A CONVERSATIONAL LOGIC: *WA* AND *GA*[*]

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Abstract

This paper (a) presents a fragment of a logic of conversation with some philosophical basis (b) attempts to model and explain differences and properties of *wa* and *ga*, notably the so called Unagi-Bun, the comparative (contrastive) readings of *wa* and uniqueness (complete-list) readings of *ga* (c) brings inner piece to those who wisely do not read it.

1   Basic examples

The fundamental intuition is that *wa* serves to emphasise the predicate whereas *ga* serves to emphasise the subject.[1]

1. *Ga* has a sense of uniqueness (complete-listing) that *wa* does not. Compare

    Sachi wa nihon ye kaerimashita (Sachi *wa* to Japan returned)

    with

    Sachi ga nihon ye kaerimashita

    which in some cases (more cases than with 'wa') suggests that Sachi is unique in her returning, or at least that Sachi makes up a complete list of (relevant) people who have returned. This may be seen more easily if the predicate is one which demands uniqueness.

    Gabbay san wa ichiban yatsu hito desu (Mr Gabbay *wa* the most awful person is)

    is acceptable, but.

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[*] Or: *Bakka na seiyojin ga nihon go wo narattara tohomonai koto ni narimasu.*

[1] NOTE: Most data was collected or tested personally from numerous native speakers unlucky enough to be passing the author at the time. Only individual preferences were noted, hence, in this paper, a sentence may be said to be 'better' than another with little further qualification. Further qualification was not given by subjects of the survey mainly because they were not confident to do so. Translations are for the most part literal but neither stylised nor complete for that would be to beg the question.

Gabbay san ga ichiban yatsu hito desu[2]

is preferred. Furthermore, not only is

dare ga sonno uso wo iimashita ka? (Who *wa* such a lie told?)

a much better formed question than the 'wa' form but to either, the response

Jitsuo ga iimashita (Jitsuo *ga* told [it])

is better formed than

Jitsuo wa iimashita

2. Unagi-Bun: to say

Watashi wa piza (I *wa* pizza)

can be acceptable, maybe meaning 'I want a pizza', whereas the 'ga' form

Watashi ga piza

is apparently less useable. Use of 'ga', if not meaning that one is identical with a pizza seems acceptable more in cases where a question 'Dare ga piza?' is asked.

3. *Wa* has a sense of making a comparison that it would appear *ga* lacks.

Kore wa shiroi keredomo are wa kuroi (This *wa* white but that *wa* black)

or with conjunction

Kore wa shirokute are wa kuroi (This *wa* white[ing][3] that *wa* black)

a comparison is welcomed. With the use of *ga* however the first was said to be very strange and

Kore ga shirokute are ga kuroi

was said to sound like what teacher might say to a student of Japanese who had failed to understand the difference between 'shiroi' and 'kuroi'. The 'ga' form of

Motosan wa shinda (Mr Moto *wa* died)

seems slightly preferred. But the 'wa' form is likely to be expected to continue:

... keredomo Osakisan wa [mada] ikite iru (... but Osakisan *wa* [still] alive)

It is assumed here that this type of comparison is brought on by a mechanism based on meaning of *wa* rather than one based on the meaning of the predicate. Here is a different class of comparison that is assumed here brought on by the meaning of the predicate:

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[2] Also: Yoshiko ga mottomo uruwashii onna da etc..

[3] The gerund being used where English uses 'and'. In English too, e.g. 'Peter running Jane walked'.

Yuji wa tatte iru no da suwatte iru no ja nai (Yuji is standing but not sitting)

also

Yuji wa hashitte iru keredomo asette (wa) imasen. (Yuji running is but hurrying is not)

The thought being that it is *wa* that seems best for such sentences.

4.　　　Kingyo ga iru (Goldfish *ga* is, i.e. there is a goldfish)

which seems a little preferred to its 'wa' form Of the 'wa' form was said strange, but acceptable if continued by something like ' ... keredomo inu wa nai' (... but dog *wa* not. Compare with

Watashi ni wa ie ga aru (me to/at/in *wa* house *ga* is)

Which was said a more useable way of claiming to have a house than

Watashi ni wa ie wa aru.

To start with 'watashi ni ga ... ' was said to be impossible.

5. Further, it seems that *ga* is for the most part not used with a negative.

ano hito wa nihonjin ja nai (that person *wa* Japanese is not)

being held in much preference to its 'wa' form.

2　Proposed solution

2.1　Philosophical basis

The most inaccessible term within the following philosophical basis is the term 'thought'. The logical counterpart of the term 'thought' in this paper is the term 'topic' or 'world'. Use of 'world' here is distinct from use in theories of necessity.

