

Distributed Pragmatic Processing for Adjective Expression: An Experimental Study*

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Abstract

This paper demonstrates that in combining a noun (thing) with an adjective (evaluation), several frame elements, which we refer to as *competitor*, *standard*, *judge*, and *background scale*, are evoked; each element significantly affects the final value-judgment externalized by an adjective expression. Specifically, some or all frame elements are involved in the meaning-making process of adjective expression formation, and they function in a unique and complex manner. To test this assumption, we conducted two simple experiments: *a drawing task* and *an eye-tracking study*. The results of these experiments supported our hypothesis.

Keywords: adjective production, evaluation, meaning-making process, frame semantics, pragmatic frame elements, drawing task, eye-tracking analysis, linguistic evolution

Adjective basics

Adjective expressions convey information related to the “**evaluation**” of an object according to various domains (e.g., *size*, *height*, *speed*, *quality*, *emotion*, and *color*), such as “this building is *tall*” and “the news is *exciting*” (Sugaya, 2015). The object evaluated by an adjective (referred to as a **target** in this paper) is expressed as a nominal or noun phrase, although they may not be linguistically externalized when the listener can sufficiently understand which object is implied in an adjective expression in some cases—for example, in Japanese, the target of a student’s adjective expression “*muzukasii* (= *difficult*) *desu* (= *be*)” is clear, say, when he or she reads a philosophy book (→ target) in front of a teacher.

Any adjective (A) is thus always required to be connected to a noun (N) in an **overt** or **covert** manner; thus, an adjective expression is considered to be a phrase (P) that

combines these two (i.e., AN phrase). Syntactically, both A and N can function as standalone phrases (i.e., AP and NP)—for example, the sentence “Tom is an open-minded tall *school teacher* who rarely attends meetings.” Such an AN phrase can function either as a noun phrase or as a clause in another sentence (e.g., “I believe he is innocent of the crime”). Note that, however, the current article shall deal only with hierarchically simpler AN forms, such as a *fast car*, *tall man*, *good weather*, *blue pen*, and so forth, because even such expressions involve a semantically and pragmatically complicated structure.

For this reason, the canonical linguistic investigation concerning adjectives has assumed that this simple association between A and N is the only requirement of an adjective expression. When delving into the meaning of adjectives and AN expressions, however, it is unsatisfactory to only carefully observe the referents of A (e.g., *delicious*) and N (e.g., *cake*) to understand their meanings. Why does this problem emerge?

Some people may believe that the meaning of *delicious cake* is a combination of the meanings of *delicious* and *cake* alone. For instance, consider the meaning of the expression “Mary’s mother is able to make a *delicious cake*.” One is likely to interpret that that cake is better than one made by others’ mothers or other persons. Although some may suppose that this is a pragmatic inference that is peripheral and may be excluded from semantic study, it must be true that these types of expression are based on a **relative comparison**, as this speaker must have experienced less delicious cakes. As such, since the distinction between semantics and pragmatics is not always clear-cut, this paper will not distinguish these two. Instead, both types of meaning are referred to broadly as meaning in contrast to form. In this case, what is the meaning of an A and AN phrase?

Furthermore, it is necessary to consider the degree of **establishment** or **novelty** to address the combination of the two (i.e., merge) and the process of meaning-making se-

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mentally. This is because **conventionality** significantly affects language in meaning and perhaps syntax as well. For example, it is well known that many unit phrases (e.g., *blue light*, *small talk*, *smart phone*) do not involve the mental process of assembling distinct items together, compared to novel phrases (e.g., *boring paper*, *long desk*, *yellow candy*, etc.), which are less determinant in interpretation, thus requiring greater cognitive load in speakers and listeners.

Meaning-making process

This study addressed the process of **encoding meaning** for the speaker and **decoding form** for the listener in a communicative situation, with a special focus on the meaning-making process as part of the former. Although some linguists may view our approach as employing a pragmatic perspective, we regard it as a semantic analysis that addresses adjectival meaning for the reason denoted above.

Here, a question may arise: why focus on the **processing**, rather than the final state, of meaning? For example, one would not be able to understand a dish ordered in a restaurant thoroughly by only tasting the finished dish; rather, one must observe the cooking process step-wise in which a cook produces the dish, and then you may be able to comprehend the dish comprehensively. Similarly, if linguists attempt to survey semantic phenomena or communicative information encoded by expressions by studying only the final state of a linguistic expression, they are likely to lack a significant portion of the meaning, resulting in incomplete findings.

