Antonymy and Canonicity: Experimental and Distributional Evidence

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Abstract

The present paper investigates the phenomenon of antonym canonicity by providing new behavioural and distributional evidence on Italian adjectives. Previous studies have showed that some pairs of antonyms are perceived to be better examples of opposition than others, and are so considered representative of the whole category (e.g., Deese, 1964; Murphy, 2003; Paradis et al., 2009). Our goal is to further investigate why such *canonical pairs* (Murphy, 2003) exist and how they come to be associated. In the literature, two different approaches have dealt with this issue. The *lexical-categorical approach* (Charles and Miller, 1989; Justeson and Katz, 1991) finds the cause of canonicity in the high co-occurrence frequency of the two adjectives. The *cognitive-prototype approach* (Paradis et al., 2009; Jones et al., 2012) instead claims that two adjectives form a canonical pair because they are aligned along a simple and salient dimension. Our empirical evidence, while supporting the latter view, shows that the *paradigmatic* distributional properties of adjectives can also contribute to explain the phenomenon of canonicity, providing a corpus-based correlate of the cognitive notion of salience.

1 Introduction

Antonymy is one of the most important semantic relations between words and/or word-senses (Lyons, 1977; Cruse, 1986; Murphy, 2003; Jones et al., 2007; Jones et al., 2012; Paradis et al., 2009; Paradis et al., 2012; Van de Weijer et al., 2012) and a key organizational principle of the mental lexicon and of adjectives in particular. One important phenomenon about antonymy is that some adjectival pairs are perceived to be better examples of the relation than others, even when near-synonymic alternatives are available (Murphy, 2003; Paradis et al., 2009; Jones et al., 2012). For example, if we ask what the antonym of *hot* is, the majority of speakers will answer *cold*, even if *freezing* and *cool* are near-synonyms of *cold* and both express opposite concepts of *hot*. Thus, *hot – cold* is perceived as a better example of antonymy than *hot – freezing* or *hot – cool*. Antonymic pairs such as *hot – cold* are typically called *canonical antonyms* (Murphy, 2003) and the whole phenomenon – which is the central topic of the present paper – is known as *antonym canonicity*.

As first showed by Deese (1964) and later confirmed by others psycholinguistics studies (Gross et al., 1989; Charles and Miller, 1989; Paradis et al., 2009), members of canonical pairs are the ones eliciting one another in free word association tasks and whose responses are shared by the majority of speakers. Additionally, canonical pairs are perceived to be in opposition even when no context is available and they are stable across word senses (Lehrer, 2002; Murphy, 2003). Murphy (2003) and Paradis et al. (2009) claim that a canonical pair arises when two words that are semantically in opposition become "conventionalized" as a pair in language, that is they are strongly associated and learnt as a form-sense unit. Thus, cognitive evidence suggests that conceptual opposition is not a sufficient condition for an antonymic pair to be a canonical pair. At this point two questions arise: why do canonical pairs exist at all? What are the conditions that determine antonym canonicity?

Another question concerns the nature itself of canonicity. Gross et al. (1989) support a dichotomous

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view, according to which a small group of canonical antonyms is strictly contrasted with a larger group of non-canonical ones. On the other hand, the fact that speakers are able to discriminate between "better" and "less good" instances of antonymy led some linguists to suggest that canonicity is a scalar phenomenon showing a prototypical structure, rather than a dichotomous one (Herrmann et al., 1986; Murphy, 2003; Paradis et al., 2009). In this sense, antonymic pairings would be aligned along a continuum of "goodness of opposition" with a few pairs – canonical ones – as representative members of the relation. As also confirmed by the data reported in the following sections, it is possible to individuate different degrees of canonicity, depending on reciprocal elicitation frequency of the adjectives, a fact that we also use as the main criterion to define canonicity.

The aim of this research is to bring new evidence on antonym canonicity and on its possible explanations. In particular, we show that pairs of adjectival antonyms with different degrees of canonicity exist in Italian as well, thereby complementing available data about English and Swedish and supporting the cross-linguistic validity of the phenomenon. In the next section, we discuss the two main models of canonicity. In the second part of the paper, we present the results of an elicitation experiment and distributional analysis of Italian canonical antonyms.

