

An Introduction to Language Faculty Science¹

Hajime Hoji

Summary

- (1) Our point of departure:
Underlying our ability to relate linguistic sounds/signs to meaning is the language faculty.

We can accumulate our knowledge about the language faculty by the basic scientific method as indicated in (2) and (3).

- (2) The Basic Scientific Method (I)
- a. Guess-Compute:
Deduce a *definite* and *testable* consequence as an entailment of hypotheses.
 - b. Compare:
Obtain *definite* experimental results in line with the consequence in (2a).
- (3) Methodological Minimalism:
One of its consequences is that the number of primitive concepts should be as minimal as possible.
- (4) The language faculty consists of LangFac^{Com} and LangFac^{Cog}.

Language faculty science seeks to obtain:

- (5) Confirmed predicted correlations of schematic asymmetries
- (6) Focus on:
- a. “confirmed” is due to (2b).
 - b. “predicted” is due to (2a).
 - c. “correlations” is due to (4).
 - d. “schematic” is due to (3).
 - e. “asymmetries” is chiefly due to (3) and (4).

The lectures will elaborate on what is meant by the above and state the immediate goal of the language faculty scientist. They are meant to be a very brief summary of the book I am currently working on (*Predictions and Experiments in Language Faculty Science*). What will be distributed during the 12/17 lectures will be a *substantially* simplified version of this file. Those who wish to obtain a basic background for language faculty science can visit <http://www.gges.org/hojiCUP/>. They might find it useful to go over the Japanese translations of Hoji 2015: Ch. 1 and Ch. 8.2 although it should be noted that what Hoji 2015 seeks to obtain is a confirmed predicted schematic asymmetry, not a confirmed predicted correlation of

¹ This file has been prepared for those who might be interested in going over what will be discussed in my lectures at Kokugoken on 12/17. The lectures on 12/17 and the handout to be distributed there will be a substantially simplified version of what is contained here. If you have any questions about the content of this file or about any other aspect of language faculty science, please feel free to email me at hoji[at]usc.edu (Replace [at] with @). You can write in Japanese.

schematic asymmetries.

Lecture One: Methodology

1. The Basic Scientific Method

- (2) The Basic Scientific Method (I)
 - a. Guess-Compute:
Deduce a *definite* and *testable* consequence as an entailment of hypotheses.
 - b. Compare:
Obtain *definite* experimental results to test the consequence in (2a)

- (7) The Basic Scientific Method (II)
Methodological Completism:
The empirical coverage (and the theoretical deduction of the predictions) should be as *complete* as possible.

- (8) The Basic Scientific Method (III)
Methodological Minimalism:
One of its consequences is that the number of primitive concepts should be as minimal.

It seems reasonable to assume that Feynman took (7) and (8) for granted when making his remarks about “Guess-Compute-Compare,” restated here as (2). Likewise, it seems to be a reasonable guess that Einstein took (2) for granted when making his remarks restated here as in (7) and (8).² I take it that any serious scientific research program aspires to pursue (2), (7), and (8) as long as it is possible and strategically viable to do so.

2. Features of language faculty science

2.1. The goal of language faculty science

- (1) Our point of departure:
Underlying our ability to relate linguistic sounds/signs to meaning is the language faculty.

- (9) Language faculty science aspires to accumulate knowledge about the language faculty by the basic scientific method consisting of (2) and (8) (and (7) as well, to a limited degree, as will be elaborated below).

2.2. The internalist perspective

(1) entails (10) insofar as the ability to relate linguistic sounds/signs to meaning is the ability of an individual, not the ability of a group of individuals.

² That seems clear from his remarks in (i), with which Einstein ends his Forward to *Dialogue Concerning the Two Chief World Systems—Ptolemaic & Copernican* by Galileo Galilei, translated by Stillman Drake, 1967, University of California Press.

(i) “[Galileo’s] endeavors are not so much directed at “**factual knowledge**” as at “**comprehension**.” But to comprehend is essentially to draw conclusions from an already accepted logical system.” (pp. xvii-xviii)

(10) The language faculty is internal to the mind/brain of an individual.

Hence, we are led to (11).

(11) Language faculty science deals with an individual.

When combined with (9), (11) has the consequence that we aspire to accumulate knowledge about the language faculty by the basic scientific method consisting of (12) and (8) (and (7) as well, though to a limited degree, as will be discussed below).

(12) The Basic Scientific Method (I), adapted to language faculty science:

a. Guess-Compute:

Deduce a *definite* and *testable* consequence *about an individual* as an entailment of hypotheses.

b. Compare:

Obtain *definite* experimental results *about an individual* and compare them with the consequence in (12a).

(8) The Basic Scientific Method (III)

Methodological Minimalism:

One of its consequences is that the number of primitive concepts should be minimal.

So, the question is how we can pursue (12).

2.3. Definite data

(13) A general point about definite data: data can be definite by having a or b:

a. a definite numerical value

b. a categorical (Yes/No) value

Because we pursue (12) in language faculty science, we must ask, for each of (13), whether and how we can *deduce* a *definite* value and whether and how we can obtain it in an *experiment*. Both types of values must be about an individual and it must be related to some properties of the language faculty. (14) schematizes the four “cases” to consider.

(14)

	a definite numerical value	a categorical (Yes/No) value
Deducible?	a	c
Observable?	b	d

“Deducible?” asks whether we can deduce the definite value in question; “observable?” asks whether we can obtain it experimentally.

2.4. Data in language faculty science

(1) Our point of departure:

Underlying our ability to relate linguistic sounds/signs to meaning is the language faculty.

Given (1), the data that is most directly related to the language faculty is something that reflects an individual’s ability that relates linguistic sounds/signs to meaning.

Any other type of data would have to be related to this ability in some way. Otherwise, it would not constitute data in language faculty science, i.e., evidence for or against our hypotheses in language faculty science.

It seems reasonable that we consider, for this purpose, the informant judgment on the acceptability of a sentence under a particular interpretation. This allows us to address the questions raised in (14) in a somewhat more concrete way than before.

2.5. Definite data in language faculty science: Initial considerations

Regardless of whether we deal with (13a) or (13b), the deducibility of a prediction of a definite/categorical value and the observability of data of a definite/categorical value must accompany each other. Otherwise, we would not be able to pursue (12).

Let us consider (14) again, now given that we deal with an individual informant’s judgment on the acceptability of a sentence under a specified interpretation.