On this premise, there is another question regarding adjectival meaning: what is included in the process of expressing an adjective? Importantly, several elements included in the process (e.g., **competitor**) may or may not appear at a linguistic level either implicitly or explicitly (e.g., “Mike is very tall *among other students at the school*.”). Thus, even elements that do not occur on the surface (i.e., a linguistic expression as a final state) can be involved in the process. These kinds of elements can be seen as either **constitutive meaning** or **pragmatic context** in a sense. At least, in the case of adjectives, most of these elements are not straightforward but highly interrelated, multi-layered, and distributed as the process of evaluation is typically regarded as indefinitely complicated in the field of psychology or economics. Research on ad-

jectives is required to elucidate such complexity, and it has yet to be conducted sufficiently. Aside from adjectival meaning, research on each type of meaning should focus on investigating the processing method by which meaning is encoded.

Frame semantics of adjectives

In order to consider the pragmatic perspective of adjectival meaning, an analysis must be conducted on the basis of the linguistic theory of frame semantics (Fillmore, 1982). “Frame” is a general term that may be applied to a variety of linguistic phenomena because it broadly refers to “the whole structure evoked by one part,” which may also be referred to as **context**, **background**, and **relevant information**. To illustrate, the word *week-end* requires that the listener understands the calendric seven-day cycle and social practice of beginning work on Monday (or Sunday). This basically reflects the concept of **encyclopedic knowledge** of language expressions (Langacker, 1987a; Haiman, 1980).

This theory has been accepted by many cognitive linguists in this decade because such **wide, hidden, and evoked** knowledge is used in a wide variety of linguistic scenes, such as **producing metaphors**, **connecting words**¹, and **changing lexical categories** (e.g., derivation of N into V). There are critical limitations to this theory that must be discussed and resolved; the term itself is too broad, thus exhibiting the problem of Occam’s razor. The definition of the phrase “whole structure” seems to be ambiguous in scope or in the extent of the area broadened by a given meaning, resulting in **ad hoc** and explanations with **low predictive power**. Nevertheless, the background information of an expression’s meaning (i.e., frame) must be unique to the human language, and an effective theory of such meaning is indispensable for semantic and pragmatic studies.

Moreover, since the frame relies on the **specific** knowledge (i.e., memory) of a given expression, it is disadvantaged by an inability to address abstract concepts or generalizations. Even so, this paper considers the following: *What are relevant frame elements evoked to express an AN expression?* Since all elements cannot be addressed in this paper, a selection of central elements is introduced below: **competitor**, **standard**, **judge**, and **background**

¹In the case of AN, for example, the expression “a usual seat” evokes a frame of a relevant person, the action of sitting, and daily behaviors, which frame elements enable the clarity of the expression.

scale. Revealing these elements and discovering their functional mechanisms may be key to elucidating the process by which an adjective is expressed.

Frame elements

First, some competitors should emerge covertly through relative comparison to a target, although this is never limited exclusively to the adjective case. Primitively, when a target is evaluated in a domain (e.g., a man is evaluated in height), it must have a greater value in that domain than some others (\rightarrow competitors) in the same group as the target (**comparison class**) (Sapir, 1944; Kennedy, 1997). Above all, they seem to be necessary components of adjectival meaning (Kennedy, 1999), although some people might beg the question of whether this is the case in non-gradable adjectives as well (e.g., *open/closed* and *semantic/pragmatic*).² For speakers, competitors create an evaluation as the first step and facilitate the concept of a judgment in a domain because two identical objects in a single domain do not evoke that domain at all. For listeners, assumed competitors must be inferred that are the basis of a speaker's utterance including a chosen adjective. This is because, for example, the desk may greatly vary in size when a listener is asked to "bring a *wide desk*" by a speaker.

Second, there are many cases in which, rather than competitors, a standard frame element may be emphasized to make a value-judgment that may be expressed by an adjective (cf. Bylinina, 2012). It is considered to be a **threshold value embedded in a situation** of a target, which is **subjectively interpreted** by a speaker (cf. Sugaya, 2018). The entity that is seen as a target can be situated in various backgrounds (e.g., a book on your desk, in your hand, or in a bookstore); from these interrelations, a standard may be construed from which an act is supposed to begin or end. Consider a situation in which, a power-supply cord that is connected to your laptop on the desk but does not reach any outlets. Without stating a direct comparison, you may evaluate it as *short*, considering the relation between the room arrangement and the length of the power cord.

Third, a speaker may attend to not only a target but also the person(s) who observes that target from their

own perspective—or, judge(s). In general, this is related to **empathy**, the notion of **reading another's mind**, and **joint attention** (Tomasello, 1995, 1999; Sugaya, 2019a). Clearly, the judge (as well as the two frame elements denoted above) tend to depend specifically on the target and situations. Moreover, the frame element is so flexible and extrinsic that some may not include the existence of any judge (moreover, not draw upon one's memory), so its nature as a frame element may be relatively weak—note that Japanese tends to include judges more frequently than English does (Sugaya, 2017). Nonetheless, the frame element (background) must also decisively affect evaluation with an adjective (foreground). For example, consider the case in which a young child plays with a *large ball* and how the ball (\rightarrow target) may be described to convey the evaluation to your friend in the same room. It is likely that a lot of people (\rightarrow speaker) would create perspective using the young child (\rightarrow judge) to evaluate the large ball (\rightarrow target).