2 Models of canonicity

The existence of a group of antonymic pairs whose members elicit one another in free word association tasks was first reported by Deese (1964). He noticed that this kind of association seems to be consistent with most frequent English adjectives and proposed that two adjectives form a canonical pair because they share linguistic contexts (Deese, 1964; Deese, 1965). Two major models of canonicity have been proposed in the literature. Following the terminology used by Paradis et al. (2009), we refer to them as the *lexical-categorical approach* and the *cognitive-prototype approach*.

The former approach was developed within the structuralist framework, which is based on the assumption that the relations are the semantic primitives, meanings therefore derive from the relations words have among them in the lexical network (e.g., Lyons, 1977). In this sense, antonyms form a set of "stored lexical association", with an adjective having or not having a canonical antonym. This view is best exemplified by the way adjectives are organized in the Princeton WordNet model (Miller, 1995). Antonymy is treated here as a lexical relation and a group of canonical pairs – the *direct* antonyms – is strictly contrasted with a group of non-canonical ones – the *indirect* antonyms –, thereby creating a strict dichotomy. In order to explain canonicity within the lexical-categorical model, Charles and Miller (1989) claim that Deese's idea that direct (canonical) adjectives share linguistic contexts can be defined in two different ways: according to the *substitutability hypothesis*, two adjectives are learned as direct antonyms because they are interchangeable in most contexts, while according to the *co-occurrence hypothesis*, direct antonyms co-occur in sentences significantly more often than chance. Charles and Miller (1989) bring psychological evidence supporting the latter view, and Miller and Charles (1991) add that the substitutability hypothesis by itself would not allow to discriminate between antonyms and synonyms, since they both tend to co-occur in similar contexts. Additionally, Justeson and Katz (1991) individuate some syntactic patterns in which antonymic adjectives are often found to co-occur, such as *between X and Y* and *X or Y*. Moreover, Fellbaum (1995) argues that also nominal, verbal and cross-categorical antonyms (e.g., *to begin* (V) – *endless* (Adj)) co-occur in a sentence more often than chance, suggesting that antonyms do not have to be adjectives or to belong to the same syntactic category to express semantic opposition. Therefore, antonym canonicity would be explained by the syntagmatic nature of the relation, in accord with the co-occurrence hypothesis (Charles and Miller, 1989; Justeson and Katz, 1991).

On the other hand, the *cognitive-prototype approach* – developed in the Cognitive Linguistic framework – argues that producing antonyms is not a matter of automatic lexical association but a knowledge-driven process (Murphy and Andrews, 1993; Murphy, 2003; Paradis et al., 2009). Meanings are here considered to be conceptual in nature, therefore they do not form a stored network but are constantly negotiated by the speakers in the contexts where they occur, thanks to general cognitive processes (Paradis et al., 2009; Paradis et al., 2015). As suggested by Murphy and Andrews (1993) and later showed by Jones et al. (2007) and Van de Weijer et al. (2012), conceptual opposition turned out to be the cause of lexical relation, instead of the other way around. This evidence has led to treat antonymy as a context-sensitive semantic relation. In this respect, canonicity is a scalar

phenomenon: Antonymic pairs are aligned along a continuum from "better" to "less good" examples of the relation – as first noted by Herrmann et al. (1986) –, but at the same time the category shows a prototype structure (Murphy, 2003; Paradis et al., 2009). Various studies have in fact pointed out the special status canonical antonyms enjoy, since the members of a canonical pair have both a relation of opposition and a strong lexical entrenchment in memory. The relation is therefore semantic *and* lexical (Jones et al., 2007; Paradis et al., 2009; Van de Weijer et al., 2012; Jones et al., 2012). In diagnosing an adjectival pair as canonical, Paradis et al. (2009) suggest that what is crucial is the dimension of *alignment*, which has to be cognitive salient. This means that the antonymic pairs perceived as the best examples of the relation by the speakers would be the ones describing simple (i.e., easily identifiable) properties, in which the two members occupy the opposite poles, with equal distance from the midpoint.

The behavioural data on Italian adjectives reported in the sections below confirm that antonym canonicity has indeed the gradient nature predicted by the cognitive-prototype model. Moreover, we show that canonicity has also an important distributional correlate, which however does not depend on their syntagmatic co-occurrence, as claimed by Miler & Charles (1989), but rather on their paradigmatic distributional similarity.