(14)

	a definite numerical value	a categorical (Yes/No) value
Deducible?	a	c
Observable?	b	d

The question about (14b) is whether it is possible to assign a *definite numerical* value to the informant’s acceptability judgment about a given sentence under a specified interpretation. Inspection of our own intuitions tells us that it is not possible to do so, like assigning “78.5% acceptable” to our own judgment. Since the answer to (14b) is no, the answer to (14a) would be immaterial.

Turning to the question in (14d), it does not seem impossible to assign a categorical (Yes/No) value to our acceptability judgment about a given sentence under a specified interpretation. That leads us to the question whether it is possible to *deduce* from hypotheses a categorical (Yes/No) value of our acceptability judgment about a given sentence under a specified interpretation

2.6. Deducibility of a categorical value

The answer to the question whether it is possible to deduce from hypotheses a categorical (Yes/No) value of our acceptability judgment about a given sentence under a specified interpretation depends upon the answer to each of the questions in (15).

- (15) a. What kind of hypotheses can/do we put forth and in terms of what theoretical primitives?
- b. What is meant by a specified interpretation?
- c. What is meant by each of the categorical values (Yes and No)?

Only with certain answers to the questions in (15), can we deduce a prediction of a categorical value for an individual informant. Furthermore, the answers to (15) are closely inter-connected with each other. For example, only by focusing on a certain aspect of the interpretation of a sentence, can we deduce a prediction of a categorical value, as will be pointed out shortly.

2.6.1. Theoretical primitives

Let us first consider (15a). In order to formulate our hypotheses, we must have a theoretical primitive in terms of which we state our hypotheses. As Chomsky has pointed out, as in [Chomsky 2017](#), the recognition of infinite creativity (digital/discrete infinity) of “language” leads us to postulate the existence of the Computational System of the language faculty. For without some kind of recursive operation of combining elements, infinity would not be possible. The existence of the Computational System and the Methodological Minimalism (see (8)) lead us to postulate the simplest computational operation. It should (iteratively) combine two elements/item and form one, which can be considered an operation of set formation. The operation has been called *Merge*. The output of the (iterative) application of Merge is

strictly hierarchical; it does not encode the precedence relations among the elements/items therein. Chomsky considers the linear-precedence relation, necessitated by the need to externalize the purely hierarchical representation for the access of the sensorimotor system, to be of a secondary importance and communication to be of a tertiary importance to the language faculty.³

One of the most basic structural relations definable in terms of *Merge* is the structural relation holding between A and B as indicated in (16).⁴

(16) A is *Merged* with something that contains B.

The structural relation holding between A and B indicated in (16) is called *c-command*; A is said to *c-command* B when (16) holds.⁵

As noted, the postulation of *c-command* is based on that of *Merge*, and the postulation of *Merge* is based on that of the *Computational System* of the language faculty, which is in turn is based on the recognition of digital/discrete infinity. If we consider this line of thinking a general theory of the language faculty, an immediate consequence of the general theory is the existence of *c-command* effects. How to detect *c-command* effects should then be a central issue in language faculty science

Let us call the output of the iterative application of *Merge* a *Hierarchical Representation*. Assuming, with Chomsky, that Hierarchical Representation is the basis for meaning (more precisely, the Computational-System-based meaning), we can pursue the basic scientific method in (12) by formulating hypotheses in terms of *c-command* and deduce definite predictions about the informant's judgment on the relation between sounds and meaning, on the basis of the hypothesized *c-command* relation in the Hierarchical Representation corresponding to a particular phonetic sequence.

2.6.2. Hypotheses in language faculty science

2.6.2.1. Two types of hypotheses in language faculty science

(17) Chomsky's view of the language faculty (I):

The language faculty is a genetic endowment, shared by all members of the human species, with its initial state growing into its steady states (which we shall call *I-language*, following Chomsky 1986 (*Knowledge of Language*) based on the linguistic environment to which it is exposed while retaining the fundamental properties of the initial state.

³ This conception, Chomsky suggests, provides a straightforward explanation for the universally observed property of structure-dependence as an innate property of the language faculty and is in harmony with, and hence renders support for, the thesis about the emergence of the language faculty being quite abrupt and the one about the language faculty being unique to the human species. Chomsky has maintained this view in many of his previous lectures and published works, including Berwick and Chomsky 2015 and Chomsky 2016 and lectures such as "Language and the Cognitive Science Revolution(s)," delivered at Carleton College on April 8, 2011 (<https://www.youtube.com/watch?v=XbjVMq0k3uc>, last accessed on May 30, 2-17), and "Language and Other Cognitive Systems: What is Special about Language?," delivered at the University of Cologne during June 6, 2011 (<https://www.youtube.com/watch?v=CgCriS1-bLY>, last accessed on May 30, 2017).

⁴ Two structural notions inherent in *Merge* are *sisterhood* (because it combines *two* elements/items and forms one) and *containment* (because *Merge* can apply iteratively and hence one of the elements/items being *Merged* can be a result of an earlier application of *Merge*, thereby *containing* two or more elements/items therein. *C-command* is a combination of *sisterhood* and *containment*, which we can make transparent by restating (16) as in (i).

(i) A is a sister to something that contains B.

⁵ Whether we consider the containment relation to be reflexive results in different definitions of *c-command*. I assume the choice to be an empirical one and we will leave it undecided about it here.

The language faculty of any individual we deal with is necessarily in its steady state. (17) thus leads to the requirement on prediction-deduction in language faculty science as stated in (18).

- (18) The requirement on prediction-deduction in language faculty science:
 The deduction of a prediction in language faculty science must be based on *universal* and *I-language-particular* hypotheses, where “universal hypotheses” are hypotheses about the initial state of the language faculty and I-language-particular hypotheses are those about the properties specific to a steady state of the language faculty, i.e., an I-language.

If we carried out (12) successfully and if we obtained definite experimental results in line with the definite prediction deduced from hypotheses formulated in terms of c-command, that would count as the detection of c-command effects.

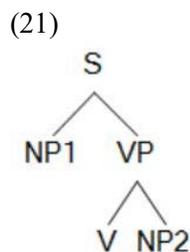
- (12) The Basic Scientific Method (I), applied to language faculty science:
 a. Guess-Compute:
 Deducing a *definite* and *testable* consequence *about an individual* as an entailment of hypotheses
 b. Compare:
 Obtaining *definite* experimental results *about an individual* to test the consequence in (2a)

Toward that goal, we can first put forth a universal hypothesis like (19).