At any point in a conversation a speaker has a variety of thoughts available to him. Sentences are intended to convey thoughts and to manipulate the thoughts of interlocutors. It is left open in this paper how the intentions of a speaker relate to the meanings of his words. However, sometimes the intent of the speaker is strongly linked with the meaning.

We take a use of *wa* as the speaker intending or meaning to emphasise the predicate. We take a use of *ga* as the speaker intending to emphasise the subject. In order to model this we read a sentence like *A wa B* as something like:

(1) Any thought involving *A* must be a thought involving *B*.

We read a sentence like *A ga B* as:

(2) Any thought involving *B* must be a thought involving *A*.

Conditions on what thoughts the interlocutor may have will vary the affect of such an instruction. Our logic shall model this by means of a modal logic where the possible worlds (or topics) are meant to represent thoughts relevant to the context.

2.2 Basic semantics

Let $\mathcal{L}$ be first order language containing no $n + 1$-ary function symbols, an existence predicate and the symbols $\square$ and $\diamond$, we define a context to be the triplet $\mathcal{C} = \langle W, L, V \rangle$ where

Definition 2.1

1. W is a set of worlds.

2. L is a mapping from W into the powerset of $\mathcal{L}$. Let l_w denote the subset of $\mathcal{L}$ assigns to w.

3. A is a set of functions that assigns to each world a valuation. Let f_w be the valuation assigned to w, then for every n-ary predicate symbol P of l_w, $f_w(P)$ is a set of n-tuples of constants in l_w.

Intuitively a context is a set of topics (thoughts) relevant to the conversation. Each topic contains relevant constants (people) and predicates. W is the set of topics, L says who and what predicate is relevant to each topic, and V says what is the case in each topic.

Definition 2.2 An *assignment* σ, on a context $\mathcal{C}$, is a mapping from the variables and constants of $\mathcal{L}$ into the set of constants of $\mathcal{L}$ such that

If constant a is in l_w of a $w \in W \in \mathcal{C}$ (i.e. is relevant at w), then $\sigma(a)$ is also in l_w.

σ says to what each variable and constant refers. For the most part it is as if we use, say, Yuukisan's name to represent Yuukisan, in this case the name 'Yuuki' is assigned itself.

We define when a formula of $\mathcal{L}$ is satisfied by an assignment σ at a world w.

Definition 2.3

1. $P(x_1 \ldots x_n)$ is satisfied by σ at w when all predicate and constant symbols of $P(x_1 \ldots x_n)$ are in l_w and $\langle \sigma(x_1) \ldots \sigma(x_n) \rangle$ is an n-tuple f_w assigns to P

2. $\sim \alpha$ is satisfied by σ at w when all predicate and constant symbols of α are in l_w and $\langle \sigma(x_1) \ldots \sigma(x_n) \rangle$ is not an n-tuple f_w assigns to P

3. $\alpha \vee \beta$ is satisfied by σ at w when all predicate and constant symbols of α and β are in l_w and either α is satisfied at w or $\square$ is satisfied at w

4. Similar definitions may easily be derived for the other truth functional connectives.

5. $\square \alpha$ is satisfied by σ at w when all predicate and constant symbols of α are in l_w and α is satisfied at every world in W.

6. $\exists x \alpha$ is satisfied by σ at w when all predicate and constant symbols of α are in l_w and $\exists x \alpha$ is satisfied by some σ' at w such that σ' is x-alternate to σ.

7. If a and b are constants then $a = b$ is satisfied by σ at w when $\sigma(a)$ and $\sigma(b)$ are in l_w and $\sigma(a) = \sigma(b)$.

We shall use a notion of truth that is different from the 'satisfied at every world' notion. Our notion of truth is defined as follows:

Definition 2.4

1. α is true in $\langle W, L, V \rangle$ when α is satisfied at all $w \in W$ that contain all the constant and predicate symbols appearing in α and there is such a $w \in W$.

2. α is false in $\langle W, L, V \rangle$ when α is not satisfied at all $w \in W$ that contain all the constant and predicate symbols appearing in α and there is such a $w \in W$.

A sentence is true if it is satisfied in every topic (world) where it is relevant (all its constants and predicate symbols are part of that world).

2.3 Simple subject-predicate sentences using *wa* and *ga*

First we define new operators into our language.

Definition 2.5

- If φ is a formula containing x as a free variable then $\square_{\varphi}\alpha$ is satisfied by σ at w when w satisfies $\exists x \varphi$ and α is satisfied at every world in W that satisfies $\exists x \varphi$.