3 Elicitation Experiment

We have conducted an elicitation experiment to identify antonymic pairs with different degrees of canonicity in Italian. Each participant was asked to provide the best opposite for some Italian adjectives, divided in two different test sets. The antonymic pairs obtained in such way were classified accordingly to the frequency of reciprocal elicitation. Subject's production frequency has then been used to categorize the elicited data into canonical and non-canonical pairs: *Two adjectives A and B are canonical if and only if A elicited B as the most frequent response and vice versa*.

The elicited pairs were later analysed with respect to their frequency of co-occurrence (in terms of Pointwise Mutual Information, as a measure of association strength). The aim was to evaluate the lexical-categorical approach, in particular to test whether the co-occurrence hypothesis provides a good explanation of canonicity.

Even if the experiment was designed following the guidelines of Paradis et al. (2009), stimuli were selected on the basis of a different criterion, namely concreteness. Moreover, we also added adjectives that could generate morphologically derived antonyms. Furthermore, according to the view of canonicity as a scalar phenomenon (Herrmann et al., 1986; Murphy, 2003; Paradis et al., 2009), we expect that the number of response for each adjective will be extremely variable.

3.1 Stimuli

Two different datasets were used in the elicitation experiment and tested separately. The first set – Set_1 – was formed by 70 Italian adjectives selected manually on the basis of their concreteness: 35 were concrete adjectives – describing a concrete property (e.g., *aperto* "open") – while 35 were abstract ones (e.g., *felice* "happy"). Unmarked members of canonical pairs from Paradis et al. (2009) and Jones et al. (2007) were included in this test set, conveniently translated. The second test set – Set_2 – was formed by all the adjectives elicited by Set_1, removing duplicates and items already included in Set_1. Set_2 has therefore been used to investigate which adjectives mutually elicit each other. Set_2 consists of 132 stimulus words. Nonce words were included in both Set_1 and Set_2 and subjects were instructed to identify them. This was necessary in order to ensure that all participants were native Italian speakers.

3.2 Task

The task was performed on the online crowdsourcing platform *Crowdflower.com*[1]. Each participant was asked to provide the best opposite for 10 randomized adjectives from one of the two test sets. For each item a specific blank space was provided. Responses were automatically collected by the platform. Twenty answers were collected for each stimulus word. An example was given in the instructions, along with the recommendation to write one single word for each stimulus and mark nonce words. The participants were all Italian native speakers.

[1] *Crowdflower.com* allows users to access an online workforce of millions of people to clean, label and enrich data.

3.3 Results

As a pre-processing step, orthographic and typing errors were corrected and non-pertinent responses were cancelled (e.g., synonyms). Nouns, verbs and adverbs were eliminated or transformed into adjectives.

Data were then analysed taking into account the number of distinct responses provided from the participants for each stimulus adjective. As expected, the results confirm the previous findings stating the existence of a continuum of lexical association (Herrmann et al., 1986; Paradis et al., 2009). The mean value of distinct responses per adjective is 2.85, but the number varies from a minimum of 1 to a maximum of 10 distinct responses (see Table 1). The standard deviation value, 2.96, indicates that the majority of stimulus elicited just one or two antonyms. Moreover, Set_1 was more consistent than Set_2. Set_1 responses mean value is 2.14 (sd 1.54), while Set_2 responses mean value is 3.23 (sd 2.53).

Type-Token Ratio and Entropy were calculated in order to evaluate the amount of dispersion in responses. An entropy value equal to 0 was observed for 75 stimulus adjectives, suggesting they all elicited one and the same antonym (e.g., *veloce* "fast", *buono* "good", *vivo* "alive", *facile* "easy"). The highest entropy values were instead observed for abstract adjectives and for a group of Set_2 stimuli (e.g., *sciocco* "fool", 0.92; *austero* "austere", 0.9; *serio* "serious", 0.85; *libero* "free", 0.75).

Category	Response mean	Std. deviation	Entropy mean
All Stimuli	2.85	2.96	0.22
Set_1	2.14	1.54	0.15
Set_2	3.23	2.53	0.25

Table 1. Response and entropy mean for the two datasets.