- (19) Formal Object(a, b) is possible only if a c-commands b.

Clearly, (19) alone does not give us a testable prediction. To obtain a testable prediction, we also need I-language-particular hypotheses such as (20) for I-languages of the speakers of “English.”

- (20) a. NP₁ Verb NP₂ *must* correspond to (21).
 b. NP₂, NP₁ Verb *can* correspond to (21).



What is relevant in the Hierarchical Representation in (21) is only the hierarchical relation among the elements/items therein (although we see the linear-precedence relation because it is shown two-dimensionally here). (19) and (20) lead to a definite consequence regarding the c-command relation between two items/elements in the Hierarchical Representation corresponding to any two NPs that appear inside a sentence of the form of “NP Verb NP” (or of the form of “NP, NP Verb”).

The last type of hypothesis we need should relate some interpretation detectable by the informant to the presence or the absence of FO(a, b). We thus seek some meaning relation pertaining to two linguistic expressions, which we shall call **Meaning Relation(A, B)**, so as to turn the consequence based on (19) and (20) *testable*. Hypotheses that relate the existence of FO(a, b) to MR(A, B) is of the form in (22).

- (22) MR(A, B) is possible only if there is FO(HR(A), HR(B)), where HR(X) stands for the

item/element in Hierarchical Representation corresponding to the linguistic expression X in a phonetic sequence.

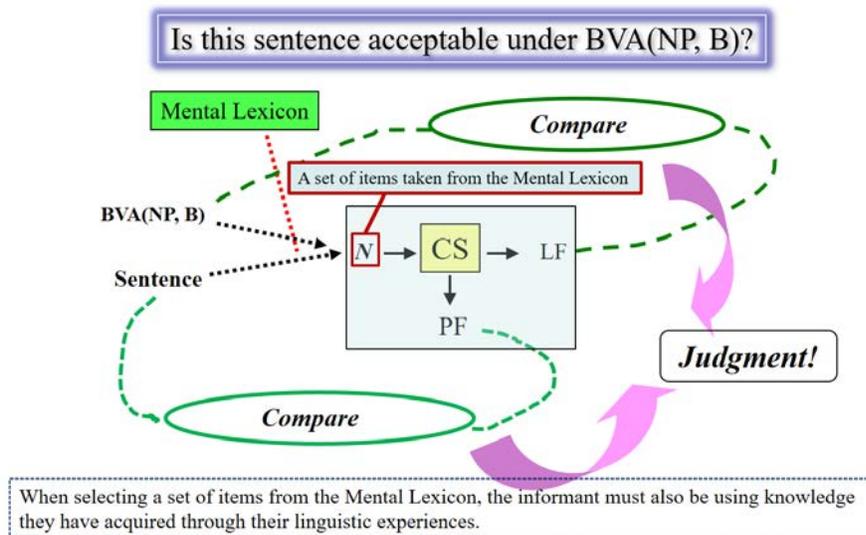
A major task of the language faculty scientist is then to identify MR(A, B), with the specific choices of MR, A, and B such that its availability must be based on FO(HR(A), HR(B)) at least in certain syntactic and discourse contexts for a given informant (at a given time) for various I-languages.

2.6.2.2. The model of the Computational System and the model of judgment-making

Recall that we want to deduce a definite prediction about an individual informant's judgments based on our hypotheses. This means that we must have a hypothesis about what goes on in the mind/brain of the informant when they judge a sentence under a specified interpretation. We adopt the Ueyama model of judgment-making by the informant as given in (23).

(23) The Ueyama (2010) model of judgment making

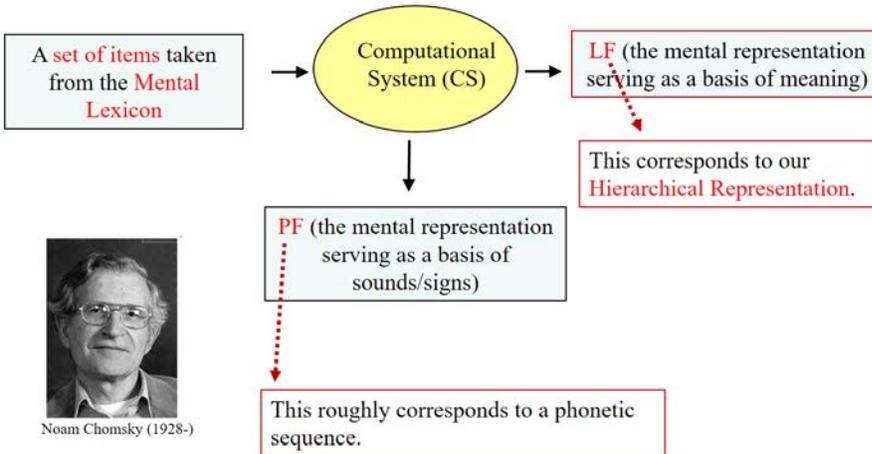
A Hypothesis about what goes on in the mind of the informant when they make a judgments on a sentence



(24) Chomsky's 1993 model of the Computational System of the language faculty

Chomsky's Model of the Computational System

Chomsky 1993



2.6.3. MR(A, B) can arise without FO(a, b)

We have introduced the type of hypothesis of the form in (22).

- (22) MR(A, B) is possible only if there is FO(HR(A), HR(B)), where HR(X) stands for the item/element in Hierarchical Representation corresponding to the linguistic expression X in a phonetic sequence.

As noted, without a hypothesis of this type, the consequence from hypotheses such as (19) and (20) would remain not testable. Hypotheses of the type in (22) make crucial reference to a particular **M**eaning **R**elation pertaining to two linguistic expressions. Our judgments about the relation between linguistic sounds and meaning, however, can be affected a great deal by factors that are related to how we understand the world, how the inference “module” of the mind works, etc.⁶

It should therefore not be surprising if MR(A, B) *could* arise without FO(a, b) (more precisely, FO(HR(A), HR(B))). It would actually be surprising to many if we could indeed identify instance of MR(A, B) that must be based on FO(a, b). We pursue the possibility that we can identify MR(A, B) that must be based on FO(a, b) because of our belief that it is indeed possible to pursue (12), which has been supported by experimental results.

So I take (25) to be valid.