Forth, although all elements that have been introduced above are relevant in the context of a "target," the last—background scale—directly contributes to the "**foreground scale**" (or main scale) that is concerned with the domain of evaluation. For example, in order to rate a library, you may refer to several related domains such as *size*, *cleanliness*, *silence*, and *number of books* as background scales to support the final quality judgment (\rightarrow foreground scale). Although this may also not be fixed knowledge elicited from memory, it is possible that when conducting a specific evaluation (e.g., the quality of a library), the criteria for judgment may be more or less determined for each individual or social context. If so, background scale may also be considered a frame element for AN expressions.

The four frame elements described in this paper are integral in our ability to evaluate or connect between A(P) and N(P). In other words, **the frame elements with specific functions play a significant role in combining a thing (N) with an evaluation (A)**: note that only one or more (sometimes, all) of these elements can be employed. It is necessary, however, to demonstrate the significance or functions of these frame elements, **compared to irrelevant elements**, in adjective expressions through experimentation.

²We believe that the adjectives are non-gradable for the following reasons. First, evoking competitors (maximally) generally occurs in any predication of language, as some comparison is included even in the ordinary sentence "her father ate her chicken (not her mother)." Second, even absolute adjectives can be seen as gradable as one may say, "the door is *very* open now" as a well-formed expression.

Empirical studies of the frame elements

This paper investigates the theory discussed above using two task types: **drawing and eye-tracking**. The hypothesis posits that some different pragmatic elements (i.e., competitor, standard, judge, and background scale) would distinctively function in the meaning-making process of adjective expressions and, consequently, should be regarded as part of adjective meaning. Both experiments focus on the **visual world** in order to address the meaning of AN expressions in a direct and concrete manner, observing what participants **draw** in a frame (Experiment 1) and what they **attention to** in a drawing (Experiment 2). Note that these two experiments do not simply attempt to verify the hypothesis but also facilitate an exploratory analysis of new knowledge; specifically, they are expected to provide information regarding how each frame element works in relation to one another.

Experiment 1

Experiment 1 is a drawing task that is based on the theory of frame semantics. A concept similar to the frame, suggested by Langacker (2008), is the **immediate scope of prediction** imposed on a cognitive domain (e.g., space and time). As the meaning of *finger* evokes the concept of *knuckle* (Langacker, 1987b, 56-57), a profiled entity should occur with, or be embedded in, a based one as part of (encyclopedic) meaning. As a *hypotenuse* must be drawn with a *right triangle* (ibid: 59), frame elements in an immediate scope of prediction are likely to be expressed in a visual representation by subjects. This experiment was conducted on the basis of this theoretical presupposition.

Methods

Participants

The sample was comprised of 132 undergraduate students from the Mie University who were separated into three parts for different tasks. Group A included 43 students, Group B included 45, and Group C included 44. All participants were native speakers of Japanese.

Procedure and materials

All participants were asked to draw eight pictures of eight linguistic phrases, which varied among each group, for twelve minutes. Two nouns, two verbs, and two AN expressions were provided for drawing to each group. Participants were directed to draw a picture for six nouns, six

verbs, and twelve adjective phrases in total. The items that participants were directed to draw are indicated in Table 1 on the next page, although two AN expressions (“bad classroom” and “good library”) are missing due to difficulty in analysis and presentation on the table.

Results

After collecting the data, we began with a specific analysis of all pictures drawn by participants ($132 \times 8 = 1056$). Because the primary purpose was to identify elements that were relevant to adjective meaning, we classified those pictures in terms of the types of things that were portrayed alongside a target. For instance, an item that seemed to be in the same category but a different value than a target (i.e., competitor) was marked with “T + C” on Table 1 (see (5) of Figure 1 for an illustrative picture). Furthermore, when a related person was also indicated on a frame, as in (8), this was regarded as a judge (i.e., “T + J”). Moreover, some participants drew additional pictures that were sorted into **setting** (i.e., “S”). Note that, however, this setting included various types of situations—some of which could be considered standard, as in the example (12), clearly involving a standard (i.e., minimum value) with which one item begins reaching another for expressing the meaning of the predicate (i.e., *short*).

See Table 1 for the results of such classification and Figure 1 for drawing examples. Table 1 presents a proportion of each category to valid responses in any linguistic phrase. Before those of AN phrases, take a look at the results of noun and verb expressions. As was widely predicted, an **autonomous noun** such as *pencil* was drawn only with a target, whereas a **relative noun** such as *lid* tended to be drawn with the whole structure. This is the case in absolute/relative verbs. In the former (e.g., *walk* and *run*), only an actor (or agent) was described alone; in the latter, (e.g., *hit* and *exchange*), related objects and instruments were required.