We investigated to what extent adjective frequency estimated in a corpus[2] and concreteness influence the amount of dispersion in responses – in terms of entropy values. The first parameter does not seem to be correlated with entropy values (Pearson's correlation value, r= -0.211), indicating that the number of responses obtained is independent from the frequency the adjective is used in texts. On the other hand, there is a significant difference between entropy values of concrete and abstract adjectives, the abstract ones eliciting more different antonyms (Wilcoxon: p-value < 0.001, W=6670).

Stimuli were then paired with each antonym and we recorded the reciprocity of their elicitation, taking into account how many times the two members of each pair elicited one another (i.e., the frequency of reciprocal elicitation across participants). Among the 446 pairs emerged, 250 were not analysed because one of the members was not included in the stimuli. Remaining pairs were classified on the basis of their frequency of reciprocal elicitation into three groups: non-reciprocal, reciprocal and canonical. We observed 66 non-reciprocal pairs and 130 reciprocal ones. The canonical antonyms are a subset of the reciprocal pairs, for which the first member elicited as most frequent response the second one and vice versa. These consist of 65 pairs (see Appendix A).

Furthermore, different patterns of adjective reciprocity were individuated. Participants strongly agreed on 24 pairs, which were perceived as perfectly binary. Two different antonyms were provided for 16 adjectives in a one-to-two match. In the majority of these cases the two options were respectively an opaque and a morphologically derived antonym (e.g., *attivo – passivo/inattivo* "active – passive/inactive", *felice – triste/infelice* "happy – sad/unhappy", *vestito – nudo/svestito* "dressed – naked/undressed", *perfetto – difettoso/imperfetto* "perfect – defective/imperfect"). The other two reciprocity patterns were one-to-many and many-to-many. We observed the former in five cases (i.e., *concreto* "concrete", *comico* "comical", *fragile* "fragile", *libero* "free", *intelligente* "smart"), in which a single adjective elicited up to 8 possible antonyms and the relation held also in the opposite direction. Four instances of the many-to-many patterns were observed (i.e., *mobile* "movable", *improvviso* "sudden", *calmo/tranquillo* "calm/quiet", *sbagliato* "wrong"), where multiple and complex relations arose defining a highly complex semantic field of antonyms and synonyms.

[2]The adjectives frequencies were recorded on the Italian online corpus PAISÀ. It is a fully annotated corpus of authentic contemporary Italian texts from the web. It contains about 250M tokens. It is freely available at this website: http://www.corpusitaliano.it/.

In order to look more deeply into the canonicity phenomenon and its lexical or semantic nature, we recorded on the Italian online corpus PAISÀ the co-occurrence frequency of each pair[3] – and compared it with their expected frequency. The difference turned out to be always statistically significant (chi-squared test: p-value < 0.05), both for canonical and non-canonical pairs.

Pointwise Mutual Information (PMI) was also calculated and used as a measure of lexical association between the adjectives. We limited the analysis only to pairs with co-occurrence frequency ≥ 5. These were 217 pairs: 63 canonical – 27 abstract and 36 concrete – and 154 non-canonical – 91 abstract and 63 concrete. Moreover, pairs were marked according to frequency of production in both directions. Complete production data were observed for 138 pairs – all the 63 canonical pairs and 75 non-canonical, 36 concrete and 39 abstract.

There is a significant difference between the PMI of canonical and non-canonical pairs (t-test: p-value < 0.001, t = 6.7144). This confirms the statement that canonical antonyms have a strong lexical association. Actually, the correlation values between PMI and subjects production frequency reveal an interesting pattern. For canonical antonyms, no significant Pearson's correlation was observed (r = 0.107), suggesting that even the best examples of the relation could have a low PMI value. Conversely, the correlation between PMI and subject production frequency for non-canonical pairs is significantly higher (r = 0.419): The more the two members of a non-canonical pair are lexically associated the more they tend to elicit one another.

Concreteness does not influence these values. Even if abstract adjectives elicit more possible antonyms, abstract and concrete pairs are not significant different with respect to PMI values (t-test: p-value=0.1928, t=-1.3068). Both (non-)canonical abstract and (non-)canonical concrete pairs can be found and we can assume that concreteness is not a parameter of influence in canonicity. However, it is worth noting that the majority of abstract pairings – both canonical and non-canonical – are morphologically derived.

