐ It's surprising for Mary to read a book.

So, when a modifier like *surprisingly* is applied to a degree predicate, the direction of monotonicity of the degree predicate is reversed: [[*surprisingly tall*]] is a predicate for which it holds that $\forall x \forall d \forall d' \big[\mathbf{surprising}(\mathbf{tall}(d')(x)) = 1 \rightarrow \mathbf{surprising}(\mathbf{tall}(d)(x)) \wedge d' < d = 1\big]$. In words: if it is suprising for John to be tall to a degree d, him being tall to any higher degree $d' > d$ would also be surprising. With a non-downward monotone modifier like *unsurprisingly*, there is no such entailment reversal: if it is unsurprising for John to be tall to a degree d, him being tall to any lower degree $d' < d$ would also be unsurprising. But in fact, by the definition in (9), John *is* tall to all lower degrees d'. This makes being *unsurprisingly tall* is a trivial property: everyone with a height, no matter how small, is *unsurprisingly tall*. Nouwen (2009) assumes that such trivially true interpretations are ruled out for pragmatic reasons; hence, the only available interpretation for a sentence like (10a) can be paraphrased as "It is unsurprising/expected/credible that John is tall"

Morzycki-nouns show the same pattern when modified by an evaluative adjective, which can be accounted for straightforwardly when we assume that these nouns, too, denote monotone degree predicates:

(12) a. Bill is an unbelievable/extraordinary/indescribable idiot. (degree reading)

b. Bill is a believable/ordinary/describable idiot. (no degree reading)

In a way very similar to Nouwen's approach above, de Vries (2010); Morzycki (2009) account for the contrast between (8) and the following parallel sentences, which cannot be used to express the proposition that Bill's degree of idiocy is very low:

(13) a. #Bill is diminutively stupid.[3] (no degree reading)

b. Bill is a diminutive idiot. (no degree reading)

Given this strong evidence for the claim that nouns like *idiot* and *nerd* (other examples are *fan, psychopath, airhead, goat cheese aficionado, simpleton, loser* and *weirdo*) are linguistically gradable in exactly the sense that adjectives like *tall* are, we may wonder which aspect of their semantics makes them so. Morzycki speculates that these nouns are gradable because they 'identify a single scale': what makes a *weirdo* a weirdo is just their degree of weirdness, which means that different instances of WEIRDO can easily be ordered on such a scale.

While Morzycki's description is definitely a step in the right direction, I feel it is not entirely accurate. There are nouns like *nerd* that are clearly gradable (as (13b) shows), yet nerdiness is a cocktail of many different properties, and doesn't seem measurable on a single dimension. Conversely, why wouldn't *chair* be gradable, on a single, one-dimensional scale of how much it resembles a typical chair? Just as with absolute adjectives, the bounded end of the degree scale would correspond to maximal embodiment of the prototype. People would easily be able to order a collection of more or less chair-like objects along such a scale. Yet *chair* does not admit degree readings of size adjectives - an *enormous chair* is a physically big chair, not a very typical chair. Finally, it is unclear *why* the distinction between one- versus many-dimensional concepts should play a role in the availability of linguistic gradability in the first place, as many multidimensional adjectives are linguistically gradable (e.g. *intelligent* or *healthy*).[4]

On the other hand, however, the fact that *chair* does not admit degree readings of size and evaluative adjectives may be exactly what we should expect given that CHAIR is a [+P] concept that can be maximally embodied. The same holds for maximal-value absolute adjectives (e.g. "*The door is enormously/unbelievably open"). Perhaps nouns like *chair* correspond to absolute adjectives, being gradable in a similar sense. This is the view espoused by Sassoon (2007): in Sassoon's view, nouns like *chair* are gradable because their referents can be more or less typical examples of the concept the noun denotes. This is supported by the grammaticality of sentences like the following:

(14) a. This object is more a chair than a stool.

[3] I am hashing this sentence because I am not quite sure it is interpretable at all.

[4] (Multi)dimensionality does seem to play a role in nominal gradability in a different way: in a series of papers, Galit Weidman Sassoon argues that multidimensional predicates fall into different classes depending on the way the values of its dimensions are integrated, and that this classification correlates with a predicate's ability to appear in various degree constructions (e.g. Sassoon, 2016; Sassoon & Fadlon, 2015).

b. This object is almost/barely a chair.

In fact, the classes of nouns with which Morzycki and Sassoon concern themselves more or less seem to be in complementary distribution in the same way that relative and absolute adjectives are:

(15) a. Bill is a huge/incredible idiot. (degree reading)
b. This object is a huge/incredible chair. (no degree reading)

(16) a. *?Bill is nearly/barely an idiot.
b. A stool is nearly/barely a chair.[5]

Thus, a possible synthesis of Morzycki's and Sassoon's approaches to nominal gradability, and a connection to our adjectival data, suggests itself: like absolute adjectives, 'Sassoon nouns' are compatible with endpoint modifiers but do not allow size and evaluative degree modification, and like relative adjectives, 'Morzycki nouns' are incompatible with endpoint modifiers but do allow degree readings of size and evaluative modifiers. This suggests that the former class corresponds to [+G+P] concepts (note that this is exactly how Kamp & Partee classify CHAIR), and the latter to [+G-P] ones.

In the remainder of this paper, I will not concern myself much with the conceptual properties of the Sassoon nouns, because Sassoon herself has written on this extensively. Instead, I will focus on empirically defending the claim that Morzycki-nouns denote [+G-P] concepts.

2 Gradable nouns as [-P] concepts

I propose that the class of Morzycki-nouns can be defined in prototype-theoretic terms as exactly those nouns that denote [+G-P] concepts: categories whose membership is gradable, but which lack a prototype. For nouns that are directly derived from [+G-P]-denoting adjectives, this does not actually seem a bold proposal. Dutch, for example, has a relatively productive operation of adding the suffix *-erd* to property-denoting adjectives in order to form a noun meaning 'a person with this property': thus, *slim* 'clever' becomes *slimmerd*, *dik* 'fat' becomes *dikkerd*, *gemeen* 'mean' becomes *gemenerd*, and so on. These nouns, like the adjectives, are all linguistically gradable, so there is no reason to assume that they do not inherit their conceptual structure from the adjective. They exemplify Morzycki's aforementioned definition of a 'gradable noun': a noun with a single measurable dimension. But as I already noted, the class of gradable nouns also includes nouns that seem more complex nouns like *nerd, genius*, and

[5] I am inclined to think that this particular example, as well as (14a), are cases of metalinguistic gradability (cf. McCawley 1988's 'metalinguistic comparison': "Your problems are more financial than legal"), but in later papers, Sassoon has presented more quantificational evidence that at least 'social' nouns (human roles, such as *journalist* and artifacts such as *chair*) are relatively OK in various real degree constructions (Sassoon & Fadlon, 2016). See also section 3 for more on the possible connections between Sassoon's findings and the approach presented in this paper.

perhaps *idiot*, whose interpretation depends on multiple dimensions. Take *nerd*, which is probably the best example. Whether someone can be called a nerd depends on many things: their IQ, computer skills, certain aspects of their look, their knowledge of obscure science fiction movies, and so on. Some of these dimensions may themselves have prototypes. How can we know whether NERD, as a whole, has one?