Concerning AN phrases, the results were a somewhat more complicated because two words—both of which could evoke some frames—were combined to form a phrase. First, consider the data of *small shoes*: a number of participants depicted one or more competitors, as in (15). However, some drew a foot, as in (16), to indicate a standard instead of competitors, which indicates that one could not put on the shoes (\rightarrow target) owing to the size (smallness). Similarly, the results of *large bed*, in which

	PENCIL (鉛筆) (n=43)	LAPTOP (パソコン) (n=44)	BALL BALL (ボール) (n=45)	BOTTOM (底面) (n=42)	LID (ふた) (n=43)	FRONT COVER (表紙) (n=43)	WALK (歩く) (n=44)	RUN (走る) (n=44)	JUMP/FLY (飛ぶ) (n=43)	HIT (打つ) (n=44)	WATCH (見る) (n=45)	EXCHANGE (交換する) (n=43)	
T only	.907	.955	.933	.071	.558	.070	A only .863(3)	.864	.372		.378		
T + W				.929(2)	.349	.884	A + S .090	.090	.581				
T&J (related person)			.022(1)				A + O				.600	agent1,2+ object1,2 .628(4)	
T + S	.023	.022					I + O			bat +ball .363			
*T+ sth written by pencil	.055						A+ I +O			bat+ball +batter .477		*agent1,2+ object1 .047	
*T+ attachment (USB memory)	.023						A + I			bat +batter .023			
uncomprehensive				.047			O only + attachment (dog)	.022			.023	.022	object1+ object2 .186
	SHORT ARM (短い腕) (n=43)	LARGE BED (大きなベッド) (n=43)	LARGE DESK (大きな机) (n=45)	TALL (背が高い) (n=44)	SHORT CABLE (短いケーブル) (n=39)	SMALL SHOES (小さい靴) (n=41)	HIGH CEILING (高い天井) (n=43)	NARROW CLASSROOM (狭い教室) (n=42)	BIG BUILDING (大きな建物) (n=43)	TALL BUILDING (高い建物) (n=45)			
T only	.070	.395	.378	.045	.564	.220		.214	.163	.200			
T + W	.528(9)												
T + C		.116(5)	.178	.795(13)	.179(11)	.488(15)		.071	.535	.467			
T+W+C	.419(10)												
T + J		.441(6)	.267				.814(8)	.643	.233	.244			
T+J+C							.140						
T + S (standard)		*.047 room scene (7)	*.156 chair cup bottle etc.	*.090 door house (14)	*.153 outlet mouse smartphone (12)	*.170 foot (16) *.100 hand mouse grass				*.089 mountain cloud etc.			
uncomprehensive					.026			.023					

target = T, whole of target = W, competitor = C, agent =A, relevant person = J, setting = S, object = O, instrument = I

Table 1: Results of the experiment.