To sum up, both canonical and non-canonical pairs co-occur significantly more often than chance, against the prediction of the lexical-categorical approach. On the other hand, it is true that canonical adjectives have higher association strength as measured by PMI, even if this value does not correlate with subject production frequency. That is, there are frequently produced canonical pairs, which have low values of association strength. Conversely, PMI appear to correlate (albeit moderately) with the subject production frequency of non-canonical pairs. We can surmise that the fact they are strongly associated allow speakers to recognize them as antonyms, increasing their production frequency.

4 Distributional Analysis

The results of the elicitation experiment did not fully support the lexical-categorical model of antonym canonicity, and are instead consistent with the gradient interpretation of canonicity advocated by the cognitive-prototype approach. However, the notion of "salient dimension", which is central to the latter model, is not defined in a precise way. Moreover, when a pair such as *hot – cold* – whose dimension is clearly identifiable as TEMPERATURE in its basic literal interpretation – is used in a metaphorical sense, its dimension of alignment is not equally easy to identify.

With the aim of providing a more solid empirical grounding to this notion, we propose a distributional interpretation of the concept of "salient dimension" as similarity of the nominal contexts co-occurring with adjectives. Therefore, we argue that the salience of the dimension expressed by canonical adjectives depends on the fact that they share a high number of similar nominal co-occurrence contexts. As a matter of fact, if – as stated by Lehrer (2002) – a canonical pair can extend its opposition to a new semantic field when one of the members acquires a new sense, we would expect both members of the opposition to occur with the same nouns, thanks to the great amount of possible ontological domains they can apply in. Moreover, Paradis et al. (2015) demonstrate that members of canonical pairs are used in the same semantic contexts and structures not only when they co-occur but also when they are used individually. In the present case, we define nominal contexts of co-occurrence as the nouns each adjective modifies or is a predicate of. We have then represented adjectives with distributional vectors and used the cosine as a measure of context similarity. Since we assume that canonical pairs share a higher number of contexts than non-canonical ones, we predict that

[3]Co-occurrence frequencies were estimated using a text window from 0 to >3, specifying both words had to be tagged as adjective, and restricting search within sentence boundaries.

the cosine values of canonical pairs are significantly higher than those for non-canonical pairs.

4.1 Data

The distributional analysis was performed on the 138 pairs with co-occurrence frequency ≥ 5 and mutually produced by the subjects. Eight pairs were removed because one of the members was not included in the distributional model used for this analysis (cf. below) or were erroneously lemmatized (i.e., as past participle forms). Therefore, the distributional analysis was performed on 130 pairs, 62 canonical and 68 non-canonical.

4.2 Procedure

Noun-adjective co-occurrences were automatically extracted from *La Repubblica* corpus (Baroni et al., 2004) with *LexIt* (Lenci, 2014)[4]. All the nouns each adjective in the test pairs modifies or is a predicate of were collected. Co-occurrences were weighted with Positive PMI (PPMI) and represented as a multidimensional vector for each adjective. The cosine was used to measure the distributional similarity of each test pair (Turney and Pantel, 2010). Therefore, the higher the cosine of an antonymic pair, the more its members tend to co-occur with the same nouns.

4.3 Results

The overall mean cosine is 0.11 (sd 0.07) (see Table 2). Considering the two groups separately a relevant difference can be noted. The mean cosine value for the canonical pairs is 0.21 (sd 0.2), while for non-canonical ones is 0.12 (sd 0.17). Moreover, maximum cosine for canonical pairs (0.44) is much larger than the maximum one for non-canonical pairs (0.27).

Category	Mean	Std. Deviation	Max. Value
All Pairs	0.11	0.07	-
Canonical (62)	0.21	0.20	0.44
Non-canonical (68)	0.12	0.17	0.27

Table 2. Mean cosine and maximum values.

The difference between the cosines of canonical and non-canonical adjectives is highly significant (Wilcoxon test: p-value < 0.001, W=313). Once again, it turned out that concreteness is not a relevant factor. Nevertheless, it seems interesting to notice that canonical pairs with the lowest cosine values are the morphologically derived and abstract ones. What seems to be relevant is the correlation between cosine values and pair production frequency. The Pearson's correlation for canonical pairs (r = 0.29), though weak, is clearly larger than that for non-canonical ones (r = 0.07). In general, the distributional analysis shows that the goodness of opposition of a canonical pair of antonyms tends to be directly proportional to the distributional similarity of the adjectives with respect to the nominal contexts they co-occur with.