First, note that for every putative NERD-prototype we come up with, we can, in principle, imagine someone who is even more nerdy: someone whose IQ is ever so slightly higher, whose eyesight is just the tiniest bit worse, whose programming skills extend to just one more programming language. This seems to indicate that the concept denoted by *nerd* cannot be maximally embodied, and hence has no prototype.

Now, consider the concept GENIUS. There are many dimensions one can associate with genius - high IQ, natural talent for a particular art or science, excellence at a very young age, representing a turning point in the history of their field, lasting relevance - and no matter which genius we pick, we can come up with someone who embodies these dimensions more. However, there are certain people we associate with the quintessential genius: 9 out of 10 people will probably mention Albert Einstein when asked to list examples of geniuses, and the name is likely to be on top of most of those lists as well. We can answer the question "Was Albert Einstein a genius?" affirmatively without the least bit of hesitation. All these are measures that are highly correlated with prototypicality (Laurence and Margolis (1999)). So does this mean that GENIUS has a prototype?

I propose the ready availability of Albert Einstein as the quintessential genius is related to the difference between prototypicality - the degree to which a particular instance resembles an abstract prototype - and accessibility: the ease with which a particular instance is retrieved from memory (cf. Ashcraft, 1978). This difference has been demonstrated perhaps most strikingly in the previously mentioned series of studies by Armstrong et al. (1983). When asked to rate different even numbers for exemplariness of well-defined categories like EVEN NUMBER, subjects gave graded responses (favouring 2 and 4 over 34 and 806, for example), even though they all agreed that no even number could be 'more' or 'less' even than any other even number. Armstrong et al. speculate that such choices reflect the identification heuristics we employ when categorising various kinds of objects: for example, when deciding whether a natural number is even, most people will check whether it is divisible by 2, a check that is probably quicker to perform for some numbers than for others. So, graded responses do not necessarily tell us anything about the underlying conceptual structure of a category: they may merely tell us that some instances are faster and easier to categorise than others, with resemblance to a prototype only one of many possible heuristics. This is what I will refer to as the *accessibility* of an instance[6]. I speculate that anything that makes a given instance salient fa-

[6]Armstrong et al. use the term 'exemplariness', but since this might be misconstrued as referring to Exemplar Theory - a competitor to Prototype Theory - I will use a more neutral

cilitates its accessibility; in the case of human nouns like GENIUS this might be factors like: familiarity with someone's life and/or work, the frequency with which this person is mentioned in the media, or a strong emotional opinion on someone. Thus, Albert Einstein counts as the 'quintessential' genius not because he embodies the concept more than anyone else (although he obviously embodies it to a large degree), but because he is extremely well-known to the extent that his name has become synonymous with 'an intelligent person'. There is no sense in which genius is measured in terms of 'resemblance to Einstein' similar to, for example, the way 'bird-ness' is measured in terms of resemblance to a prototypical bird.

In short, I expect that 'typicality' ratings for GENIUS will correlate strongly with (semi-)independent factors like familiarity and emotional attitude. On the other hand, familiarity has been shown not to affect typicality judgements in concepts with clear prototypes such as BIRD Malt and Smith (1982); I expect the same will hold for emotional attitude.

In the remainder of this section, I describe 3 different experiments. **Experiment 1** uses a classic typicality rating task (Rosch, 1973) in order to elicitate typicality ratings for various instances of BIRD and GENIUS. The same participants also rated the same instances on two dimensions that should be independent from typicality: familiarity and emotional attitude. The experiment was designed to substantiate the above claim that graded membership ratings for the concept GENIUS do not primarily reflect degrees of resemblance to an Einstein-like prototype, but are heavily influenced by an instance's accessibility.

2.1 Experiment 1

2.1.1 Method

Participants
An online questionnaire (made with Google Forms) was sent out to a total of 19 participants, recruited from my personal Facebook friends, who participated for a chance to win one of three five-euro gift certificates. All participants were speakers of Dutch and almost all were college or university graduates.

Procedure
The questionnaire consisted of four subparts (the fourth was part of experiment 2 and will be discussed in the next section). Part 2 was a classic category membership rating task, with instructions inspired by Rosch's seminal typicality rating experiment (Rosch, 1973). In this task, participants were asked to rate how well they felt a certain individual represented a given category on a scale from 1 to 7, with 1 representing a perfect example and 7 a really bad one. Part 1 and 3 used the same seven-point scale rating system, but in part 1 subjects were asked to indicate their familiarity with several instantiations of a given

term.

Task 1: familiarity ratings
Your task is to rate each bird and each genius on a scale from 1 to 7, indicating your familiarity with the genius or bird species in question. Give an 1 to birds or geniuses that you know very well; give a 7 to birds or geniuses that are completely new to you; and give suitable intermediate ratings to the ones in between. *(At the top of the page containing the GENIUS instances)* Study the pictured/described geniuses. Do you recognise both the name and the face of the genius, are you aware of their field and the way they contributed to it, do you know the important biographical details? Then give the genius a 1. Have you never heard of this person before? Give them a 7. If the genius looks/sounds familiar to you but you don't know a lot of details, give them a 4, and so on. Follow your intuition: there's no need to keep mental lists of all the facts you know and your knowledge will not be tested in any way. *(At the top of the page containing the BIRD instances)* Study the pictured/described birds. Do you recognise both the name and appearance of the bird, have you often seen it on pictures or in real life, do you know its characteristics and habits (like habitat and food)? Then give the bird a 1. Have you never seen the bird (pictured) before and does its name mean nothing to you, give it a 7. If the bird looks/sounds familiar to you but you don't know a lot of details, give it a 4, and so on. Follow your intuition: there's no need to keep mental lists of all the facts you know and your knowledge will not be tested in any way.
Task 2: typicality
Your task, again, is to rate each pictured individual on a scale from 1 to 7, but in contrast to the previous part it's not about your knowledge of the bird or genius in question, but about the extent to which you feel the pictured individual is a good and representative example of the category in question. If the pictured individual is it a perfectly representative example of what you think it means to be a bird or a genius, give him/her/it an 1. If the pictured individual is a very bad example of the concept - an animal that hardly resembles a bird, a person who you feel isn't much of a genius at all - give him/her/it a 7. A moderately representative bird or genius gets a 4, and so on. Don't think about it too much, just follow your intuition. *(Repeated - just mentioning 'genius' or 'bird', respectively - at the top of both the page containing the GENIUS instances, and the page containing the BIRD instances)*
Task 3: emotional attitude
Study the pictured birds and geniuses and indicate to what extent your feelings about them are positive or negative. Does a particular bird or a particular genius make you super happy, give him/her/it a 1. If you feel it's a very unpleasant individual, give him/her/it a 7. Is your emotion neutral, give him/her/it a 4, and so on. It doesn't matter whether you can justify or explain your feelings; just follow your intuition. *(Repeated - just mentioning 'genius' or 'bird', respectively - at the top of both the page containing the GENIUS instances, and the page containing the BIRD instances)*

Table 1: Instructions for Experiment 1.

concept, while in part 3 they indicated their emotional attitude towards these instantiations.