- (25) The subject matter of language faculty science (i.e., the language faculty) consists of what can be understood by the basic scientific method (LangFac^{Com}) and what cannot (LangFac^{Cog}), and a large portion of it seems to belong to the latter.⁷

⁶ It is an empirical matter whether a given factor will remain part of LangFac^{Cog}. I.e., the demarcation between LangFac^{Com} and LangFac^{Cog} is an empirical matter and it is bound to change as our research advances.

⁷ “Com” in “LangFac^{Com}” and “Cog” in “LangFac^{Cog}” are intended to connote “computational” and “cognitive.” I owe Yuki Takubo (p.c. October 2018) for suggesting the use of “Com” and “Cog” in place of “Core” and “Periphery,” respectively. What is meant by “Com/Core” and “Cog/Periphery” is “Understandable by means of the basic scientific method” and “not understandable by the basic scientific method,” respectively.

2.7. What leads to each of (26)

Let us now consider what leads to each of (26).

- (26) Concrete features of language faculty science (I):⁸
- a. Focus on Schemata
 - b. The *fundamental schematic asymmetry* (that the *Schema⁹ is such that there *cannot* be any sentence instantiating it that is judged to be acceptable under the specified interpretation) while its corresponding ^{ok}Schema, minimally different from the *Schema, is such that there *can* be a sentence instantiating it that is judged to be acceptable (at least to some extent) under the specified interpretation)
- (27) An example of the fundamental schematic asymmetry:
- a. ^{ok}Schema: [... B ...] [more than one N] Verb (with BVA(more than one N, B))
 - b. *Schema: [... B ...] Verb [more than one N] (with BVA(more than one N, B))
- (28) What leads to (26a):¹⁰
- Focus on the detection of c-command effects
- We consider a phonetic sequence *in terms of a Schema* so as to be able to address the c-command relation (or the lack thereof) between two objects in the Hierarchical Representation corresponding to two NPs in a phonetic sequence.
 - That is the first step for the detection of c-command effects.
 - Another step is to check the availability of MR(A, B) pertaining to two linguistic expressions A and B in a phonetic sequence such that it is crucially dependent upon FO(HR(A), HR(B)).
- (29) What leads to (26b):
- A Schema representing an infinite number of sentences
- There is, in principle, no limit to how complicated the sentence instantiating each type of Schema can be. It is therefore, in principle, impossible to predict full acceptability for every sentence instantiating the ^{ok}Schema while such issue does not arise in the case of sentences instantiating the *Schema; Hoji 2015: Ch.2.4 contains basic discussion of this.

2.8. More features of language faculty science

Some more feature of language faculty science will be briefly addressed below.

⁸ The bulk of the conceptual discussion in *Language Faculty Science* (henceforth Hoji 2015) is devoted to this issue. See its Glossary (available at: <http://www.gges.org/hojiCUP/index.shtml>) for what is meant by the concepts mentioned in (26). Although Hoji 2015 greatly simplifies the matter, it does provide a basis for pursuing language faculty science as it is being articulated here. We could not address *correlations of schematic asymmetries* without *the fundamental schematic asymmetry*. The former is the most crucial aspect of language faculty science according to our/my current understanding; and the latter is the most crucial aspect of language faculty science as outlined in Hoji 2015.

⁹ “Schema” = “sentence pattern”

¹⁰ Additionally, the replicationist perspective and concern with the universal properties of the language faculty can also be considered as being responsible for (26a).

- (30) Concrete features of language faculty science (II): Predictions in language faculty science:
- a. We cannot expect to obtain a *confirmed predicted schematic asymmetry* in the terms of Hoji 2015.
 - b. The definite predictions in language faculty science must be about *correlations of schematic asymmetries*.¹¹

What we seek to obtain in language faculty science is (31) instead:

(31) Confirmed predicted correlations of schematic asymmetries

- (32) Focus on:
- a. “confirmed” is due to (12b).
 - b. “predicted” is due to (12a).
 - c. “correlations” is due to (25).
 - d. “schematic” is due to (28).
 - e. “asymmetries” is chiefly due to (29).

Recall (25).

- (25) The subject matter of language faculty science (i.e., the language faculty) consists of what can be understood by the basic scientific method (LangFac^{Com}) and what cannot (LangFac^{Cog}), and a large portion of it seems to belong to the latter.

Given (25), it follows that the design of an experiment focusing on LangFac^{Com} must pay close attention to various factors of LangFac^{Cog}. Furthermore, it is an empirical matter whether a given factor can be understood as falling within LangFac^{Com} or LangFac^{Cog}. It is only by closely examining the effects of various factors, by following the basic scientific method in (12), that we can hope to learn how they can be controlled for and whether they belong to LangFac^{Com} or LangFac^{Cog}. The relevant task can be carried out effectively only by someone who is familiar with (12), the hypotheses in question, the intended interpretations under discussion, and a host of other related issues. It thus follows that the designer of the experiment is the best informant in an experiment in language faculty science.

- (33) Concrete features of language faculty science (III): Experiments in language faculty science:
- a. Experiment: The designer-informant experiment is an experiment, where we try seek truth.
 - b. Demonstration: What used to be called a non-researcher-informant “experiment,” including a multiple-non-researcher-informant experiment, is intended to be a demonstration. It must contain Sub-Experiments in addition to its Main-Experiments.

3. The methodological guideline specific to language faculty science

|| We started out with the basic scientific method in (2), (7), and (8), following Feynman and Einstein. ||

¹¹ This is the main point of *Predictions and Experiments in Language Faculty Science*, the book I am currently working on. Focusing on (26) is for the purpose of pursuing *confirmed predicted schematic asymmetries*. As suggested above, the clear recognition of (25) leads us to adopt (30b). It also makes it clear why we deal with a particular instance of MR(A, B), with particular choices for A and B, and a particular way of specifying the intended MR(A, B), etc., for a given informant at a given time. It is because it is hoped that the (un)availability of the MR(A, B) might provide evidence for the detection of c-command effects in conjunction with the (un)availability of other types of MR(A, B).

- (2) The Basic Scientific Method (I)
 - a. Guess-Compute:
Deducing a *definite* and *testable* consequence as an entailment of hypotheses
 - b. Compare:
Obtaining *definite* experimental results to test the consequence in (2a)

- (7) The Basic Scientific Method (II)
 - Methodological Completism:
The empirical coverage (and the theoretical deduction of the predictions) should be as *complete* as possible.