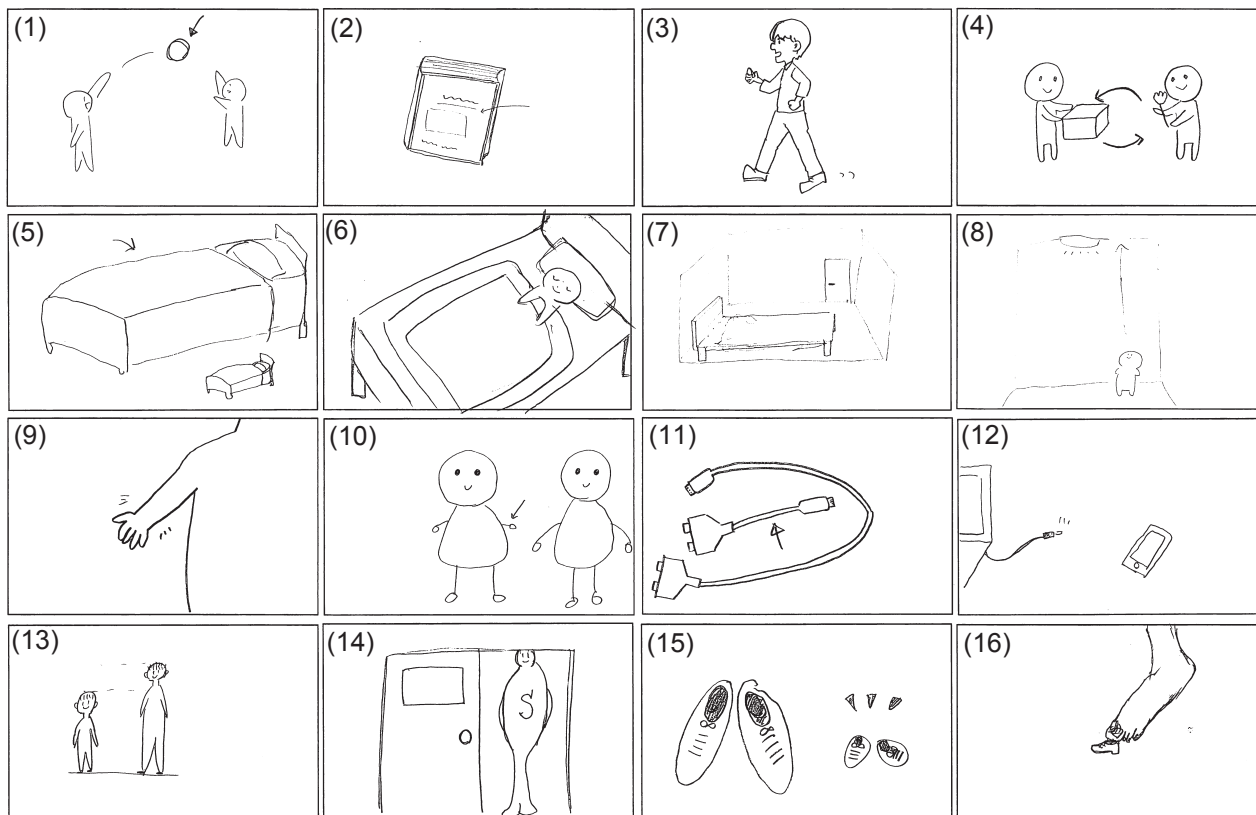


Figure 1: Examples of drawings.

fewer respondents drew a picture of competitors, such as (5). Rather, many participants drew a picture of the subject that made the judgment and was relevant to the target (cf. (6) for an example). Moreover, it is interesting that some participants offered a room scene encompassing a target, appearing to consider the proportion between these two, as illustrated in (7). Due to space limitations, refer to Table 1 for all data.

Discussion

The drawing task sufficiently revealed that which should be included in the meaning of a linguistic expression by means of depicting an immediate scope of predicate (or a frame). These drawings could not perfectly correspond to that scope. However, it is possible that a large number of pictures provided evidence of which frame elements are necessary (or should be depicted) in meaning. Note that since any classification of elements could be arbitrary, multiple evaluators should analyze pictures drawn by participants to ensure that the methodology is more effective.

If the methodology is valid and produces significant and relevant results, some notable suggestions regarding adjective semantics may be derived. First, this study partly supported the hypothesis stating that frame elements are relevant to adjective meaning. This indicates that the process of encoding an adjective contains the processes of competitor, standard, judge, and background scale to some extent, thus enabling those elements to become integral components of adjective meaning.

Furthermore, because the current experiment is explanatory, there may be further scope for understanding and examining frame elements. First, **the choice of the frame elements critically depends on modified nominals**, which also evoke different types of frames. For instance, a *bed* is known to be placed in a “room”; thus, the balance between a bed and a room is more inclined to be considered (i.e., a standard) when combined with *large*. As a *cable* is an electric cord, on the other hand, connecting two electrical goods, *short* evokes the distance between two items—a standard. Second, **competitors must be the foundation of an adjective’s meaning** because a large portion of participants drew similar things to the target.³ This supports a traditional account that even a positive form (“A is large”)

³Radically speaking, the reason competitors are the foundation of adjective meaning is that other frame elements (specifically, standard and judge) may be based on one or more competitors experienced by a speaker. Unless some competitors exist, those elements cannot appear.

should essentially involve a comparative form of an adjective (“A is larger than B”) (Sapir, 1944).

Experiment 2

For the same purpose, we conducted a different type of experiment that measured the participants’ eye movement. Unlike the previous experiment (i.e., the task of drawing pictures), it focused on the things to which attention was given in a scene in association with a linguistic expression. This was based on a recent eye-tracking methodology referred to as the **visual world paradigm** (Tanenhaus et al., 1995). Specifically, by observing and comparing the pictures (visual stimuli) on which participants focused and those they did not, we have uncovered some relevant and necessary components of adjective meaning and its processing.

Methods

Participants

Twenty-three (11 female) undergraduate students at Mie University participated in this survey, all of whom were native monolingual Japanese speakers who did not participate in the previous experiment.

Procedure

After filling out a form and completing an eye tracker calibration process, participants did a rehearsal trial as an opportunity to practice. Then, they worked on the trials, all of which involved the same procedure: a **sentence presentation**, a **picture presentation**, and then a **judgment task** with a five-point scale. Before presenting those stimuli, they were asked to look at a point of gaze (+) at the center of the screen. Although they could generally go to the next page in a self-paced manner, each picture was shown for only five seconds. This trial was repeated ten times (i.e., ten sentences, pictures, and questions) at random, but four of the trials were dummies (i.e., **filler** tasks), included so that the participants would not notice the intention of the experiment.