- If a is a constant then $\square_{a}\alpha$ is satisfied by σ at w when w satisfies $\exists x = a$ and α is satisfied at every world in W that satisfies $\exists x = a$.

For example if a is a name then $\square_a \alpha$ is satisfied at w when α is satisfied in every topic at which a is relevant.

Definition 2.6

- 'A *wa* F' will translate as $\exists u \square_a \varphi$, where a is the appropriate formalisation of the clause A and φ is an appropriate formalisation of the clause F (where the free variable u is used, where necessary, as a marker for the subject) .

- A *ga* F will translate as $\exists u \square_{\varphi} u = a$, where φ is an appropriate formalisation of the clause F.

We now try to formalise some aspect of the context. The intuition is that, in conversation, some thoughts (topics) should not be broken down any further, these characterise the context. For example an 'ordering food' context is characterised by the waiter being unable to break down any further a thought involving a customer and his order, nor should he think of the customer ordering something different (once the order has been placed).

Definition 2.7

A set of formulas Ψ represent a singular concept when there is some topic w such that

1. The predicate and constant symbols of Ψ are relevant at w (are in l_w).

2. For every tuple $a_1 \ldots a_n$ in hence in l_w if

- α is in Ψ and w satisfies $\alpha[a_1 \ldots a_n]$ (or $\sim\alpha[a_1 \ldots a_n]$) then $\alpha[a_1 \ldots a_n]$ (or $\sim\alpha[a_1 \ldots a_n]$) is satisfied in every topic in which the $a_1 \ldots a_n$ are relevant.

- If predicate symbol P is in l_w and $Pa_1 \ldots a_n$ (or $\sim Pa_1 \ldots a_n$) is satisfied in w then $Pa_1 \ldots a_n$ (or $\sim Pa_1 \ldots a_n$) is satisfied in every topic in which the $a_1 \ldots a_n$ are relevant.

- Every constant of l_w satisfies a member of Ψ.

we call such a w the singular topic of Ψ.

A special case is if Ψ is simply $\{x = a\}$, in this case we call Ψ the singular concept of a (and the appropriate world, the singular topic of a).

The philosophical intuition for conditions (b) is that 'simple' idea is so fundamental (or basic) to the conversation the information within is unassailable.

If w is singular then, since α may not occur in l_w or Ψ, it does not follow that if α is (or is not) satisfied in the singular topic w then α is (or is not) not satisfied every topic in which a is relevant.

2.4 Examples

Sentence	Informal Formalisation
watashi wa piza	$\exists u \Box_{\text{watashi}}[\text{piza}(u)]$
watashi ga piza	$\exists u \Box_{\text{piza}}[u = \text{watashi}]$
watashi ni wa ie ga aru	$\exists u \Box_{\text{watashi}}[\exists u \Box_{\text{iru}(x)}\text{ie}(u)]$

In the table we used 'aru(x)' and not '$\exists y(y = x)$' for we are treating existence as a predicate (unlike relevance, which provides a better interpretation of the existential quantifier here). The entire formalised form of the clause 'ie ga aru' occurs as a subscript.

Our theory provides a suggestion as to why we must say 'ni wa' rather than 'ni ga'. We can say that 'ni' here is forcing 'watashi' not to be singular, instead we must consider 'watashi' plus some extra constants, then 'ni; forces further predication to be on only these extra constants (e.g. that one of them is a house). Thus we can read 'watashi ni wa ie ga aru' as:

In every watashi-topic [4] there exists a house

where the 'ni' forces the house and the 'watashi' to be distinct. Now, since we are dealing with whether '*watashi*' is singular or not we must use 'wa'.

2.5 Semantic Results

We will now look the predictions this theory makes on the truth conditions of some sentences.

1.
   - 'watashi wa piza' formalises as $\exists u \Box_{\text{watashi}}[\text{piza}(u)]$.
   - If $\exists u \Box_{\text{watashi}}[\text{piza}(u)]$ is satisfied at w then there is a u which satisfies, in every world where 'watashi' is relevant, 'piza(u)'.

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[4] In every topic in which 'watashi' is relevant. That is, every world w where 'watashi' is in l_w.

- If we assume that 'watashi' represents a singular concept then we obtain the result that 'watashi' is a pizza. However suppose 'watashi' is not singular, say if we are in a restaurant and the context demands that every person be considered with respect to what he ordered. The claim is that the notion of singular topics formalises the effect context can have on such sentences.

- It follows that there is an object u in w which satisfies 'piza(u)' in every world where 'watashi' is relevant. In particular it satisfies it at w.