- (8) The Basic Scientific Method (III)
 - Methodological Minimalism:
One of its consequences is that the number of primitive concepts should be minimal.

We have then adapted (2) as in (12).

- (12) The Basic Scientific Method (I), adapted to language faculty science:
 - a. Guess-Compute:
Deduce a *definite* and *testable* consequence *about an individual* as an entailment of hypotheses.
 - b. Compare:
Obtain *definite* experimental results *about an individual* and compare them with the consequence in (12a).

There is a methodological guideline specific to language faculty science, where we deal with individuals and where we cannot deal with definite numerical values of mathematical significance. It is related to the nature of data.

In physics, at least in its early stages, it is possible to assign, by rigorous measurement, definite numerical values to various objects/distances/angles/etc, even without any hypotheses behind the relations among the various numerical values thus measured. Once they follow the basic scientific method in (2) and deduce definite predictions and once the definite predictions are supported experimentally or observationally, and once the earlier observations have been found to be among the consequences of the hypotheses, the earlier observations, along with the new observations, are considered as part of the accumulated knowledge about the subject matter by the basic scientific method in (1). One may say in this sense that there can be a fact without hypotheses in physics even when it is not yet part of the knowledge accumulated by the basic scientific method in (1).

As discussed above, we cannot assign a definite *numerical* value to the informant's judgment on the acceptability of a sentence under a specified interpretation. The definite value we can assign to the informant judgment is categorical, as also discussed above. It is in light of the theoretical considerations as addressed above that we can aspire to attain the informant judgment of a categorical nature in line with the fundamental schematic asymmetry in (26b). This is how we are led to accept (34), which in turn leads to (35).

- (34) There are no facts in language faculty science without hypotheses even at its earliest stages of development. (Theory-laden nature of data in language faculty science)

- (35) **Methodological Guideline Specific to Language Faculty Science:**
Attaining success in pursuing (12) has primacy over any other

considerations, including Methodological Completism in (7).

Attaining success in pursuing (12) means establishing facts. Having established facts by pursuing (12) means that we have a set of universal and I-language-particular hypotheses about $\text{LangFac}^{\text{Com}}$ and a set of hypotheses/assumptions about $\text{LangFac}^{\text{Cog}}$ that have led to the design of a particular experiment, and that we have obtained an experimental result as predicted. The effective experimental device thus consists of such hypotheses and assumptions. An important point to bear in mind.

Because of (35), we first focus on a particular “empirical domain” that seems to us to give us a reasonably good chance of success in pursuing (12). Once we have attained success, and perhaps after we have replicated our success in line with (12), we will deal with “empirical domains” beyond the initial one, by building on the effective experimental device identified in dealing with the initial “empirical domain.” Everything else will be ultimately built on such a device although subsequent research may well lead to modification of the initial hypotheses and/or assumptions.

4. How the language faculty scientist does research

4.1. The defining properties of the language faculty scientist

The language faculty scientist is all of (36).

(36) The language faculty scientist is:

- a. Internalist/Individualist
- b. Universalist
- c. Definitivist
- d. Replicationalist

(37) The design of the experiment must be based on hypotheses about $\text{LangFac}^{\text{Com}}$, which are of two types (one is a universal hypothesis and the other is an I-language-particular hypothesis) and hypotheses/assumptions about $\text{LangFac}^{\text{Cog}}$.¹²

4.2. Methodological minimalism in language faculty science

(12) The Basic Scientific Method (I), adapted to language faculty science:

- a. Guess-Compute:
Deduce a *definite* and *testable* consequence *about an individual* as an entailment of hypotheses.
- b. Compare:
Obtain *definite* experimental results *about an individual* and compare them with the consequence in (12a).

(38) Merge as the atomic operation of the Computational System:

The atomic operation of the Computational System of the language faculty is the simplest possible computational operation that leads to digital infinity, i.e., the one that iteratively combines two elements and forms one.

¹² It is not clear if hypotheses about $\text{LangFac}^{\text{Cog}}$ also come in two types, universal and I-language-particular, as in the case of hypotheses about $\text{LangFac}^{\text{Com}}$.

The detection of the effects of the atomic operation and the establishment of an effective experimental device for that purpose is thus the immediate goal of the language faculty scientist. Everything else will be built on such a device. The atomic operation (*Merge*) is one that, by definition, gives us the *sisterhood* relation and the *containment* relation, and the *c-command* relation is the combination of the two relations. We focus on the *c-command* effects because they are the immediate structural effects of the atomic operation of *Merge* that at the same time enables us to address, most productively, the structural relations among the items that have been Merged.

Lecture Two: Experiments

5. Detecting c-command effects

5.1. Japanese

5.1.1. Basic cases

5.1.1.1. Three types of dependency interpretations

BVA(A, B)
 Coref(A', B)
 DR(A, B')
 as instance of MR(A, B)

(39) The basic SOV patterns *not* crucial for the detection of c-command effects:

	Subject		Object		Verb	Sample sentences with the intended MR(A, B), in their English renditions	
	NP	-ga	NP	-cm			
BVA(A, B)	A		[... B ...]			Every boy praised his father. (with BVA(every boy, his))	
Coref(A', B)	A'						That boy praised his father. (with Coref(that boy, his))
DR(A, B')	A		B'				Every boy praised two girls. (with DR(every boy, two girls))

ga: NOM

cm: a case marker other than *-ga*, for an “argument” (such as *-o* (ACC) and *-ni* (DAT))¹³

¹³ We have been focusing on *-o* (-ACC) and *-ni* (-DAT). As to *-ni* (-DAT), we are here focusing on the type of verbs whose “basic” case-marking pattern is GA NI (the so-called “regular transitive” with *-ni* marking the direct object), rather than NI GA (the verbs of the so-called “ergative” case-marking pattern).