5 Summary and Discussion

The aim of the present paper was to identify antonymic pairs with different degrees of canonicity in Italian. We have defined as canonical those adjectives with the highest mutual production frequency in an elicitation task. We also intended to verify if – as suggested by Herrmann et al. (1986), Murphy (2003) and Paradis et al. (2009) – canonicity is a scalar phenomenon, that is if pairs are distributed on a scale – a continuum of "goodness of opposition" – from better to less good examples of the relation. The second goal of our research was to further investigate the canonicity phenomenon in order to explain the different behaviour of canonical and non-canonical antonyms. In particular, we tested the two previous approaches in the literature – *lexical-categorical* and *cognitive-prototype* – to determine

[4] *LexIt* is a platform to explore distributional profiles of Italian nouns, verbs and adjectives. *LexIt* distributional profiles contain a vast array of statistical information, automatically extracted from corpora with state-of-the-art computational linguistic methods. The contexts extracted are freely accessible at this website: http://lexit.fileli.unipi.it/.

which are the parameters that cause the strong association between the two members of a canonical pair. An elicitation experiment and a distributional analysis were carried out.

The elicitation experiment confirmed the existence of a continuum of "goodness of opposition", as already stated by the *cognitive-prototype approach* and contrary to the dichotomous view of the relation offered by the *lexical-categorical approach*. We observed pairs with strong agreement among the participants – only one or two distinct antonyms were elicited for a given stimulus – as well as adjectives that produced up to 10 distinct responses. Moreover, classifying pairs as canonical and non-canonical on the basis of the frequency of production allowed us to individuate different patterns of reciprocity, corresponding to different degrees of canonicity. Thus, as already stated by Jones et al. (2007), we can state that canonicity – and the whole antonymy relation in general – is not strictly binary in the sense that it does not require exclusivity. On the other hand, a small group of pairs obtained full agreement among the speakers, since members produced one another as unique response in the elicitation experiment. These pairs have a strong lexical association and entrenchment in memory, and confirm the prototypical internal structure of antonymy (Murphy, 2003; Paradis et al., 2009). Interestingly, these results also suggest the cross-linguistic validity not only of the scalar and prototypical structure of antonymy, but also of what adjectives are considered the best examples of the relation. Italian data, in fact, reveal a picture highly similar to the previous studies on Swedish and English and the best examples of the relation are the same in the three languages.

For what concern how canonical antonyms come to be associated, the elicitation experiment offered the possibility to evaluate the *lexical-categorical approach*. As noticed, observed co-occurrence frequency was always larger than expected both for canonical and non-canonical pairs. This means that both canonical and non-canonical pairs co-occur significantly more often than chance. Hence, the *co-occurrence hypothesis* alone is not sufficient to explain the existence of the canonicity phenomenon because it does not allow to discriminate between canonical and non-canonical antonyms. We found instead a correlation between PMI values and production frequency for the non-canonical pairs. This means that association strength, as measured by PMI, is a good indicator of the tendency of non-canonical antonyms to elicit one another, suggesting that the more they are observed and used together in text the more they are perceived as "good" antonyms.

Even if production statistics support the *cognitive-prototype approach*, the notion of "salience of dimension" used by such explanation lacks clear empirical criteria. As already mentioned, when a pair is used in a metaphorical sense the dimension of alignment is not so easy to identify. This seems to be confirmed by the behaviour of abstract and morphologically derived pairs, whose behaviour deserve further investigation. Therefore, we have proposed a distributional interpretation of the notion of salient dimension. We carried out a distributional analysis of the nouns co-occurring with the adjectives (in modification and predication contexts), assuming that the opposition between the two members of a canonical pair is stable across their senses. Thus, our hypothesis is the more the antonyms occur in the same nominal contexts, the more they are perceived as canonical. Vector cosine was used as a measure of the distributional similarity of adjectives in nominal contexts. As predicted, we found a significant difference between the cosine values of canonical and non-canonical pairs. This means that the members of a canonical pair tend to modify or be predicate of the same nouns.