- Note that since 'watashi' is not singular it need not be 'watashi' that satisfies 'piza(u)' in every world where 'watashi' is relevant. In the case of 'watashi' not being singular 'watashi wa piza' means something like 'I have something to do with a pizza'. We can say (but we need not) that the idiom demands that {watashi,b} be singular where b is something distinct (and maybe even owned by) 'watashi'.

2.
- 'watashi ga piza' is formalised as $\exists u \Box_{\text{piza}}[u = \text{watashi}]$

- If $\exists u \Box_{\text{piza}}[u = \text{watashi}]$ is satisfied at w then there is a u which satisfies, in every world where $\exists x\,\text{piza}(x)$ is satisfied, '$u = \text{watashi}$'.

- Assume that 'piza' is singular. So, by the definition of singular topic, 'watashi' satisfies 'piza(x)'. Also it follows that 'watashi' satisfies 'piza(x)' in every world where 'watashi' is relevant (from Def 2.7).

- Therefore particular 'watashi' satisfies 'piza(x)' in w.

- Thus we obtain the peculiar meaning that I am identical with a pizza. If 'piza' is not singular then the result is much the same as for 'watashi wa piza'.

- Where neither 'watashi' nor 'piza' are singular there is little difference, given by this semantics, between wa and ga.
  We would characterise the context of ordering in a restaurant by {piza(x), person(x)} as singular and maybe also {$x = \text{watashi}, x = \text{food}$} (here, 'food' is a constant but we can do it differently), depending on what the context is precisely.

- We analyse the contextual effect of a question like 'what do you want?' as forcing the person (the 'you') to be no longer singular (as he cannot be now considered aside from the order). This means that 'watashi wa piza' is a better answer, for 'piza' may be singular thus making 'watashi ga piza' peculiar.
  We analyse the contextual effect of a question like 'what do you want?' as forcing 'piza' to be no longer singular (*not*, each person as the question is not directed at any particular person). This means that 'watashi wa piza' is a better answer, for 'watashi' may be singular thus making 'watashi ga piza' peculiar.
  The uniqueness (or complete list) sense of 'ga' may be seen by the following example. To guarantee that 'kore wa shiroi' (this is white) predicates 'shiroi(x)' of 'kore', 'kore' must be singular. But then if someone says 'are ga shiroi' (that is white), from our analysis of 'ga' this forces 'are' to be in all 'shiroi(x)' topics, notably in the singular topic of 'kore' (thus forcing the identity 'kore = are'). Thus 'x ga A' will contradict any 'y wa A' where y is singular and $y \neq x$ is already established. So if what is in question is not what has been done by members of a group as a whole, but what has been done separately by each member then the analysis of this is to make each member represent singular concepts (topics). But in this case 'Sachi ga nihon ni

kaerimashita' has a uniqueness (complete list) sense, which is captured as above by the theory. 'Sachi wa nihon ni kaerimashita' does not have this reading so easily, neither does our theory so easily provide it.

3. • 'watashi ni wa ie ga aru' is formalised as $\exists u \Box_{\text{watashi}}[\exists u \Box_{\text{aru}(x)}\text{ie}(u)]$.

   • Suppose it is true, then it is satisfied at a world w where all the appropriate predicate and constant symbols are relevant.

   • Then there is a u which satisfies, in every world where 'watashi' is relevant, '$\exists u \Box_{\text{aru}(x)}\text{ie}(u)]$'.

   • A world w' satisfies '$\exists u \Box_{\text{aru}(x)}[\text{ie}(u)]$' when there is a u such that in every world where $\exists x \text{aru}(x)$, $[\text{ie}(u)]$. Or when something is a house in every world where something satisfies $\text{aru}(x)$. Further $\exists x \text{aru}(x)$ will be satisfied at w' if $\exists u \Box_{\text{aru}(x)}[\text{ie}(u)]$ is satisfied (from Def 2.5).

   • The verb 'to be' is one of the most basic verbs there is and is taken here to be singular in most conversation. We can consider objects existing, apart from other predicates they might have.[5]

   • So $\exists u \Box_{\text{watashi}}[\exists u \Box_{\text{aru}(x)}\text{ie}(u)]$ is satisfied at w when in every world where 'watashi' is relevant, there is a u which is a house in every house-relevant world that satisfies '$\exists x \text{aru}(x)$'. In particular there will be a house in every world where 'watashi' is relevant. For the formula $\exists u \Box_{\text{aru}(x)}[\text{ie}(u)]$ is satisfied at every 'watashi'-relevant world, but for that formula to be satisfied $\exists x \text{aru}(x)$ must be satisfied (from Def 2.5) and thus $\exists x \text{ie}(x)$ must also be satisfied. In other words, there must be a house at every world in which 'watashi' is relevant.

