Language Faculty Science as an Exact Science\(^1\):  
An experimental illustration, with some introductory remarks

1. Preliminary remarks

An elementary observation: Once they have reached a certain maturational stage, every member of the human species is able to produce and comprehend the language to which s/he is exposed, barring any serious impairment.

A working hypothesis: underlying this ability of ours to relate linguistic sounds (and signs) and meaning is the language faculty, often referred to as a mental organ.

The goal of language faculty science is to understand properties of the language faculty by adopting the most basic method (of hypothesis-testing) in physics and its closely related fields, which Richard Feynman dubbed as "Guess-Compute-Compare." Language faculty science is concerned with aspects of the language faculty that can be understood "scientifically" in this sense.

2. Main claims

(1) Language faculty science as an exact science is possible.

(2) What is meant by the language faculty? 
   Once they have reached a certain maturational stage, every member of the human species is able to produce and comprehend the language to which s/he is exposed, barring any serious impairment. Following Chomsky, I adopt the working hypothesis that underlying this ability of ours to relate linguistic sounds (and signs) and meaning is the language faculty. 
   The initial state of the language faculty ... the UG (Universal grammar) 
   The steady state of the language faculty ... the I-language\(^2\)

(3) What is meant by an exact science? 
"Guess-Compute-Compare" [GCC]\(^3\)

\(^1\) In this presentation, I will present a very brief introduction to language faculty science as outlined in my forthcoming book Language Faculty Science. Due to the time constraint, I can only cover a portion of what is addressed in the book. The separate handout "Glossary" covers the concepts that are most crucial in Language Faculty Science.

If you are interested in learning more about language faculty science, you can do any (combination) of the following:
(i) Visit http://www.gges.org/hoji/ and check out the postings under 44350 "Language Faculty Science" in the "Remarks" board under Discussion.
(ii) Email me at hoji@usc.edu or talk to me in person and ask me for some readings related to language faculty science.
(iii) Join our informal discussion group at Kyodai to discuss language faculty science. To do so, please talk to me in person or email me at hoji@usc.edu.

\(^2\) The I of I-language stands for internal and individual (and intensional). I-language, as opposed to E-language. (Chomsky 1986)
(4) The two starting points of this research:
   a. The internalist approach to language
   b. The "Guess-Compute-Compare" (GCC) method

(5) The main consequence of taking the internalist approach seriously:
   We deduce predictions about individual speakers (not about a group of speakers) of a particular language based on (i) hypotheses about universal properties of the language faculty (=the properties of the UG) and (ii) hypotheses about properties of the steady state of the language faculty (=the individual speaker's I-language). In addition, we must have a hypothesis about what formal property underlies a particular interpretation that is detectable by the informant. Such hypotheses will be called a bridging hypothesis.

(6) The main consequence of taking the GCC method seriously:
   ✓ Our predictions must be as definite as possible; they must be deduced from our hypotheses; and we should be able to compare them with our experimental results.
   ✓ That means that our experimental results should be as definite as possible.
   • Given (6), "predictions" in (5) should be "definite predictions."

We thus try to formulate hypotheses about the language faculty, deducing definite predictions about individual speakers, and compare the predictions with experimental results. Insofar as we can carry this out successfully with compelling empirical demonstration, i.e., insofar as we obtain experimental results in accordance with our definite predictions about individual speakers, that will constitute support for the existence of the language faculty.

3. Data in language faculty science

(7) What can we take as evidence for (or against) our hypotheses about the language faculty?
   • No a priori restrictions as to what can be regarded as evidence in language faculty science.
   • The language faculty is, by hypothesis, what underlies our ability to relate linguistic sounds and meaning.
   • It thus seems reasonable to consider the informant judgment on the relation between linguistic sounds and meaning as evidence in language faculty science.
   • No matter what kind of evidence we might consider, it should be revealing about the subject matter from the perspective of the GCC method. We leave open, of course, the possibility that other types of evidence may serve the same purpose and provide converging evidence for our hypotheses.