The questionnaire as a whole was prefaced by a general introduction, explaining that I was interested in questions of categorisation such as "Is an avocado a fruit?" and "Is a skateboard a vehicle?", and the various bases on which people make such decisions. Each individual subtask was prefaced by instructions specific to the task; these instructions were repeated at the top of each page of that subtask, so participants were able to review the instructions at each page of the questionnaire. The instructions (translated from Dutch and slightly shortened) can be found in table 2.1.1.

Stimuli

In each of the 3 parts of the questionnaire, the same two concept names were presented (BIRD and GENIUS), each with 10 instantiations. Instantiations

ROCK BUNTING: this songbird measures 16 cm and occurs in Asia, Northern Africa and Southern Europe. It builds its nest on or near the ground and feeds on insects and birds.
RABINDRANATH TAGORE (1861-1942): Bengali poet, composer, writer, painter, independence and peace activist and educational reformer. Published his first volume of poetry when he was 16 and his first opera when he was 20. Became the first non-Western winner of the Nobel Prize for literature in 1913 and founded his own university with the prize money. Composed the national anthems of both India and Bangladesh.

Table 2: Example of the kind of descriptions used in Task 1, 2 and 3 of Experiment 1.

were presented in the form of a picture accompanied by the name and a short description; examples of these descriptions can be found in table 2. The 10 instances of GENIUS, chosen to represent a wide range of fields, achievements, time periods and nationalities, as well as both genders, were: Leonardo da Vinci, Emily Dickinson, Dmitri Mendeleev, Steve Jobs, Hildegard of Bingen, Marie Skłodowska Curie, Rabindranath Tagore, Albert Einstein, Michael Jackson and Björk. The 10 instances of BIRD, also chosen in order to present a highly diverse list, were: blackbird, ostrich, rock bunting, Egyptian goose, gannet, kiwi, green honeycreeper, emperor penguin, kingfisher and little grebe.

2.1.2 Results and discussion

Table 2.1.2 shows the mean typicality, familiarity and attitude ratings for all instances of GENIUS and BIRD (ordered from high to low typicality).

Following the observations and speculations made by Armstrong et al. (1983); Ashcraft (1978) and Malt and Smith (1982), and my own intuitions about the accessibility factors that might influence people's tendency to identify certain people as 'prototypical' geniuses, I predict that apparent typicality judgements for concepts denoted by gradable nouns (GENIUS, in this case) will be strongly correlated with typicality-independent measures of accessibility (familiarity and emotional attitude, in this case), while typicality ratings for BIRD will be independent from familiarity and attitude: they reflect 'degree of bird-ness' and nothing else.

In order to test this prediction, I obtained Spearman correlation values comparing all responses on task 1 to all responses on task 2, and similarly for task 3 and task 2, for both GENIUS and BIRD. Furthermore (following a suggestion from Galit Weidman Sassoon, p.c.) I calculated individual correlation values for each participant and then checked whether the obtained correlations differed significantly between the BIRD and GENIUS tasks by means of a paired-samples t-test.

The results shown that the prediction is borne out. There are moderately strong and highly significant (α=0.01) correlations between 'typicality' and familiarity and especially 'typicality' and attitude for GENIUS, while the correlations for GENIUS are negligible and/or insignificant (table 2.1.2). Furthermore, as table 5 shows, these differences in correlation - when obtained for each indi-

	Typicality	**Familiarity**	**Attitude**
Einstein	1.4	1.5	2.3
Da Vinci	1.5	1.7	2.1
Curie	2.8	3.2	2.5
Mendeleev	3.2	5.6	3.3
Jobs	3.7	1.8	4.4
Jackson	3.9	1.5	3.8
Tagore	4.5	6.6	3.7
Bingen	4.5	5.5	3.5
Björk	4.7	2.9	3.3
Dickinson	4.8	4.5	3.0

	Typicality	**Familiarity**	**Attitude**
Blackbird	1.4	1.8	2.9
Rock bunting	1.8	6.2	2.5
Kingfisher	1.9	2.8	1.8
Honeycreeper	2.1	6.6	2.0
Gannet	2.8	4.6	3.4
Grebe	3.1	6.3	4.0
Eg. goose	3.2	4.8	4.0
Ostrich	5.3	1.5	3.3
Kiwi	5.4	3.1	3.2
Em. penguin	5.7	2.3	1.7

Table 3: Mean typicality, familiarity & attitude ratings for all instances of BIRD and GENIUS, ordered from high to low typicality.

	Typicality and familiarity	**Typicality and attitude**
BIRD	-0.1858	0.19724*
GENIUS	0.353*	0.58593*

Table 4: Spearman's ρ correlation values between typicality (task 2), familiarity (task 1) and attitude (task 3) ratings. Starred values are significant with $p < 0.01$; the non-starred correlation is significant with $p < 0.05$. N=188.

	Mean: BIRD	Mean: GENIUS	paired t	standard error	p
Typicality-familiarity	-0.2647	0.3900	7.5552	0.087	<0.0001
Typicality-attitude	0.1447	0,5777	3.8397	0.113	0.0012

Table 5: The result of applying a paired-samples t-test to individual participants' Spearman correlation values. N=19.

vidual participant - are also highly significant.

Of course these results only apply to the GENIUS-BIRD comparison, so they are not enough to support any conclusions about the difference between Morzycki-concepts and uncontroversially [+P] concepts in general. What I have hoped to show is that various measures that have been experimentally connected to prototypicality - such as fast categorisation speed, a high chance of being mentioned by many people when asked to list instances of a concept, and a high chance to appear at the top of such lists - may also be the result of other accessibility-facilitating factors, so finding such patterns does not necessarily reflect the prototype structure of a given concept.

2.2 Experiment 2

Experiments 2 and 3 were designed to test the hypothesis that the dimensions most prominently associated with gradable noun concepts involve unbounded gradable properties, while the dimensions most prominently associated with non-gradable noun concepts are either non-gradable or bounded. The motivation behind this is twofold.

First, the degree to which an individual embodies a certain complex concept is a function of the number of associated properties that individual has, but also of the degree to which it embodies these properties. Whether or not a concept has a prototype - whether it is possible to maximally embody that concept - therefore depends on whether it is possible to maximally embody the properties of which this concept is composed. For associated dimensions that involve non-gradable, all-or-nothing properties (such as having eyes or being over 18 years old), maximal embodiment simply means satisfying that property. For dimensions involving specific degrees of gradable properties (such as having light blue eyes or weighing 30 kilos), maximal embodiment means having the ideal value.

But dimensions that involve an *unbounded* degree of some gradable property (such as being tall, having high blood pressure, or loving opera) cannot be maximally embodied, since it is always possible to imagine some individual who is just a tiny bit taller, has a slightly higher blood pressure, or an even greater fondness of opera. From this it follows that any concept that is composed of such unbounded dimensions cannot be maximally embodied. The following hypothesis seems intuitive to me: the more central the role of unbounded dimensions in determining concept membership, the more central the resulting lack of maximal embodiment will be to our understanding of that concept, and the more likely it is to affect the concept's linguistic behaviour. Given our current assumptions, this means that we expect membership of Morzycki-concepts to be determined largely on the basis of unbounded dimensions, while membership of Sassoon-concepts will be determined largely on the basis of non-gradable dimensions or gradable dimensions with an ideal value.