   • Note however that in this case, if 'watashi' is singular then 'watashi ni wa ie ga aru' implies that 'watashi' is a house. But this is a bonus, the fact that we must say 'watashi *ni* wa ... ' rather than 'watashi wa ... ' suggests that the 'ni' and is demanding that 'watashi' is not singular and that we must consider 'watashi' in relation to something, say, owned by 'watashi'. This provides an explanation of why 'watashi wa ie ga aru' is unacceptable.

3 Comparison and negation

1. Two forms of comparison have been noted with *wa*. The form which appears to be brought on by the meaning of the predicate

   Yujisan wa tatte iru keredomo suwatte nai

and another which appears to be brought on by the meaning of *wa*

   Kore wa shiroi keredomo are wa kuroi

Cases of the first type have been accounted for above; two predicates which are incompatible or unexpected to hold of the same object may not be allowed into the singular topic of a particular individual. Thus 'suwaru(x)' and 'tatsu(x)' may no both be allowed into

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[5]Unless, perhaps, the conversation is about fictional and non-fictional houses, then 'aru' should not be singular.

Yujisan's singular topic. The point being that Yujisan's singular topic is only important if we use *wa*, this explains why such a comparative sentence uses *wa*.

As to a case of the second type, it seems that this is brought on by something in the meaning of *wa* that requires a comparative reading. Notice that 'kore wa shiroi' formalises as $\exists u \Box_{\text{kore}}[\text{shiroi}(u)]$, which means that there must be something that is white in every topic that is 'this' (kore). We have shown above what conditions there must be to force the predication of 'shiroi(x)' on 'kore'. However there is nothing to stop the predication of 'shiroi(x)' *anything else* that appears in a kore-topic. The logic deliberately leaves it open that any other object in a topic in which 'kore' is relevant gets predicated as being white. Now, therein lies the comparison. The sentence $\exists u \Box_{\text{kore}}[\text{shiroi}(u)]$ leaves it ambiguous as to what exactly satisfies shiroi(u). So, in order to remove the ambiguity, we must add another clause that rules out the valuation of shiroi(u) to any other object that is relevant in a kore-topic. Thus we feel the need for a 'keredomo are wa shiroi ja nai' or 'keredomo are wa kuroi' (if 'are' is relevant).

With *ga*, as seen above, a phenomena similar to the comparison of the first type gives us the uniqueness that is implied by *ga*. Further, notice that a formalisation of 'maiku ga riko' is $\exists u \Box_{\text{riko}}[u = \text{maiku}]$, but there can be only one 'maiku' so there is no ambiguity in its satisfaction. Thus, in general, we do not so easily find a comparative reading of sentences that use *ga*.

2. With the exception of sentences implying non-existence like 'kami ga nai' it seems that, in general, sentences using *ga* do not take the negative. A sentence like

> Sono Eikokujin wa wakaranakatta (That Englishman *wa* didn't understand)

is better that

> Sono Eikokujin ga wakaranakatta.

The first means simply that the Englishman does not understand, but the second seems useable only if a number of people are known to understand except one and we wish to know who.[6] Even in that scenario the sentence is strange. To see why this is consider the formalisation of the two. The first formalises to $\exists u \Box_{\text{Eikokujin}}[\sim\text{wakatta}(u)]$, this is then operates as per normal.

However the negation of the second sentence would be $\exists u \Box_{\text{wakatta}}[\sim(u = \text{Eikokujin})]$. It is the subject that *ga* emphasises and so it is the subject that is negated. The logic can be said to demand this if we stipulate that that particular type of negation negates within the scope of the modal operator (not external to the modal operator). For $\exists u \Box_{\text{wakatta}}[\sim(u = \text{Eikokujin})]$ to hold there must be an object that is *distinct* from the Englishman in every topic where someone *has* understood. This is a strange and specialised meaning that can hardly ever be meant, which is why '*ga*' is less often used with the negative.

Note that negation can be treated in two ways under this system. Some negations may be external to the operator so we may have $\sim\exists u \Box_{\text{iru}}[u = \text{Eikokujin}]$, which states simply that the Englishman does not exist. Maybe we can be no more that descriptive here and

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[6] It seems that unless at least one person (other than the Englishman) *does* understand, the sentence (ga-form) is inappropriate.

stipulate that 'iru' takes the external form with *ga* whereas a verb like 'wakaru' takes the internal form.

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