(40) The SOV patterns crucial for the detection of c-command effects:¹⁴

	Subject		Object		Verb	Sample sentences with the intended MR(A, B), in their English renditions
	NP	-ga	NP	-cm		
BVA(A, B)	[... B ...]		A			His father praised every boy. (with BVA(every boy, his))
Coref(A', B)			A'			His father praised that boy. (with Coref(that boy, his))
DR(A, B')	B'		A			Two girls praised every boy. (with DR(every boy, two girls))

(41) The OSV patterns crucial for the detection of c-command effects:

	Object		Subject		Verb	Sample sentences with the intended MR(A, B), in their English renditions
	NP	-cm	NP	-ga		
BVA(A, B)	[... B ...]		A			His father, every boy praised. (with BVA(every boy, his))
Coref(A', B)			A'			His father, that boy praised. (with Coref(that boy, his))
DR(A, B')	B'		A			Two girls, every boy praised. (with DR(every boy, two girls))

I-language-particular hypotheses such as (42) (i.e., hypotheses about the correspondences between a schematic phonetic sequence (*ps*) and the mental representation corresponding to it serving as the basis for meaning) have the consequences about whether HR(A/A') c-commands HR(B/B') for each *ps* in (40) and (41).^{15, 16}

(42) I-language-particular hypotheses (about “Japanese”):

- a. “NP₁-ga NP₂-cm Verb” *must* correspond to the Hierarchical Representation in which HR(NP₁) asymmetrically c-commands HR(NP₂).
- b. “NP₂-cm NP₁-ga Verb” *can* correspond to the Hierarchical Representation in which HR(NP₁) asymmetrically c-commands HR(NP₂).

5.1.1.2. Two Formal Objects

(43) Formal Objects:

- a. FD(a, b)
- b. DD(a, b)

FD(a, b) and DD(a, b) are two instances of FO(a, b).

(44) Universal hypotheses:

¹⁴ The factors not indicated in (40)/(41), such as the “head N of the Subject,” the head of B,” “the head of A,” the “quantifier” in A, etc., can also affect the informant judgments, as will be briefly discussed in Section 5.1.1.4. A more complete discussion will address such details.

¹⁵ We refer to the object in the Hierarchical Representation corresponding to a linguistic expression X as HR(X).

¹⁶ We need an additional hypothesis to ensure (i).

(i) For three expressions in a parsed phonetic sequence, A, B and C, where B contains C, if HR(A) c-commands HR(B), then HR(A) c-commands HR(C).

- a. FD(a, b) only if a c-commands b.
- b. DD(a, b) only if a c-commands b.

5.1.1.3. Different sources of a dependency interpretation MR(A, B)¹⁷

If the availability of *every instance* of MR(A, B) were based on FD(HR(A), HR(B)), we would then have a definite prediction about its unavailability in what corresponds to the phonetic sequence (ps) in (40), along with the expectation about its availability in what corresponds to the ps in (41). Such, however, is not (always) the case. Consider Japanese BVA(A, B). It is not the case that it is always unavailable in (40). Let us refer to BVA(A, B) that is possible in (40) as Quirky-BVA(A, B), following Ueyama 1998.

Given that BVA(A, B) can arise not only based on FD(HR(A), HR(B)) but also as an instance of Quirky-BVA(A, B), we must have a means to control for the latter to be able to focus on the former. Otherwise, BVA(A, B) cannot serve as an effective tool for detecting c-command effects. If the availability of Quirky-BVA(A, B) were solely due to the choices of A and B, we could have the definite prediction regarding (40) by focusing on such choices of A and B. As it turns out, however, what choices of A and B result in the clear unavailability of BVA(A, B) is not invariant among speakers and even within the single informant. Similar uncertainty arises in the case of Coref(A', B) and DR(A, B'). Let us refer to Coref(A', B) and DR(A, B') that are possible in (40) as Quirky-Coref(A', B) and Quirky-DR(A, B'), respectively. What affects Quirky-Coref(A', B) most clearly is the choice of B and what affects Quirky-DR(A, B') is the choice of A in the case of DR(A, B') although there are other factors, as will be discussed below.

FD-BVA and Quirky-BVA
 FD-Coref and Quirky-Coref
 DD-DR and Quirky-DR

5.1.1.4. The factors that can affect Quirky-BVA/Coref/DR

As to what affect our judgments on the availability of BVA(A, B) in a given sentence S (or on the acceptability of S under BVA(A, B)), we are aware of the following factors:

- (45) LangFac^{Com} factors:¹⁸
 - a. whether HR(A) c-command HR(B)
 - b. whether HR(A) and HR(B) are co-arguments
 - c. whether HR(B) (or B itself?) is (lexically) marked as [+Dep] (or in some other way, depending upon the theoretical characterization of this “lexical” condition on b of FD(a, b))
- (46) LangFac^{Cog} factors (I): Quirky-inducing factors, not a complete list:
 - a. whether A of BVA(A, B), due to its “lexical properties,” can be understood as “corresponding to” or “expressing” the “topic” of the S¹⁹
 - b. whether the S is embedded in a “categorical” (as opposed to “thetic”) context”
 - c. whether the N of “B-no N” (B’s N) is a relational term

¹⁷ Here I am ignoring precedence-based BVA/Coref, i.e., BVA/Coref(A/A', B) that is based on A/A' preceding B. We exclude the possibility of such BVA/Coref by focusing on the phonetic sequence in which A/A' does not precede B, as in (40) and (41).

¹⁸ These have to do with the three conditions on FD(a, b). For the initial stage of the designer-informant experiment, we only consider sentences for which the conditions on FD(a, b) having to do (45b) and (45c) are satisfied.

¹⁹ (46a) collapses the two issues, one having to do with the “lexical properties” of A and the other having to do with the “syntactic position” of A. Although that is not a trivial simplification, it does not affect the main point of the discussion here.

- d. how “natural” the S may be “pragmatically”

The availability of Coref(A', B) in a given sentence S (or the acceptability of S under Coref(A', B)) can be affected by similar factors, more precisely, by the same factors in (45), with A replaced by A', and a subset of the factors in (46), i.e., (46b, c, d).

Notice that the LangFac^{Cog} factors common for Quirky-BVA(A, B) and Quirky-Coref(A, B') exclude (46a). A' of Coref(A', B) is referential and hence it can be understood as “corresponding to” or “expressing” the “topic” of the S; but see Note 19. Likewise, the availability of DR(A, B') in a given sentence S (or the acceptability of S under DR(A, B')) can be affected by similar factors, more precisely, the same factors in (45a), with B replaced by B', and a subset of the factors in (46), i.e., (46a, b, d), with BVA(A, B) replaced by DR(A, B'). To make the exposition complete, I list in (47) and (48) the LangFac^{Cog} factors affecting Quirky-Coref and those affecting Quirky-DR in (47) and (48), respectively.