However, this argument hinges on the implicit assumption that *realistic* degrees do not play any role in determining concept membership. This assumption seems somewhat at odds with Rosch and Mervis (1975)'s claim that our mental representation of a concept (and its prototype) is essentially based on family resemblance calculations performed on actual encountered instantiations of that concept. This might lead us to expect that all concept dimensions are naturally bounded by the limits of reality. For example, the heavier a person is the more they embody the concept FAT, which seems to signify that FAT is unbounded, but there are still limits to how heavy a human being can realistically be. Perhaps these natural limits serve to impose a bound on the concept's dimensions, such that it is possible after all to maximally embody a concept like FAT. In other words, while a person who weighs 800 kilos is certainly fatter than a person who weighs only 250 kilos, the latter might be a more prototypical embodiment of the concept FAT because it has more in common with the actual instances of FAT on the basis of which a prototype for the concept might be calculated. If this is the case, our reasoning behind the claim that certain concepts lack a prototype, and consequently our attempt to link this property to linguistic gradability, collapses. Before we can conclude that membership of gradable noun concepts is determined on the basis of unbounded dimensions, we therefore need to show that unbounded dimensions play a role in our conceptual cognition in the first place, regardless of considerations of realism.[7]

In this section, I describe two experiments (the second one a follow-up on the results of the first) designed to test the hypothesis that Morzycki-nouns are mainly associated with unbounded dimensions, while Sassoon-nouns are mainly

[7]This question is reminiscent of the one explored in Barsalou (1985). Barsalou notes that the prototype for goal-oriented concepts like DIET FOOD seems to involve non-realistic values: the best example of a DIET FOOD is a product that contains zero calories, despite the fact that zero-calorie food does not exist in real life. Thus, a concept's prototype can have properties that none of its instances have. Barsalou's ideal-based approach to prototypes isn't fully applicable here because I am discussing [-P] concepts, but at least it shows that conceptual structure is not fully determined by the properties of actually encountered instances.

In this part, you will be shown 5 words for various categories. Your task is to list, for each category, what you think are characteristic properties for a member of this category. Here is an example for the category DOG: Characteristics of a dog: - it barks. - it has a long tail. - it wags its tail. - it reaches approximately to my knees. - it makes a very good pet. - it can do tricks. - it hates cats. This task is NOT about free association: perhaps dogs remind you of your eccentric Great Aunt Margot or of that one time the neighbours' dog ate your homework, but don't write 'Great Aunt Margot' or 'homework'. It's about characteristic properties a typical dog possesses according to you. It does not matter whether you can think of exceptions - not all dogs hate cats, but it's still a property that I strongly associate with a typical dog and that's why I included it in the list above. Guidelines: 3 to 8 characteristics for each category, or what you can think of in approximately 30 seconds. Just write down what naturally occurs to you, don't force anything - it doesn't matter whether you write down a lot or a little.

Table 6: Instructions for Experiment 2.

associated with bounded ones. Experiment 2 consisted of a dimension-naming task, as in Rosch & Mervis (1975). Rosch and Mervis (1975) observe that the dimensions that are most often listed by people are also the most accurate predictors of prototypicality; the results of Experiment 2 should give us a fairly good impression of the dimensions that are most prominently associated with a concept, and hence of the properties that play the largest role in determining concept membership. Subsequently, Experiment 3 was designed to test whether a new set of participants preferred bounded, unbounded or non-graded 'all-or-nothing' interpretations of the dimensions elicited in Experiment 2.

2.2.1 Method

Participants
Experiment 2 was part of the same Google Forms questionnaire that also included Experiment 1, and served to break up the various subtasks of Experiment 1. It had the same 19 participants as Experiment 1.

Procedure
Participants were presented with five nominal concept names at a time (once in between Task 1 and Task 2, once in between Task 2 and Task 3 of the questionnaire), 10 concept names in total. They were asked to take approximately 30 seconds per category name and make a list of properties they associated with members of this category. Each part was preceded by identical instructions, which were closely modeled on the ones used by Rosch & Mervis (1975; their Experiment 1); a translated and slightly abridged version can be found in Table 6.
Stimuli
Five Morzycki-nouns and five Sassoon-nouns were used in Experiment 2, with

the classification based on my own intuitions about their compatibility with evaluative and size modification. The nouns were included in randomised order, but not individually randomised for each participant.

(1) **Sassoon:** BIRD, CAR SALESMAN, VEGETABLE, ITEM OF FURNITURE, STUDENT (all single words in Dutch)

(2) **Morzycki:** NERD, HIPSTER, FRATBOY, ARSEHOLE, NEUROTIC

2.2.2 Results

The results of Experiment 2 were tallied, and the five most commonly mentioned dimensions were identified for each concept. The threshold of 5 dimensions was chosen because most less-commonly mentioned dimensions were often mentioned just once or twice and/or seemed a result of free association (e.g. 'comedy' for NERD, 'San Francisco' for HIPSTER or 'free as a bird' for BIRD). On average, participants listed the following number of dimensions for each concept: ITEM OF FURNITURE 3.2, CAR SALESMAN 3.4, STUDENT 3.5, VEGETABLE 3.8, BIRD 4.9; NEUROTIC 2.6, ARSEHOLE 3.1, HIPSTER 3.5, NERD 4.4, FRAT BOY 4.9.

There were several ties, which I resolved by collapsing some very similar properties. For example, I collapsed several HIPSTER properties like 'obsessed with 'pure' and 'authentic' food', 'coffee geek' and 'loves rare beers' into one umbrella dimension 'preoccupied with special, unique and 'pure' foods/beer/coffee', and collapsed 'perfectionist', 'control freak' and 'obsessed with tiny details' into 'very detail-oriented' in the case of NEUROTIC.

The five most commonly named dimensions for each concept can be found in table 7.

2.3 Experiment 3

For the motivation behind Experiment 3, see section 2.2.

2.3.1 Method

Participants
Experiment 3 was sent out as a Google Forms questionnaire to 23 people (also Dutch, recruited from my personal Facebook friends, and participating for a chance to win a gift certificate), approximately a week after Experiment 1/2. The two groups of participants overlapped to some extent: between 9 and 15 participants in Experiment 3 had previously filled out the questionnaire that included Experiments 1 and 2[10].

[10]Participants could provide their e-mail addresses in order to compete for the gift certificates; there was an overlap of 9 addresses between the first and second questionnaires, in addition to 6 participants (in total) who did not provide an address.

BIRD	**CAR SALESMAN**	**VEGETABLE**
Has feathers	Smartly dressed	Healthy
Has wings	Smooth talker	Green
Flies	Untrustworthy	Grows on the ground
Lays eggs	Friendly, jovial behaviour	Cooked before eating
Has a beak	Knowledgeable about cars	Eaten for dinner[8]
FURNITURE	**STUDENT**	
Practical use	Attends college/university	
Used inside the house	Young (early twenties)	
Made of wood	Active social life	
Has legs	Intelligent	
For sitting or putting things on	Lives in a student room/dorm	
NERD	**FRATBOY**	**HIPSTER**
Good with computers	Drinks lots of beer	Alternative/eccentric style
Wears glasses	Posh accent[9]	Has a beard
Intelligent	Wears a suit jacket & tie	Wears glasses
Socially awkward	Loud	Obsessed with special, unique
Peculiar interests/obsessions	Arrogant	and 'pure' foods/beer/coffee
		Loves obscure bands
ARSEHOLE	**NEUROTIC**	
Mean, unsympathetic personality	Nervous, agitated behaviour	
Mean, unsympathetic behaviour	Very detail-oriented	
Is a man	Worries a lot	
Selfish	Has tics and compulsions	
Doesn't care about others	Insecure	

Table 7: Results of Experiment 2: the five most commonly mentioned dimensions for each concept.