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3 Feynman, Richard. 1965/1994: 150:
"In general, we look for a new law by the following process. First we guess it. Then we compute the consequences of the guess to see what would be implied if this law that we guessed is right. Then we compare the result of the computation to nature, with experiment or experience, compare it directly with observation, to see if it works. If it disagrees with experiment, it is wrong. In that simple statement is the key to science. It does not make any difference how beautiful your guess is. It does not make any difference how smart you are, who made the guess, or what his name is—if it disagrees with the experiment, it is wrong. That's all there is to it."
4. Big questions

(8) a. How can we make definite predictions about the judgment of an individual speaker of a particular language as a reflection of universal properties of the language faculty? ("Guess + Compute" of GCC)
b. How can we expect to obtain definite experimental results in accordance with such predictions? ("Compute + Compare" of GCC)

(9) We can pursue language faculty science as an exact science by adopting the EPSA method. (EPSA: Evaluation of Predicted Schematic Asymmetries)

(10) The fundamental schematic asymmetry
a. The *Schema*-based prediction:\nEvery example sentence instantiating a *Schema is unacceptable with the specified interpretation pertaining to two expressions.
b. The okSchema-based prediction:
Some example sentences instantiating an okSchema are acceptable at least to some extent with the specified interpretation pertaining to two expressions.

The combination of the two types of predictions in (10) is called a predicted schematic asymmetry. When we obtain experimental results in line with the predicted schematic asymmetry, we obtain a confirmed predicted schematic asymmetry. I suggest that, in language faculty science as an exact science, confirmed predicted schematic asymmetries are the minimal units of facts.

4 The emphasis on the importance of the *Schema-based prediction in language faculty science is directly related to Lakatos' notion of "theoretically progressive problemshift."

5 The considerations that lead us to accept the asymmetry in question also lead us to accept (i) instead of (ii), as a schematic representation of what we can predict and hence how we can interpret our experimental results.

(i)

<table>
<thead>
<tr>
<th>Judgment Prediction</th>
<th>*</th>
<th>not *</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ok</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(i) must be understood in contrast to (ii).

(ii)

<table>
<thead>
<tr>
<th>Judgment Prediction</th>
<th>*</th>
<th>??</th>
<th>ok</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>??</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ok</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Three types of judgments in (ii) exhaust the possible informant judgments on the acceptability of a sentence (under a specified interpretation). If we were to deduce these three types of informant judgments, we would have the three types of predictions as indicated in (ii). Once we understand the informant judgments to be either "completely unacceptable" or "not completely unacceptable," in line with (10), both the "??" judgment and the "ok" judgment in (ii) will be subsumed under the "not *" judgment in (i).

6 What is recognized here is the inseparability of facts and hypotheses in (and the theory-ladenness of) language faculty science even at its earliest stage.

7 One may start by establishing "confirmed schematic asymmetries" which are not (yet) deduced from hypotheses. One might say that such confirmed schematic asymmetries can be regarded as "potential facts" in language faculty science and that they become "facts" when they are deduced from universal and language-particular hypotheses.
The recognition of the fundamental schematic asymmetry in (10) is independent of how the predictions are given rise to, as long as we "work with schemata," which has been necessitated by (4).

- Without its recognition, it would be impossible to deduce definite and categorical predictions about the informant judgment and expect them to be supported experimentally.

In this part of my presentation, I will try to provide an experimental illustration of the proposed methodology for language faculty science, keeping the conceptual discussion minimal. The Experiments to be discussed are about English.

The time considerations force me to make strategic decisions as to how to present the most fundamental aspects of language faculty science as an exact science, including what may be an effective illustration of the conceptual and methodological articulation of the proposed methodology and what may be an effective experimental demonstration of the viability of language faculty science.

It is hoped, despite the truncated nature of today's presentation that it will make some of the audience want to learn more about language faculty science. Language Faculty Science is scheduled to be published toward the end of this summer. I hope some of you will take a look at it. I repeat the book's slogan stated at the end of Chapter 1, "[L]anguage faculty science as an exact science is possible; yes, it is. Some may say that I am a dreamer. But I am not the only one. I hope upon reading the rest of the book some of the readers will join us."

5. Illustration based on Experimental results

I adopt Chomsky's (1993) model of the Computational System (=CS) of the language faculty because it allows us to formulate hypotheses that would lead to definite and categorical predictions.

According to this model of the CS, what underlies the meaning is the mental representation called an LF representation. The only structure-building operation allowed in this model of the CS takes two syntactic objects and forms one (called Merge). The structural relation among two syntactic objects at LF can thus be defined in terms of a basic and universal structural relation (of c-command) directly definable in terms of Merge. We can now formulate hypotheses about the correspondence between a surface phonetic sequence and its LF representation(s), or more specifically, about the c-command relation between two syntactic objects at LF corresponding to two expressions in the surface phonetic sequence.

5.1. EPSA [31]-4
5.1.1. Example sentences

[E1] (Intended as: for every individual $x$ that is a boy, $x$ praised $x$'s father)
   
   Every boy praised his father.