Throughout the experiment, participants’ eye movements were recorded with a Tobii’s screen-based eye-tracker (Tobii Pro Nano) mounted on a 13.3-inch laptop (HP EliteBook 830), with a sampling rate of 60 Hz. In addition, Tobii Pro Lab was used as a presentation and analysis tool, enabling an exact manipulation of the entire experiment.

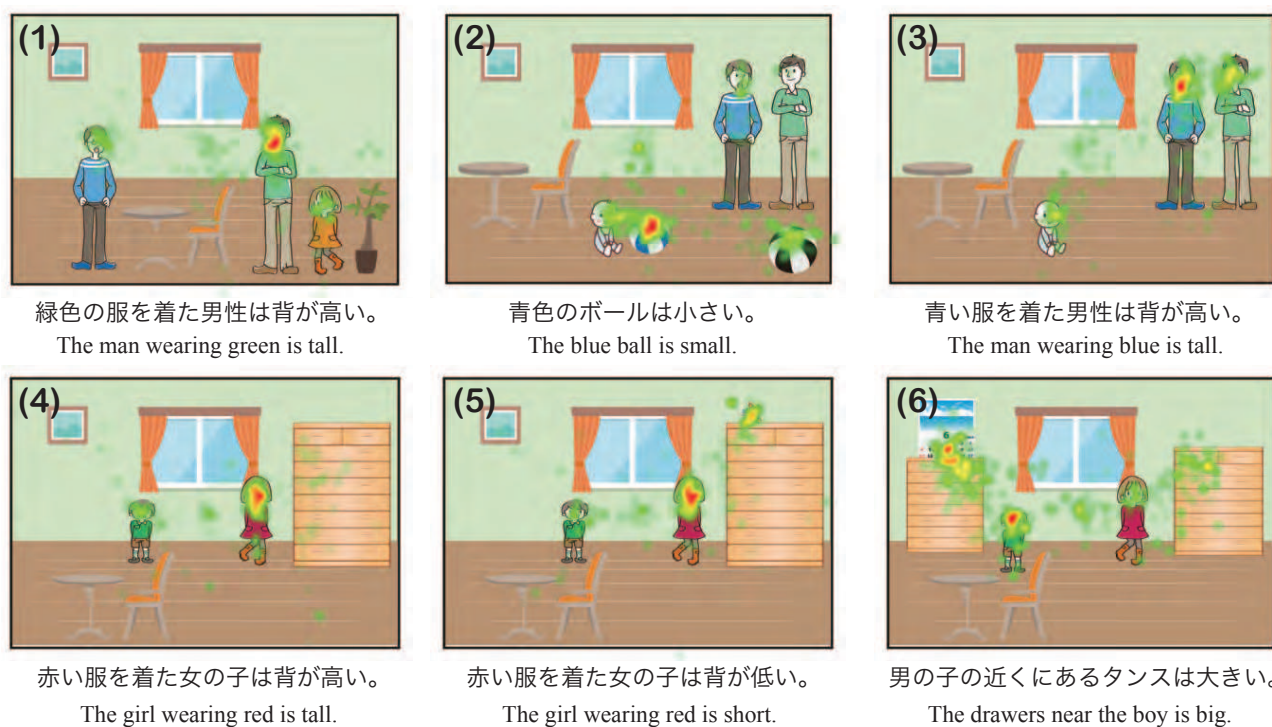


Figure 2: The heat map of gazing

Materials

First, in regard to the drawing stimuli, the background (i.e., an inner room scene) was the same in all pictures while the arrangement of people and furniture varied from one to the other. Let us look at Figure 2, where all situations except for the fillers are exhibited—for now, we can ignore the heat map superimposed there. Pictures (1), (3), and (4) were concerned with **competitors**. In contrast, (2) is clearly related to a **judge**, while (5) and (6) are associated with **standards**. Note that the figures are randomly presented, so their numbers do not indicate the order of trials.

Second, the sentences presented prior to the pictures are also shown below them, both in Japanese (actual) and in English (translated). The adjectives adopted in this experiment were *tall/short* and *large/small* in visual, spatial domains; of course, all were shown in a positive form. As the simplest syntactic structure, a single subject (NP) was followed only by a predicate (AP): the ‘S copula A’ (SVC) construction.

Lastly, the participants were asked to rate the degree of **sentence-picture correspondence** on a five-point scale. However, since the purpose of this experiment was to analyze the viewing data, the responses recorded here were not included in the scope of investigation.

Results

Now let us pay attention to the heat map in Figure 2 for intuitive understanding. This denotes the average extent to which participants fixed on an area in the image. Overall, the gazing intensity of each target was clearly the strongest among the persons and furniture situated in the room. More important in this article is the attention to those images that pictorialize frame elements. It seems, in common, that this figure indicates a higher intensity of gazing at each frame element.