Procedure
Participants were presented with a list of 50 items (divided into 5 blocks, each on a new page), each based on one of the concept dimensions listed in Table 7. Each of these dimensions was presented in three different ways, and participants were asked to choose the formulation they felt captured the membership criterion most accurately. The questionnaire as a whole was prefaced by a short introduction identical to the introduction to Experiment 1/2, explaining that I was interested in questions of categorisation such as "Is an avocado a fruit?" and "Is a skateboard a vehicle?", and the various bases on which people make such decisions. This introduction was followed by an instruction, a translation of which can be found in Table 8. A short summary of the instructions (without the examples) was repeated at the top of each of the 5 pages of the task.
Stimuli
Each of the 50 dimensions obtained in Experiment 2 was presented in three different ways, and participants were asked to choose the formulation they felt captured the membership criterion most accurately. Thus, for example, one dimension associated with NERD would be the wearing of glasses, which was then formulated in three different ways (the labels 'all-or-nothing', 'bounded' and 'unbounded' have been added here for clarity and were not part of the original items):

(3) A real, typical nerd:

a. **All-or-nothing:** wears glasses.

You will be shown 50 membership criteria for various concepts, for example "A typical dog weighs around 25-30 kilograms" or "A typical vehicle has wheels". Each of these criteria is formulated in several different ways. For instance:
A typical vehicle:
(a) has wheels
(b) has 4 wheels
(c) has an even number of wheels
(d) has wheels; the more the better
Your task is to choose the formulation that, according to you, best represents how you would apply this particular criterion when you are judging whether something or someone is a member of a given category or not. In the above case, you could choose (a) if you think that having wheels as such is important, not so much the particular number of wheels; (b) if you think a vehicle with 4 wheels (like a car) is clearly a 'better', more typical vehicle than a vehicle with some other number of wheels (like a bicycle or a train), and (c) if you feel that vehicles with an even number of wheels (bicycle, car, train) are more typical than vehicles with an odd number of wheels (unicycle, tricycle, rickshaw). Finally, you could choose option (d) if you think that vehicles with lots of wheels are inherently more typical than vehicles with few wheels. NB: 'better' here means "a better example of the category VEHICLE" - it has nothing to do with a positive value judgement.
If your favourite option isn't listed, choose the one that most resembles it.
The given options are different for each question, but always speak for themselves. It is important to follow your intuition when choosing an answer. There are no right or wrong answers and it doesn't matter one bit whether your answers are rational or consistent.

Table 8: Instructions for Experiment 3.

b. **Bounded:** wears strong glasses, but not ridiculously strong ones.

c. **Unbounded:** wears glasses; the stronger the better.

For a complete list of items, see Appendix B.

According to the 'unbounded' option, a higher score on a particular dimension also means a higher concept membership score, regardless of whether this is realistic. According to the 'bounded' option, typical instantiations of a certain concept possess a certain quantifiable property, but only up to some extent. According to the 'all-or-nothing' option; the degree to which an instantiation possesses a certain property is not important, and the only relevant distinction is between individuals that have the property and individuals that lack it.

In formulating the bounded options, I deliberately used modifiers like 'excessively', 'ridiculously' and 'unrealistically' in order to present these boundaries as natural and realistic; I surmised that if people picked the unbounded option regardless of its implied excessiveness or ridiculousness, this would indicate that considerations of realism did not play a role in determining concept membership along the dimension in question.

All items followed the pattern exemplified above: a description of the form *A real, typical X:* followed by the 3 options, always in the same order (all-or-nothing, bounded, unbounded). The 50 items of the questionnaire (10 concepts x 5 dimensions) were presented in 5 blocks, each containing one dimension for each concept, in random order.

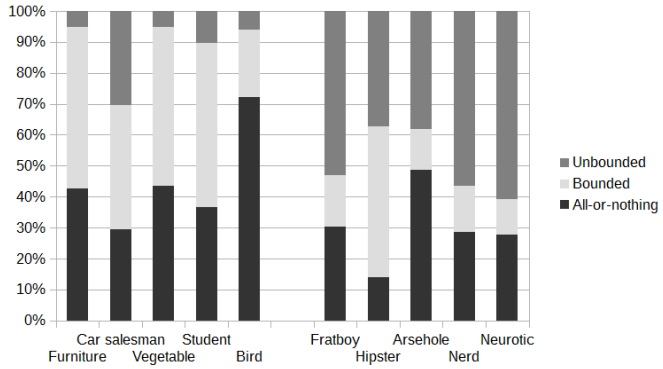

Figure 1: Total proportion of picks for each of the three dimension types. The Sassoon nouns are on the left, the Morzycki nouns on the right.

2.3.2 Results and discussion

The predictions of the present approach were borne out. For the Sassoon nouns, participants overwhelmingly favoured the bounded and all-or-nothing options; but for the Morzycki nouns, they picked the 'unbounded' options significantly more often. The graph in figure 1 shows the total proportion of all-or-nothing, bounded and unbounded picks for each of the 10 concepts. To make sure the differences were not purely due to one or two different dimensions, I assigned a final label to each of the 50 dimensions based on the type that was picked most often (thus, a dimension that has more 'all-or-nothing' responses than either of the other two types was labelled 'all-or-nothing', and so on). The results become even more pronounced, as shown in figure 2: the only Sassoon noun with a dimension that was judged unbounded by a majority of participants was *car salesman* (the dimension in question was 'is a smooth talker'), while all Morzycki nouns had at least one unbounded dimension (and three of them at least 3 out of 5). Finally, I made sure that the differences between Sassoon and Morzycki nouns held within individual participants by comparing the number of all-or-nothing, bounded and unbounded responses for each participant across the two noun categories by means of a paired-samples t-test. The results can be seen in table 9. As the table shows, all three dimension types showed a significant difference: people picked the all-or-nothing and bounded options significantly more often for the non-gradable nouns, and the unbounded options significantly more often for the gradable nouns.