In summary, our experimental evidence suggests that, *contra* Charles and Miller (1989, strong *paradigmatic distributional similarity*, rather than syntagmatic co-occurrence, is the distinctive feature of canonicity. Two adjectives form a canonical pair because they are used to describe the same things and the same situations, but from two opposite points of view. What can be *tall* can be also *short*, as what is *hot* can be also *cold*. This allows the opposition to be moved into a new semantic field when one of the members of a canonical pair acquires a new sense (Lehrer, 2002). Hence, high frequency of co-occurrence – in similar syntactic structures – has to be considered as an effect of this kind of relation. As correctly argued by Miller and Charles (1991), paradigmatic substitutability can not be used to characterize antonymy in general, since this feature is also shared by other semantic relations, most notably synonymy. However, paradigmatic substitutability can instead be used as an empirical criterion to define the subset of canonical adjectives. It is in fact likely that paradigmatic substitutability is also one of the factors determining the high cognitive salience of the property expressed by canonical adjectives.

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Appendix A. Canonical antonyms emerged from the elicitation experiment.

veloce	*lento*	"fast – slow"
forte	*debole*	"strong – weak"
grande	*piccolo*	"big/large – small/little"
largo	*stretto*	"wide – narrow"
buono	*cattivo*	"good – bad"
bello	*brutto*	"beautiful – ugly"
aperto	*chiuso*	"open – close"
povero	*ricco*	"poor – rich"
alto	*basso*	"tall – short"
lungo	*corto*	"long – short"
vivo	*morto*	"alive – dead"
maschile	*femminile*	"male – female"
pieno	*vuoto*	"full – empty"
pesante	*leggero*	"heavy – light"
sporco	*pulito*	"dirty – clean"
stabile	*instabile*	"stable – unstable"
facile	*difficile*	"easy – hard"
pubblico	*privato*	"public – private"
positivo	*negativo*	"positive – negative"
civile	*incivile*	"civilized – uncivilized"
legale	*illegale*	"legal – illegal"
onesto	*disonesto*	"honest – dishonest"
fortunato	*sfortunato*	"lucky – unlucky"
iniziale	*finale*	"initial – final"
bianco	*nero*	"white – black"
bagnato	*asciutto*	"wet – dry"
comodo	*scomodo*	"comfortable – uncomfortable"
completo	*incompleto*	"complete – incomplete"
simmetrico	*asimmetrico*	"symmetrical – asymmetrical"
vero	*falso*	"true – false"
logico	*illogico*	"logical – illogical"
limitato	*illimitato*	"limited – unlimited"
possibile	*impossibile*	"possible – impossible"
razionale	*irrazionale*	"rational – irrational"
perfetto	*imperfetto*	"perfect – imperfect"
pari	*dispari*	"even – odd"
certo	*incerto*	"sure – unsure"
dolce	*amaro*	"sweet – bitter"
ordinato	*disordinato*	"orderly – messy"
rilevante	*irrilevante*	"relevant – irrelevant"
scuro	*chiaro*	"dark – light"
grasso	*magro*	"fat – slim"
sicuro	*insicuro*	"secure – insecure"
mangiabile	*immangiabile*	"eatable – uneatable"
mobile	*immobile*	"movable – unmovable"
organico	*inorganico*	"organic – inorganic"
calmo	*agitato*	"calm – rough/upset"
piacevole	*spiacevole*	"pleasant – unpleasant"
preciso	*impreciso*	"precise – imprecise"
duro	*morbido*	"hard – soft"
morale	*immorale*	"moral – immoral"
giusto	*sbagliato*	"right – wrong"
uguale	*diverso*	"identical – different"
credibile	*incredibile*	"credible – incredible"
concreto	*astratto*	"concrete – abstract"
intelligente	*stupido*	"smart – stupid"
vestito	*nudo*	"dressed – naked"
vecchio	*giovane*	"old – young"
attivo	*inattivo*	"active – inactive"
attivo	*passivo*	"active – passive"
abbondante	*scarso*	"abundant – scarce"
libero	*prigioniero*	"free – prisoner"
luminoso	*buio*	"bright – dark"
felice	*triste*	"happy – sad"
spesso	*sottile*	"thick – thin"