- (47) LangFac^{Cog} factors (I'): Quirky-Coref-inducing factors, not a complete list:
- b. whether the S is embedded in a “categorical” (as opposed to “thetic”) context”
 - c. whether the N of “B'-no N” (B''s N) is a relational term
 - d. how “natural” the S may be “pragmatically”
- (48) LangFac^{Cog} factors (I''): Quirky-DR-inducing factors, not a complete list:
- a. whether A of DR(A, B'), due to its “lexical properties,” can be understood as corresponding/expressing the “topic” of the S
 - b. whether the S is embedded in a “categorical” (as opposed to “thetic”) context”
 - d. how “natural” the S may be “pragmatically”

There is an LangFac^{Cog} factor affecting the possibility of FD-BVA/Coref(A/A', B) and DD-DR(A, B'), as indicated in (49).

- (49) LangFac^{Cog} factors (III): how a given OSV is parsed affects the possibility of FD-BVA/Coref(A/A', B) and DD-DR(A, B'):
- whether a given OSV is parsed as indicated in (42b)

There is also an LangFac^{Cog} factor affecting the possibility of FD-BVA/Coref(A/A', B) (but not that of DD-DR(A, B')) as indicated in (50).

- (50) LangFac^{Cog} factor (II): the “semantic content” of B affects the possibility of FD-BVA/Coref(A/A', B):²⁰
- whether the “semantic content” of B of BVA/Coref(A/A', B) is understood to be “small enough”

It is by closely checking how each of the LangFac^{Cog} factors noted above (and additional factors not mentioned here) affect the availability of the BVA(A, B), Coref(A', B) and DR(A, B') for a given informant at a given time that we can aspire to detect the c-command effects in the form of “correlations of schematic asymmetries.”

5.1.2. Non-basic cases²¹

²⁰ This is related to the fact that the interpretation of b of FD(a, b) is essentially that of a “bound variable.”

²¹ What is mentioned below does not exhaust what we have been checking over the years, e.g., sloppy-identity readings,

5.1.2.1. Other condition(s) on FD(a, b) and DD(a, b)

—The local disjointness condition on FD(a, b): a and b cannot be co-arguments.

5.1.2.2. Other Schemata (patterns) to check

—Different “sentence types”

5.1.2.3. Other DD-based R(A, B)

Couple-internal reading (CR(A, B), where B is “different/same,” etc.)

QP-WH (so-called the functional reading (QWh(A, wh))

- When (intricate) correlations of judgments for the basic cases are replicated in the “non-basic” cases, we get more of the sense of confirmation for our hypotheses and hence for our experimental means for detecting c-command effects.
- That gives us confidence for what we are pursuing. Since our hypotheses include universal hypotheses, we expect them to serve as a basis for an experiment dealing with any other I-language.

5.1.2.4. Application

—“Spec-binding”

—C-command effects in “ellipsis contexts”

5.1.2.5. Other promising probes

—Split BVA

5.2. English

BVA(A, B)

DR(A, B')

FD(a, b)

DD(a, b)

FD-BVA and Quirky-BVA

DD-DR and Quirky-DR

6. Website

<http://www.gges.org/hojiCUP/index.shtml>

7. Summary

- The challenge for the language faculty scientist is how to study the language faculty by keeping all of the perspectives in (36).

Negation-related “phenomena” and their interaction with BVA and DR, and even Subjacency. We have always been concerned with correlations of judgments in hopes of detecting c-command effects.

- (36) The language faculty scientist is:
- Internalist/Individualist
 - Universalist
 - Definitivist
 - Replicationalist

|| The questions they face include those listed in (51) and the related questions in (52). ||

- (51) a. How can we deduce *definite* predictions about an individual?
 b. What are the *definite* predictions about?
 c. How can we (expect to) obtain *definite* experimental results about an *individual*?
 d. How can we (expect to) replicate the *definite* experimental results about an *individual*?
- (52) a. How can we consider the *definite* experimental results about an *individual* as being revealing about the initial state of the language faculty?
 b. What kind of experiment do we conduct to test our predictions?

|| One can perhaps fully appreciate the gravity of the challenge only after one has tried to answer the interrelated questions in (51) and (52). The questions have to do with the nature of data, the nature of prediction-deduction and the experimental design, once one adopts all of the perspective in (36). Having the perspectives in (36) is a consequence of pursuing the basic scientific method in (2) when dealing with the language faculty, as adapted in (12). I have tried to provide, or hint at, answers to those questions.

We try to accumulate our knowledge about the language faculty by the basic scientific method in (12), along with (7) and (8), with the qualification made in (35).

- (12) The Basic Scientific Method (I), adapted to language faculty science:²²
- Guess-Compute:
Deduce a *definite* and *testable* consequence *about an individual* as an entailment of hypotheses.
 - Compare:
Obtain *definite* experimental results *about an individual* and compare them with the consequence in (12a).

- (7) The Basic Scientific Method (II)
 Methodological Completism:
 The empirical coverage (and the theoretical deduction of the predictions) should be as *complete* as possible.

²² It should be pointed out that Feynman stated (2)—the basis for (12)—in the context of discussing how the physicists try to find a new fundamental law in physics, not how they identify a fact in physics. For the reasons addressed elsewhere above, we do not have facts in language faculty science without hypotheses. (12) is thus not only for testing hypotheses but also for identifying facts.

It seems quite premature to address how to find a fundamental law in language faculty science. It is possible that there is no more fundamental law in language faculty science than the existence of the Computational System of the language faculty and its atomic operation of *Merge*. If so, we have already found out the fundamental law in language faculty science and all we do is to try to obtain confirming evidence for the fundamental law, with the aid of auxiliary hypotheses. A group of philosophers of science during a workshop at Kyushu University about 10 years ago pointed out to me that this might be what we are trying to do. The existence of c-command effects is a prediction of this fundamental law but the detection of such effects requires specific (universal and I-language-particular) hypotheses about LangFac^{Com} and the design of an effective experimental device for such detection *additionally* requires hypotheses/assumptions about LangFac^{Cog}.

- (8) The Basic Scientific Method (III)
 Methodological Minimalism:
 One of its consequences is that the number of primitive concepts should be minimal.
- (35) Methodological Guideline Specific to Language Faculty Science:
 Attaining success in pursuing (12) has primacy over any other considerations, including Methodological Completism in (7).