3 Discussion and conclusions

The results of these small-scale experiments support the hypothesis that the class of 'Morzycki-nouns' - nouns that pattern with relative adjectives in allow-

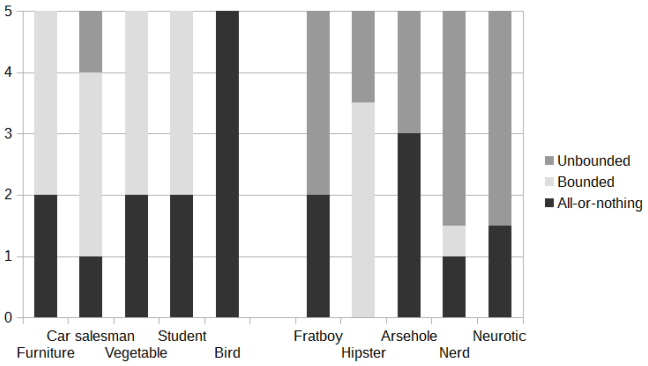

Figure 2: The number of all-or-nothing, bounded and unbounded dimensions for each concept; the assigned type is the one picked most often by the participants. The Sassoon nouns are on the left, the Morzycki ones on the right.

	mean no. of picks: Morzycki	mean no. of picks: Sassoon	paired t	standard error	p
All-or-nothing	7.48	11.22	3.5850	1.043	0.0016
Bounded	5.22	10.91	6.9805	0.816	<0.0001
Unbounded	12.3	2.87	9.221717	1.023	<0.0001

Table 9: Comparison between the number of all-or-nothing, bounded and unbounded picks for the five Morzycki nouns and the five Sassoon nouns, for each individual participant, by means of a paired-samples t-test. N=23.

ing size and evaluative modification, but not endpoint modification, and can be shown to be linguistically gradable using several monotonicity-based tests - correspond to [+G-P] concepts in Kamp & Partee's typology, just like relative adjectives. They also show that considerations of realism do not seem to play a role in determining concept membership for [-P] concepts (supporting an understanding of prototypicality in terms of maximal embodiment and nothing else). Moreover, the results of Experiment 1 suggest that the fact that some [-P] concepts, like GENIUS, intuitively seem to have a prototype may actually reflect independent aspects of instance accessibility.

Let us briefly return to the questions I started out this paper with. In the introduction I tentatively concluded, following many others, that an accurate theory of conceptual cognition probably needs elements from both Prototype Theory and the classical, definition-based theory of concepts. Previous researchers have mainly based this conclusion on philosophical and psychological arguments; I have added a linguistic one. By showing that the various concept classes identified by Kamp & Partee (1995) show distinct linguistic behaviour (and conversely, that various natural language expressions that show distinct linguistic behaviour also fall into different concept classes), I have provided additional support for the psychological reality of such a typology - most importantly, the distinction between concepts that have prototypes and concepts that lack them (or whose prototypes do not determine their extension).

A few problems and questions remain. First, it should be noted (as an anonymous reviewer did) that the Kamp & Partee-inspired argument based on which I claimed that concepts like NERD lack prototypes - it is always possible to imagine someone who embodies the concept more - also holds for concepts like GRANDMOTHER, yet GRANDMOTHER is commonly assumed (also by Kamp & Partee) to have a prototype and does not correspond to a Morzycki-noun. I do not have an immediate answer to this, but I speculate that an answer may be sought in another aspect of the Kamp/Partee typology I did not really go into: the [±PE] distinction between [+P] concepts whose extension is determined by typicality and [+P] concepts whose extension is determined by definitional criteria. Note that it is usually possible to 'coerce' [±G+P-PE] concepts like GRANDMOTHER into [+PE] concepts:

(4) I spent all day on the couch. I feel like such a granny.

(5) a. Mary was acting like a big girl.

b. John was acting like a big girl.

The speaker of (4) does not mean that she feels like a woman who has grandchildren; instead, she's claiming something about her resemblance to the GRANDMOTHER prototype. The contrast in (5) is particularly striking: if we use *big girl* to describe someone who fits the definitional criteria of GIRL, the adjective *big* receives its standard intersective size interpretation: to act like a big girl, for a girl, is to act like a girl who is big. In contrast, if we use the same

predicate to describe someone outside of the extension of GIRL, *girl* effectively starts behaving like a Morzycki noun, meaning something like 'girlish person'. When used this way, the size adjective receives a degree reading: to act like a big girl, *for a boy*, is to act very girlishly (. Do these 'coerced' versions of GRANDMOTHER and GIRL have prototypes, and if they do, what would that mean for the present analysis of Morzycki nouns as [-P] concepts? Perhaps future research may show the [-P] hypothesis is too strong in its current form.

Another interesting observation involving [+P-PE] concepts may connect the present approach to the work of Galit Weidman Sassoon on nominal gradability. Intuitively, [-PE] concepts are concepts that somehow 'exist independently' from the way they are experienced by humans, while [+PE] concepts are defined by human perception. There is no law of nature deciding which objects count as *furniture* and which do not - *furniture* is a category made up by humans in order to describe something they created. On the other hand, platonic objects such as circles and natural kinds such as grandmothers 'exist' and obey certain natural laws regardless of human perception or activity. In other words, there seems to be an intuitive connection between what Sassoon calls 'social nouns' - human roles and artifacts - and [+PE] concepts on the one hand, and natural kind nouns and [-G-PE] concepts on the other. Recently, Sassoon and Fadlon (2015) have shown that social nouns are significantly more compatible with various degree constructions than natural kind nouns; following the Kamp/Partee typology, the latter correspond to sharp concepts (or non-gradable concepts, in my adaptation), while the former (necessarily) correspond to vague (or gradable) ones. Sassoon and Fadlon (2015) account for their findings in a different way, claiming that the differences in linguistic gradability drives from the different ways the values on the concept's dimensions are integrated into a single degree scale, but perhaps there is a way to unify or at least connect the two approaches.

Finally, let me point out a possible connection between emotional attitude and linguistic gradability. Many of the Morzycki-nouns are quite emotionally charged (either positive or negative), while the Sassoon-nouns generally are more neutral. Furthermore, Dutch has a reliable way to come up with new Morzycki-nouns by compounding any noun with an expletive from its impressive collection (such as *kut* 'cunt', *klote* 'bollocks' or *tering* 'tubercolosis') - e.g. *kutklus* 'detestable job', *klotehond* 'awful dog', *teringwereld* 'horrible world'. These linguistically gradable compounds are evidently highly emotionally charged as well. I do not have an immediate explanation for this, but I do not think it is a coincidence - note also that the Sassoon noun that behaved most like the Morzycki nouns in Experiment 3 was *car salesman*, which people also tend to have an emotionally charged reaction to (among the properties most often attributed to car salesmen in Experiment 2 was 'untrustworthy', and properties in the vein of 'slick', 'smarmy' and 'pushy' also got several mentions). Hopefully, further research will shed more light on the relation of emotional attitude to the linguistic gradability of nouns.

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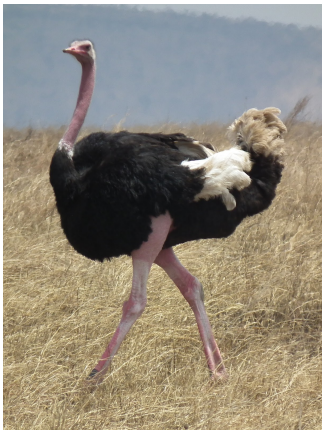
All experimental materials below are translated from the original Dutch.

A Experiment 1

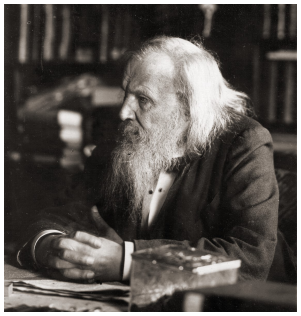
The items on the two lists below were shown 3 times at different points in the questionnaire; each time, all 10 instantiations of the concept were shown in the same order and on a single page. In each of the 3 parts, subjects rated each item on a 7-point scale (by ticking a box) according to a different criterion: first, familiarity; second, typicality; and third, emotional attitude. Items consisted of a name and a picture with a mouse-over description.