[E2] (Intended as: for every individual $x$ that is a boy, $x$ praised $x$'s father)
   
   His father, every boy praised.

[E3] (Intended as: for every individual $x$ that is a boy, $x$'s father praised $x$)
   
   His father praised every boy.

5.1.2. Predicted schematic asymmetries

[SA1] A predicted schematic asymmetry:
   
   a. **okSchema:**
      
      every NP Verb [ … $\beta$ … ]
      with BVA(every NP, $\beta$)
   
   b. **StarSchema:**
      
      [ … $\beta$ … ] Verb every NP
      with BVA(every NP, $\beta$)

[SA2] A predicted schematic asymmetry:
   
   a. **okSchema:**
      
      [ … $\beta$ … ], every NP Verb
      with BVA(every NP, $\beta$)8
   
   b. (= [SA1-b])
      
      **StarSchema:**
      
      [ … $\beta$ … ] Verb every NP
      with BVA(every NP, $\beta$)

5.1.3. Hypotheses

[U1] Universal structural hypothesis:9
   
   FD(a, b) is possible only if a c-commands b at LF.

[U2] Universal "lexical" hypothesis:
   
   FD(a, b) is possible only if b is (marked in the lexicon as) [+Dep].

[LE1] Language-particular structural hypothesis about English (SVO):
   
   S(subject)V(erb)O(bject) in English corresponds to an LF representation where S(subject) asymmetrically c-commands O(object).

[LE2] Language-particular structural hypothesis about English (OSV):
   
   O(bject)S(subject)V(erb) in English can correspond to an LF representation where S(subject) c-commands O(bject).

[LE3] Language-particular lexical hypothesis about English:

8 It is considerations about how we can ensure and maximize the significance of informant judgments with regard to our hypotheses about the language faculty that lead us to invoke a "dependency" interpretation such as BVA(A, B).

Personal pronouns in English can be marked as [+Dep] but Names cannot.

[BE1] A bridging hypothesis about $\text{BVA}(\text{every NP}, \beta)$: $^{10}$
$\text{BVA}(\text{every NP}, \beta)$ is possible only if there is $\text{FD}(\text{LF}(\text{every NP}), \text{LF}(\beta))$. $^{11}$

[BE2] A bridging hypothesis about $\text{BVA}(\text{no NP}, \beta)$:
$\text{BVA}(\text{no NP}, \beta)$ is possible only if there is $\text{FD}(\text{LF}(\text{no NP}), \text{LF}(\beta))$.

5.1.4. Schema groups and Lexical groups

(11) Schema Groups in EPSA [31]-4:

<table>
<thead>
<tr>
<th>Schema Group #1</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schema A1</td>
<td>$^\text{ok} \text{ NP} : V : [... : \beta : ... : ]$ (with BVA(NP, $\beta$))</td>
</tr>
<tr>
<td>Schema B1</td>
<td>$^*$ $: [... : \beta : ... : ] : V : \text{NP}$ (with BVA(NP, $\beta$))</td>
</tr>
<tr>
<td>Schema C1</td>
<td>$^\text{ok} : [... : \beta : ... : ] : V : \text{NP}$ (with $\beta$ being referential)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Schema Group #2</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schema A2</td>
<td>$^\text{ok} : [... : \beta : ... : ] : \text{NP} : V$ (with BVA(NP, $\beta$))</td>
</tr>
<tr>
<td>Schema B2</td>
<td>$^*$ $: [... : \beta : ... : ] : V : \text{NP}$ (with BVA(NP, $\beta$))</td>
</tr>
<tr>
<td>Schema C2</td>
<td>$^\text{ok} : [... : \beta : ... : ] : V : \text{NP}$ (with $\beta$ being referential)</td>
</tr>
</tbody>
</table>

(12) Lexical groups in [31]-4:

<table>
<thead>
<tr>
<th>Lexical Group #1</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>every boy as $\alpha$ of BVA($\alpha$, $\beta$)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lexical Group #2</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>no boy as $\alpha$ of BVA($\alpha$, $\beta$)</td>
<td></td>
</tr>
</tbody>
</table>

5.1.5. Outline

Design (Website)
Hypotheses (See section 5.1.3.)
Examples (Website)

Main and Sub-Hypotheses

Initial result (Website)

5.2. The general design of EPSA Experiments

Each Example is an instantiation of one of the three Schema types (A, B and C) and it is also of a particular Schema group and of a particular Lexical group, as illustrated in (13), where there are only two Schema groups and two Lexical groups. $^{12}$

$^{10}$ We address BVA(A, B), with specific choices of A and B, in hopes that its (un)availability might be revealing about properties of FD (and hence of the CS). There are reasons to believe that a certain type of coreference can also be revealing about properties of FD, as suggested in Ueyama 1998. The ultimate testability of our hypotheses about FD, only part of which are addressed here, can be effectively pursued only in relation to the correlation of informant judgments on predicted schematic asymmetries involving BVA of a certain type, and those involving coreference of a certain type, among others.