Language faculty science is concerned with what can be understood about the language faculty by the basic scientific method. This is like saying that we want to understand, hence, deal with, what we can understand. This seemingly tautological characterization of language faculty science is in fact one of its most fundamental defining characteristics, highlighting the close interrelation between facts and hypotheses in language faculty science.

The hypotheses we entertain define possible facts that will be part of our accumulated knowledge about the language faculty obtained by the basic scientific method. If we obtain definite experimental results in line with the definite prediction deduced by our hypotheses, what is predicted and supported experimentally is considered, at least provisionally, to be part of our accumulated knowledge about the language faculty, along with the hypothesized properties of the initial state and the steady state of the language faculty under discussion. If we do not, some aspects of the experimental design, including the hypotheses in question, must be at fault, and hence will be re-evaluated. That is how we try to accumulate our knowledge about the language faculty. What we can consider as part of our accumulated knowledge about the language faculty thus depends upon what hypotheses we entertain.

- (53) The basic scientific method in language faculty science as an exact science:
- a. Guess-Compute:
 Deduce, as an entailment of hypotheses, a *definite* and *testable* consequence about an *individual* that is *as general as possible*
 - b. Compare:
 Obtain *definite* experimental results about an *individual* in line with the consequence in (53a), and replicate them *as generally as possible*.
- (54) The detection of c-command effects and the establishment of an effective experimental device for that purpose is the immediate goal of the language faculty scientist.
- (35) Methodological Guideline Specific to Language Faculty Science:
 Attaining success in pursuing (12) has primacy over any other considerations, including Methodological Completism in (7).

8. Appendix I: If you want to learn more about language faculty science

You can Google “language faculty science.” And you find a couple of PDF files of the handouts of my presentations a few years ago on language faculty science. The articulation of the methodology for language faculty science in those files is outdated but you can still get the basic idea.

You can visit the website accompanying *Language Faculty Science*:
<http://www.gges.org/hojiCUP/>

You can visit my HP.
<http://www.gges.org/hoji/>

You can email me at hoji[at]usc.edu (Replace [at] with @).

9. Appendix II: Important points not (explicitly) made or elaborated on in the preceding pages

—Inherent difficulty with research that focuses on the “simple” (un)acceptability judgments without involving MR(A, B).

—The significance of the fundamental schematic asymmetry

10. Appendix III: What leads to each of (30) and (33)

- (30) Concrete features of language faculty science (II): Predictions in language faculty science:
- We cannot expect to obtain a *confirmed predicted schematic asymmetry* in the terms of Hoji 2015.
 - The definite predictions in language faculty science must be about *correlations of schematic asymmetries*.
- (33) Concrete features of language faculty science (III): Experiments in language faculty science:
- Experiment: The designer-informant experiment is an experiment, where we try seek truth.
 - Demonstration: What used to be called a non-researcher-informant “experiment,” including a multiple-non-researcher-informant experiment, is intended to be a demonstration. It must contain Sub-Experiments in addition to its Main-Experiments.
- (55) What leads to (30a), in the case of the designer-informant experiment:
(25b). More specifically, factors in $\text{LangFac}^{\text{Cog}}$ can affect the judgments on *Examples (as in the case of various Quirky-inducing factors²³) and, to a significantly lesser degree, those on ^{ok}Examples (as in the case of the “smallness” of B of FD-BVA/Coref(A/A', B)).
- (25) The subject matter of language faculty science (i.e., the language faculty) consists of what can be understood by the basic scientific method ($\text{LangFac}^{\text{Com}}$) and what cannot ($\text{LangFac}^{\text{Cog}}$), and a large portion of it seems to belong to the latter.
- (56) What leads to (30a), in the case of the non-researcher-informant experiment:
- (25b). More specifically, factors in $\text{LangFac}^{\text{Cog}}$ can affect the judgments on *Examples (as in the case of various Quirky-inducing factors) and those on ^{ok}Examples (as in the case of the “smallness” of B of FD-BVA/Coref(A/A', B)).
 - Uncertainty about the assignment of a formal feature when an item enters the Numeration

²³ See Section 5.1.1.3 for what is meant by “Quirky.” What is meant by “Quirky-inducing factors” here is the factors that induce the Quirky instance of MR(A, B).

- (such as “non-Indexed” in the terms of Ueyama 1998 or [+FD] on a “lexical item”). This is about LangFac^{Com}.
- c. Uncertainty about the parsing possibility, i.e., about the choice of the Numeration for a given phonetic sequence (e.g., how a given OSV is parsed, whether it is parsed as the Surface OS or as the Deep OS)). This is about LangFac^{Cog}.
- (57) What leads to (30b) in the case of the designer-informant experiment:
 (25b) + the belief that the LangFac^{Cog} factors affect the availability of different types of Quirky instances in a similar way at a given time for a given informant as long as we are dealing with the factors that contribute to the Quirky-possibility.
- (58) What leads to (30b) in the case of the non-researcher-informant experiment:
 a. (=57)
 (25b) + the belief that the LangFac^{Cog} factors affect the availability of different types of Quirky instances in a similar way at a given time for a given informant as long as we are dealing with the factors that contribute to the Quirky-possibility.
 b. The belief that the parsing possibility of a given OSV as an instance of the Surface OS (or something that has the same effects of allowing reconstruction effects) remains “available” at least for a short period of time for a given informant once the informant has access to it.²⁴
 c. The belief that the possibility of the assignment of a formal feature when an item enters the Numeration (such as “non-Indexed” in the terms of Ueyama 1998 or [+FD] on a “lexical item”) remains “available” at least for a short period of time for a given informant once the informant is able to “access” it.
- (25) The subject matter of language faculty science (i.e., the language faculty) consists of what can be understood by the basic scientific method (LangFac^{Com}) and what cannot (LangFac^{Cog}), and a large portion of it seems to belong to the latter.
- (59) What leads to (33a):
 a. There are various practical restrictions on the design of a multiple-non-researcher-informant “experiment” (e.g., the number of Examples, the types of lexical items, and the types of Schemata, etc. that can be included and tested in the experiment).
 b. We must ensure the effectiveness of how we specify the intended dependency interpretation for MR(A, B) for a given informant.

²⁴ This does not seem to take care of the effects of the presence of the CM (or the P in English) on the DL (=the “dislocated phrase” (as it is used in [Ueyama 1998 *Two Types of Dependency*](#)) upon the availability of MR(A, B) in sentences of the form in (41), for example.