In order to detail this point, we set up **areas of interest** (AOIs) and researched the relative quantity of fixation time, comparing one AOI to another; the results are displayed in Table 2. In regard to competitors, look at the data of (1), which show a great proportion of attention to the two people. Moreover, observe the fact that participants were more apt to fix on the nearby girl than on the man wearing blue, although we assumed that the more similar an entity was to a target (i.e., man and adult), the more easily it was regarded as a competitor. One possibility is that the little girl would be considered a judge from whose perspective the target (the man wearing green) was viewed. Even if that is the case, the frame element of the competitor basically functions for adjective meaning, as it

Area of Interest (AOI)	blue man	green man	girl	boy	baby	chair	table	drawing	blue ball	black ball	drawer (left)	drawer (right)	candy	calendar
(1) Average	0.54	1.99	0.54	-	-	0.17	-	-	-	-	-	-	-	-
Share of Total Time (%)	7.73	33.31	8.26	-	-	0.53	0.00	0.00	-	-	-	-	-	-
Percentage Fixated (%)	86.36	100.00	90.91	-	-	18.18	0.00	0.00	-	-	-	-	-	-
Variance	0.04	0.37	0.10	-	-	0.00	-	-	-	-	-	-	-	-
Standard Deviation (n-1)	0.20	0.61	0.32	-	-	0.06	-	-	-	-	-	-	-	-
(2) Average	0.41	0.25	-	-	0.59	-	-	-	1.24	0.70	-	-	-	-
Share of Total Time (%)	5.52	0.45	-	-	8.45	0.00	0.00	0.00	23.52	12.05	-	-	-	-
Percentage Fixated (%)	68.18	9.09	-	-	72.73	0.00	0.00	0.00	95.45	86.36	-	-	-	-
Variance	0.05	0.02	-	-	0.14	-	-	-	0.50	0.21	-	-	-	-
Standard Deviation (n-1)	0.23	0.14	-	-	0.38	-	-	-	0.70	0.46	-	-	-	-
(3) Average	1.35	0.78	-	-	0.58	0.08	-	-	-	-	-	-	-	-
Share of Total Time (%)	26.48	14.63	-	-	8.82	0.07	0.00	0.00	-	-	-	-	-	-
Percentage Fixated (%)	100.00	95.45	-	-	77.27	4.55	0.00	0.00	-	-	-	-	-	-
Variance	0.27	0.14	-	-	0.09	-	-	-	-	-	-	-	-	-
Standard Deviation (n-1)	0.52	0.37	-	-	0.31	-	-	-	-	-	-	-	-	-
(4) Average	-	-	2.15	0.48	-	0.28	-	0.17	-	-	-	0.64	-	-
Share of Total Time (%)	-	-	35.61	7.20	-	0.21	0.00	0.26	-	-	-	6.72	-	-
Percentage Fixated (%)	-	-	100.00	90.91	-	4.55	0.00	9.09	-	-	-	63.64	-	-
Variance	-	-	0.49	0.05	-	-	-	0.01	-	-	-	0.37	-	-
Standard Deviation (n-1)	-	-	0.70	0.22	-	-	-	0.10	-	-	-	0.61	-	-
(5) Average	-	-	1.75	0.43	-	-	0.35	0.22	-	-	-	-	0.87	-
Share of Total Time (%)	-	-	37.01	6.16	-	0.00	0.34	0.21	-	-	-	-	12.58	-
Percentage Fixated (%)	-	-	100.00	68.18	-	0.00	4.55	4.55	-	-	-	-	68.18	-
Variance	-	-	0.49	0.13	-	-	-	-	-	-	-	-	0.29	-
Standard Deviation (n-1)	-	-	0.70	0.36	-	-	-	-	-	-	-	-	0.53	-
(6) Average	-	-	0.38	0.78	-	-	0.07	-	-	-	1.02	0.68	-	0.67
Share of Total Time (%)	-	-	5.75	16.74	-	0.00	0.08	-	-	-	26.81	15.48	-	12.57
Percentage Fixated (%)	-	-	54.55	77.27	-	0.00	4.55	-	-	-	95.45	81.82	-	68.18
Variance	-	-	0.15	0.20	-	-	-	-	-	-	0.32	0.17	-	0.15
Standard Deviation (n-1)	-	-	0.39	0.45	-	-	-	-	-	-	0.57	0.41	-	0.39

Table 2: Results of the eye-tracking experiment.

was quite focal in pictures (2) to (6) as well.

Next, the situation in (2) included a judge whose view a participant might track so as to value the target (i.e., ball) in size. In fact, the result found a relatively heavy attention to the baby as a judge. Although it could be derived just from the closeness to the target, the data appeared to mean that a number of participants paid **joint attention**, with the baby, to the target (ball). However, it should be noted that the data (2) in Table 2 show a higher amount of gazing at the competitor, which implies the essentiality of this element.