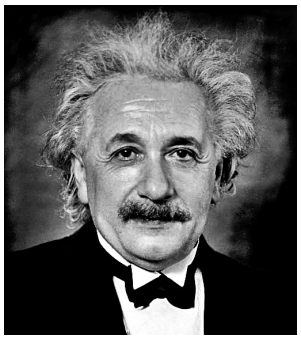
Birds		
Name	**Picture**	**Mouse-over text**
Blackbird		This 25-cm-tall songbird occurs mainly in Europe. It's an omnivore with an extensive song repertoire.
Ostrich		The ostrich lives in Africa and is the biggest bird on earth. It can't fly but it can run very fast. Females lay their eggs in a common nest and take turns brooding.

Birds - continued from previous page		
Rock bunting		This 16-cm-tall songbird occurs in Asia, Northern Africa and Southern Europe. It nests on or close to the ground and feeds on insects and seeds.
Egyptian goose		This waterfowl isn't actually a goose but a duck. Originally from Africa; the ones we find in the Netherlands are feralised ornamental birds.
Gannet		This large, aerodynamic seabird hunts for fish in the North Sea and Atlantic Ocean. Its legs and wings are weak, so it can only fly in strong winds. Is a stellar diver.
Kiwi		This New-Zealand bird is roughly the size of a chicken, but lays eggs six times the size of a chicken's egg. It can't fly and is mainly nocturnal.
Green honeycreeper		A small tropical songbird that occurs in Central and South America. Feeds predominantly on nectar.

Birds - continued from previous page		
Emperor penguin		The biggest penguin; measures up to 120 cm and weighs up to 45 kilos. Subsists mainly on fish. It can't fly, but it can dive up to 500 meters deep and stay underwater for up to 18 minutes.
Kingfisher		This 16-cm-tall bird occurs in Europe, Asia and Northern Africa. It dives for fish and nests in steep riverbanks.
Little grebe		This small, shy water bird is related to the great crested grabe. It occurs in large parts of Europe, Asia and Africa and feeds mainly on water insects and larvae.

Geniuses		
Name	**Picture**	**Mouse-over text**
Leonardo da Vinci		(1452-1519): Italian artist, scientist, architect and inventor. Considered one of the best painters ever, with the Mona Lisa as his most famous work. His designs include things as wide-ranging as defence works, musical instruments to unbuildable but ingenious flying machines. Was also a gifted astronomer and physiologist.

Geniuses - continued from previous page		
Emily Dickinson		(1830-1886): American poet who lived her life in near-total seclusion. Published only a few poems during her lifetime (which her publisher adjusted to conform to the age's style and taste; her enormous body of work was only discovered after her death. Now considered one of the greatest American poets, whose unconventional style placed her far ahead of her time.
Dmitri Mendeleev		(1834-1907): Russian chemist and inventor of the Periodic Table of Elements, a spatial ordering of all chemical elements based on their properties, which came to him in a dream. It correctly predicted the existence of various elements that hadn't yet been discovered.
Steve Jobs		(1955-2011): Entrepreneur and pioneer of the 70s computer revolution. Saved the struggling Apple company with innovative technology and groundbreaking, iconic design. Was also CEO of Pixar, which under his leadership produced several of the most critically acknowledged animation films ever.
Hildegard von Bingen		(1098-1179): Benedictine abbess, writer, poet, composer, mystical theologian, scientist and philosopher. Is considered one of the founders of natural history as a scientific field. For her religious poetry, she invented her own script and hundreds of new words. Her music is still regularly performed.

Geniuses - continued from previous page		
Marie Skłodowska Curie		(1967-1934)[11]: Polish-French physicist and chemist, pioneer in the field of radioactivity (which eventually caused her death). She was the first female professor at the university of Paris, the first woman to win a Nobel prize, the first person to win a second Nobel prize, and the only recipient of two Nobel prizes in different categories.
Rabindranath Tagore		(1861-1942): Bengali poet, composer, writer, painter, independence and peace activist and education reformer. Published his first volume of poetry when he was 16, and his first opera when he was 20. Was the first non-western winner of the Nobel prize for literature (in 1913) and used the prize money to found his own university. Wrote the national anthems of both India and Bangladesh.
Albert Einstein		(1879-1955): German physicist and founder of the theory of relativity. At 27, in a single year, he published 4 revolutionary physics papers on different topics, written in his spare time next to his day job as an office clerk. Published over 300 scientific articles during his lifetime and won a Nobel prize in 1921.
Michael Jackson		(1958-2009): Eccentric singer, songwriter, dancer and producer known as the 'King of Pop'. Began his singing career as a five-year-old, in the family group The Jackson Five. His album 'Thriller' is the best-sold album of all time; the eponymous music video is considered revolutionary and is the only music video ever to be included in the American national film registry.

[11] Note the typo in these dates (1967 instead of 1867); I do not expect this to have influenced the results in any way.

Geniuses - continued from previous page		
Björk		(1965-): This Icelandic singer and multi-instrumentalist released her debut album when she was 11. Is known for her groundbreaking, avant-gardistic music and unique music videos, on which she collaborates with international film directors, artists and fashion designers. In 2011, she released an album consisting fully of interactive apps, which has since been included in the permanent collection of the MoMA in New York. Has also received multiple acting awards.

B Experiment 3

The items on the list below were shown in blocks of 10 items per page; within each page, items were randomised differently for each participant. Each item started with the statement "A real, typical X..." followed by 3 possible continuations; first, an All-or-nothing one (A); second, a Bounded one (B); and third, an Unbounded one (U). Participants had to choose exactly 1 of the continuations by ticking a box.

The Dutch construction translated here somewhat inaccurately with 'but not' is *maar ook weer niet* ('but also again not'), which is used to qualify a previous utterance by explicitly negating a stronger alternative, e.g. *Ze was boos, maar ook weer niet woedend* 'she was angry, but not exactly furious'. It is somewhat weaker than plain 'but not'; a speaker who utters *maar ook weer niet X* seems to be hedging her commitment to the belief that X is false. As a result, the B continuations involve a slight asymmetry that is mostly lost in the translations below: the boundedness of the property is of secondary importance to possessing it in the first place.

Items: NERD	**Page**
A real, typical nerd: A has a peculiar hobby/interest that he/she puts a lot of time into and knows a lot about. B has a peculiar hobby/interest that he/she puts a lot of time into and knows a lot about, but not an unrealistic lot. U has a peculiar hobby/interest that he/she puts a lot of time into and knows a lot about - the more the better.	1
A real, typical nerd: A has great computer skills. B has great computer skills, but not unrealistically great.	2

NERD - continued from previous page	
U has great computer skills - the greater the skills, the better.	
A real, typical nerd: A is socially awkward. B is socially awkward, but not extremely socially awkward. U is socially awkward - the more socially awkward, the better.	3
A real, typical nerd: A wears glasses. B wears strong glasses, but not ridiculously strong. U wears strong glasses - the stronger, the better.	4
A real, typical nerd: A is intelligent. B is intelligent, but not absurdly intelligent. U is intelligent - the more intelligent, the better.	5