$^{11}$ "LF($\alpha$)" stands for a syntactic object at LF corresponding to the expression $\alpha$.

$^{12}$ If there are 3 Lexical groups, we will have A1-3, A2-3, B1-3, B2-3, C1-3 and C2-3, in addition to what is given under "ID number."
### 5.3. Instructions to the informants:

**14)** The informant sees one sentence at a time (Yes/No):

**Instructions:**

If you find the sentence below completely unacceptable under the specified interpretation given in the parentheses, please choose 'x.' If you find it more or less acceptable under the specified interpretation, please choose 'o.' If you are not sure, please skip to the next question.

**15)**

![Image](image-url)

- It is not possible to go back to the previous page and change your answers; please answer carefully.
- It is, however, possible to visit the same survey later and provide your answers (as many times as you wish).
- Once you have provided (an) answer(s) and clicked "NEXT," your answer(s) will be recorded. If you stop answering before you come to the end of the survey, your answers up to that point will be stored in the record.
- If you come back to the same survey, the example sentences will be presented in a different order, regardless of whether you have answered all the questions or have stopped answering in the middle of the survey.
- As noted above, your responses will be recorded as valid answers even if you have not answered all the questions in the survey. We would, however, like you to try to answer until the end of the survey.
- If you keep the survey page on your browser open, you can resume answering the survey from the previous point of the survey.

**16)** A set of three sentences are shown to the informant (Yes/No):

**Instructions:**

Please compare the three sentences below. For each sentence, please choose 'x' if you find it completely unacceptable under the specified interpretation given in the parentheses, and 'o' if you find it more or less acceptable under the specified interpretation. If you are not sure, please skip to the next question.
5.4. Interpreting Experimental results

(18) a. The \%(Y) on a Schema stands for the percentage of Yes answers (i.e., the reported judgment that the example in question is acceptable at least to some extent (with the intended BVA in the case of Schema A and Schema B in [31]-4, for example)) among all the answers/judgments given on the Examples instantiating the Schema in question.

b. The \%(I) stands for the percentage of the informants who gave a Yes answer on at least one *Example in a given Experiment.

c. The \(N(I)\) is the number of the informants who have provided answers on the Examples being considered.

The \%(Y) on each Example can be represented as in (19), for example.

(19)

<table>
<thead>
<tr>
<th>Codename</th>
<th>Schema A</th>
<th>Schema B</th>
<th>Schema C</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>002</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>003</td>
<td>100</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>004</td>
<td>100</td>
<td>100</td>
<td>--(^\text{13})</td>
</tr>
</tbody>
</table>

On the basis of the information about each informant's reported judgments on each Example (i.e., the \%(Y) on an Example) as illustrated above, we can obtain the \%(Y) on a Schema. An individual informant's \%(Y) on a Schema is the percentage of the informant's Yes answers among all the answers that the informant has given on all the Examples instantiating that Schema. The \%(Y) on Schema B, for example, is the percentage of Yes answers among all the answers given on all the *Examples.

We can also obtain the \%(Y) on each Schema among all the informants. Consider the result chart in (20).

(20) Summary of EPSA [31]-4:\(^{14}\)

participant list: \texttt{pers-r2.lst}\(^{15}\)

\(^{13}\) What is meant by "--" is that the informant did not report any judgment on the Example in question.

\(^{14}\) At the accompanying website, "Summary of EPSA [31]-4" contains not only (20) but also the \%(Y) on each Example in EPSA [31]-4 reported by each of the 179 informants.