Last but not least, the result of the experiment signified the importance of the standard. Turn your attention to the gazing time of each AOI in (5) and (6) in Table 2. In (5), the candy on the dresser (\rightarrow standard) was located too high for the girl to reach it. In (6), similarly, the calendar on the wall (\rightarrow standard) was partially hidden by the dresser (i.e., target). Taking these into consideration, participants seemed to fix on those standard things for a long time. Likewise, competitors functioned very well to a similar extent to these standards, suggesting that roughly half of the participants took no notice of the frame element in question.

Discussion

First and foremost, this experiment supported the in-

volvement of some pragmatic frame elements—in particular, *competitor*, *judge*, and *standard*—in the semantic process of adjective expressions. In fact, most participants extended their viewing field and, to a varying degree, gazed at the pictures referring to those elements. This was more obvious when compared to the filler trials that did not contain any adjectives (e.g., “A girl is standing near the table”). As often stated, an adjective is **context-dependent**, or a **relative predicate**, so the result must be reasonable as far as the perception-conception analogy is accepted. More significantly, this elucidated the types of contexts on which an adjective should rely for its production and comprehension. Needless to say, however, it will be necessary to perform additional tests, increasing the quantity of stimuli and comparing many other kinds of expressions, in order to validate the results and discover more.

In addition, this experiment has led to some suggestions concerning those frame elements. First, evoking one or more competitors underlies adjective meaning, as other researchers’ investigations into dimensional adjectives have emphasized the context of competitors (Sedivy et al., 1999; Sedivy, 2003). Second, the result obtained by delving into individual data suggested that if there were two possible interpretations (e.g., depending on the competitor or standard), participants basically chose one interpretation rather than mixing the two. In the case of (5),

more of them preferred the standard, ignoring the existence of the boy as a competitor; in that construal, the girl was seen as *short* because she could not reach the candy on top of the dresser. On the other hand, picture (6) showed the opposite: since the target was smaller/larger than the competitor, the target was regarded as *small/large*. In short, the frame element that one adopts for an adjective expression differs according to the scene.

Conclusion

This article has dealt with the role of frame elements in semantic adjective processing. Two experiments (i.e., drawing and eye-tracking) concretized the reality of the theory. In detail, they demonstrated that the process includes some of these frame elements (i.e., *competitors*, *standard*, *judge*, and *background scale*) to create adjective meaning in one's mind, although the (complicated) interrelation among them should be uncovered through further studies.

Semantic preprocessing of language

Like adjectives, some semantic frame can generally be evoked for any combination of two items. It is expected that focal frame elements vary according to the type of linguistic expression, but some common properties can be captured and predictable, as in this survey. Those elements should be considerably involved in linguistic processing, imposing a heavy cognitive load on language users. Such a great deal of inner and invisible preprocessing of language is semantic or pragmatic, rather than syntactic, since this kind of meaning-making (i.e., conceptualization) precedes the language-composing process. In connection, **the processing of merging multiple items is considerably semantic or pragmatic as well**. Thus, if a linguistic theory undocks any meaning component, the result may lack an essential portion of the human language.

Toward a meaning-based linguistic evolution study

Human beings have advanced language to describe various scenes of **mental representation**, having named a number of concepts to create one's copious vocabulary. In a mental world, two distinct images (e.g., *red* and *car*) among them are superimposed to be a single unit, which can be moreover connected with another concept (e.g., *The red car is fast*). Speaking from such a semantic perspective, human languages acquired their complex-

ity as the species evolutionarily developed a mental world configuration (including vision, emotion, construal, and thought)—simply, **meaning**. Of course, what enables such a (complicated) mental world (MW) is the lower level of **neural representation**, which is based on the rate of **neural firing** or **action potential**. Thus, a language evolution theory requires the development of evolutionary cognitive neuroscience: How do human beings develop high-level cognitive functions to make such a complex mental representation?

According with the design of this paper, we claim that the **meaning-first** assumption—that meaning constructs the basement and hierarchy of language—would make sense for researching language evolution as well, as opposed to “form-first” or Chomskyan syntactic theories (Sugaya, 2019b). Basically, most mainstream linguists seem to detach form from meaning and place it at the center of research. Because they begin with a complete condition of grammar with high applicability (above all, in English), they have to use a so-called *backward reasoning*. Specifically, two forms (F) are syntactically connected (“F+F”) and then the semantic interpretation can occur: $F+F \rightarrow M+M \rightarrow MW$. Actually, this might ‘sometimes’ appear in order to make a new, emergent concept (e.g., “eat a boring blue”) in a mental world (MW). However, it is **natural**, **primary** and **primitive** that attending to (and construing) part of a mental world makes a connected meaning (“M+M”), after which it may be expressed linguistically: $MW \rightarrow M+M \rightarrow F+F$.

With this view, in principle, superficial, isolated, and floating form-centered language theories can be defective as a foundation when considering linguistic origin and development. Human languages are based characteristically on high-level mental representations, or meaning.

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