Items: FRAT BOY	**Page**
A real, typical frat boy: A behaves in an arrogant manner. B behaves in an arrogant manner, but not absurdly arrogant. U behaves in an arrogant manner - the more arrogant, the better.	1
A real, typical frat boy: A wears a suit jacket and tie. B wears a suit jacket and tie, but not 24/7. U wears a suit jacket and tie - the more often the better, he preferably sleeps in them too.	2
A real, typical frat boy: A has a posh accent. B has a posh accent, but not extremely posh. U has a posh accent - the posher, the frattier.	3
A real, typical frat boy: A drinks a lot of beer. B drinks a lot of beer, but not an unrealistic lot. U drinks a lot of beer - the more, and the more frequently, the frattier.	4
A real, typical frat boy: A is loud and obnoxious. B is loud and obnoxious, but not ridiculously loud and obnoxious. U is loud and obnoxious - the louder and more obnoxious, the better.	5

Items: HIPSTER	**Page**
A real, typical hipster: A wears glasses. B wears glasses, but not extremely prominent ones. U wears glasses - the more prominent, the more hipsterish.	1
A real, typical hipster: A has an alternative, eccentric style. B has an alternative, eccentric style, but not extremely alternative or eccentric.	2

HIPSTER - continued from previous page	
U has an alternative, eccentric style - the more alternative/eccentric, the better.	
A real, typical hipster: A has a long and/or wild beard. B has a long and/or wild beard, but not extremely long or wild. U has a long and/or wild bird - the longer/wilder, the more hipsterish.	3
A real, typical hipster: A loves obscure music. B loves obscure music, but not extremely obscure. U loves obscure music - the more obscure and unknown, the better.	4
A real, typical hipster: A is preoccupied with special, unique and 'pure' food/coffee/beers. B is preoccupied with special, unique and 'pure' food/coffee/beers, but not extremely obsessed by them. U is preoccupied with special, unique and 'pure' food/coffee/beers - the bigger his/her obsession, the better.	5

Items: ARSEHOLE	**Page**
A real, typical arsehole: A cares little about other people's needs. B cares little about other people's needs, but is not completely uncaring. U cares little about other people's needs - the less, the better.	1
A real, typical arsehole: A has an unsympathetic personality. B has an unsympathetic personality, but also not pathologically unsympathetic. U has an unsympathetic personality - the more unsympathetic, the better.	2
A real, typical arsehole: A is a man. B is a man, but not an absurdly masculine testosterone bomb. U is a man - the more masculine, the better.	3
A real, typical arsehole: A behaves in a rude, mean manner. B behaves in a rude, mean manner, but not excessively rude or mean. U behaves in a rude, mean manner - the worse and the more often, the better.	4
A real, typical arsehole: A is selfish. B is selfish, but doesn't always think of nobody but himself. U is selfish - the more selfish, the better.	5

Items: NEUROTIC	**Page**
A real, typical neurotic: A worries about everything. B worries about everything, but not inordinately deeply or frequently.	1

NEUROTIC - continued from previous page	
U worries about everything - the deeper and more frequent the worries, the more neurotic.	
A real, typical neurotic: A has tics and compulsive tendencies. B has tics and compulsive tendencies, but moderately. U has tics and compulsive tendencies - the more, the more neurotic.	2
A real, typical neurotic: A behaves in a nervous and agitated manner. B behaves in a nervous and agitated manner, but not excessively nervous and agitated. U behaves in a nervous and agitated manner - the more nervous and agitated, the more neurotic.	3
A real, typical neurotic: A is insecure. B is insecure, but not overly insecure. U is insecure - the more insecure, the more neurotic.	4
A real, typical neurotic: A is focused on tiny details. B is focused on tiny details, but not absurdly so. U is focused on tiny details - the more focused, and the more trivial the details, the better.	5

Items: BIRD	**Page**
A real, typical bird: A lays eggs. B lays eggs, but not extremely many. U lays eggs - the more the better.	1
A real, typical bird: A flies. B flies, but not all day long. U flies - the longer and the more often, the better.	2
A real, typical bird: A has feathers. B has feathers, but also spots without feathers. U has feathers all over its body, the more the better.	3
A real, typical bird: A has wings. B has wings, but not overly prominent ones. U has wings - the more prominent the better.	4
A real, typical bird: A has a beak. B has a beak, but not an extremely big or striking one. U has a beak - the more big/striking, the better.	5

Items: CAR SALESMAN	**Page**
A real, typical car salesman:	1

CAR SALESMAN - continued from previous page	
A knows a lot about cars. B knows a lot about cars, but not an extreme lot. U knows a lot about cars - the more, the better.	
A real, typical car salesman: A dresses smartly. B dresses smartly, but not *too* smart. U dresses smartly - the smarter, the better.	2
A real, typical car salesman: A is a smooth talker. B is a smooth talker, but not absurdly smooth. U is a smooth talker - the smoother, the better.	3
A real, typical car salesman: A is untrustworthy. B is untrustworthy, but not extremely untrustworthy. U is untrustworthy - the more untrustworthy, the better.	4
A real, typical car salesman: A behaves in a friendly and jovial manner. B behaves in a friendly and jovial manner, but not overly friendly and jovial. U behaves in a friendly and jovial manner - the more friendly and jovial, the better.	5

Items: FURNITURE	**Page**
A real, typical item of furniture: A has a surface for sitting or putting something on. B has a surface for sitting or putting something on, which is neither too big nor too small. U has a surface for sitting or putting something on - the bigger the surface the better.	1
A real, typical item of furniture: A is made of wood. B is made of wood, but also incorporates other materials. U is made of wood - the more wooden bits it has, the better.	2
A real, typical item of furniture: A is used inside the house. B is used inside the house, but sometimes outside too. U is used only inside the house, never outside.	3
A real, typical item of furniture: A serves a practical purpose. B serves a practical purpose, but also has an aesthetic/artistic component. U serves a practical purpose - the more practical, the better.	4
A real, typical item of furniture: A has legs. B has 4 legs. U has legs - the more legs, and/or the higher their prominence, the better.	5

Items: VEGETABLE	**Page**
A real, typical vegetable: A is eaten for dinner. B is eaten dinner, but occasionally as part of other meals too. U is eaten for dinner and never as part of another meal.	1
A real, typical vegetable: A is healthy. B is healthy, but not some extremely healthy superfood. U is healthy - the healthier, the better.	2
A real, typical vegetable: A is green. B is mainly green, but has some other colours too. U is green - the greener the better.	3
A real, typical vegetable: A needs to be cooked before you can eat it. B needs to be cooked before you can eat it, but not too long. U needs to be cooked before you can eat it - the longer the better.	4
A real, typical vegetable: A grows on the ground (and not on a tree). B grows on the ground, but not directly on the ground. U grows on the ground - the closer to the ground, the better.	5

Items: STUDENT	**Page**
A real, typical student: A lives in a student room/dorm. B lives in a student room/dorm, but often returns to his/her parents. U lives in a student room/dorm and spends as little as possible time at his/her parents'.	1
A real, typical student: A studies at college or university. B studies at college or university, but isn't focused on his/her studies 24/7. U studies at college or university - the more time spent on studying, the better.	2
A real, typical student: A is intelligent. B is intelligent, but not absurdly intelligent. U is intelligent - the more intelligent, the better.	3
A real, typical student: A is young. B is young, but not extremely young. U is young - the younger the better.	4
A real, typical student: A has an active social life. B has an active social life, but not outrageously active. U has an active social life - the more active, the better.	5