\(^{15}\) "r2" in "pers-r2" is the code for native speakers of English, and informant classification for English EPSA Experiments always contains it. ("pers" abbreviates "person" and it is part of how the template is set up for
<table>
<thead>
<tr>
<th>Experiment</th>
<th>Informant Classification</th>
<th>Schema Group</th>
<th>Lexical Group</th>
<th>% of YES Answers</th>
<th>N(I)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[31]-4</td>
<td>r2</td>
<td>All</td>
<td>All</td>
<td>54 %</td>
<td>179</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Experiment</th>
<th>% of YES Answers</th>
<th>N(I)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[31]-4</td>
<td>54 %</td>
<td>179</td>
</tr>
</tbody>
</table>

"%(Y) on A," for example, abbreviates "%(Y) on Schema A." "N(I)" is the number of informants whose judgments are being considered. In the case of (21)/(22), the informants are native speakers of English, according to the information the informants have provided when registering as an informant for EPSA Experiments, who reported a judgment on at least one Example in EPSA [31]-4. When we focus on a particular Schema group(s) and/or Lexical group(s), thereby considering a subset of the Examples in EPSA [31]-4, the N(I) can become smaller. "N(I)" thus is not the number of informants who have participated in a given Experiment; it is the number of informants whose judgments are being considered, as noted above.

When we consider results of a multiple-informant experiment, we shall use "%(I)" to refer to the percentage of the informants in a given experiment who have reported Yes on at least one of the Examples while at the same time reporting a judgment on an Example corresponding to Schema A. Just as we predict the %(Y) on Schema B to be 0, so we predict the %(I) to be 0.

5.5. Main-Hypotheses and Sub-Hypotheses

—in all the Examples in EPSA [31]-4, $\beta$ of BVA($\alpha$, $\beta$) is his.

EPSA Experiments, including their result pages and informant lists. We see this only when we have EPSA results directly taken from the EPSA Experiment website, as in the case of (20).

16 They are the native speakers of English, according to the EPSA-registration information.

17 Here and elsewhere, the date mentioned is the date of compiling the result, not the date when the informant judgments were last reported. The "Raw Data" files at the accompanying website show the date/time of the most recently reported judgment.

18 If we focus on particular Schema group(s) or Lexical group(s), the %(I) is based on the judgments reported on the Examples of such Schema group(s) or Lexical group(s).
—The lexical condition imposed upon $FD(a, b)$ by $[U2]$ and $[LE3]$ is therefore always satisfied in the Examples with $BVA(\alpha, \beta)$ in EPSA [31]-4 (i.e., those Examples instantiating Schema A or Schema B). For each of the predicted schematic asymmetries in [SA1] and [SA2] in EPSA [31]-4, we consider $[U2]$ and $[LE3]$ as its Sub-Hypotheses and $[U1]$, and $[LE1]$ and $[BE1]$ to be its Main-Hypotheses.$^{19}$

5.6. Sub-Experiments for EPSA [31]-4
—EPSA [31]-1 checks the validity of the lexical hypotheses in $[U2]$ and $[LE3]$. 
Design [Website] 
Hypotheses 
Examples [Website] 

5.7. Sub-Experiments for EPSA [31]-1
—EPSA [31]-7 checks the effectiveness of our instructions to the informants in EPSA [31]-4 and [31]-1. 
Design [Website] 
Examples [Website] 

5.8. Main-Experiment and Sub-Experiments$^{20}$, and the importance of informant classification$^{21}$
—An experiment in language faculty science consists of a Main-Experiment and its Sub-Experiment(s). Our predictions (in the form of predicted schematic asymmetries) are about the judgments of those informants who have been identified in the Sub-Experiments as reliable informants for the purpose of checking the validity of the Main-Hypotheses in our Main-Experiment.

5.9. Reproducibility

5.9.1. Reproducibility at different "levels"
—Across-Example reproducibility within an informant 
—Across-occasion reproducibility within an informant 
—Across-informant reproducibility$^{22}$

$^{19}$ There is an important issue that needs to be addressed as to how we can try to test the validity of each of $[U1]$, $[LE1]$ and $[BE1]$. The nature of bridging hypotheses and the testability of $[LE2]$ are among the issues that would have to be addressed in depth in a fuller discussion.

$^{20}$ The point here is directly related to the structure of prediction-deduction. Of much relevance here is Duhem's indeterminacy-of-theory-by-data thesis (often known as the Duhem-Quine thesis), addressed also by Poincaré, and Popper's "principle" of "learning from errors."

$^{21}$ One may say that informant classification is justified by an elementary observation that acceptability judgments appear to differ greatly among speakers, especially, but not exclusively, when a "meaning" is addressed.

$^{22}$ A multiple-informant experiment is a collection of a single-informant experiment. Given the internalist approach and the GCC, it is the replication of a confirmed predicted schematic asymmetry obtained in a single-researcher-informant experiment in multiple-non-researcher-informant experiments that makes us confident about the validity of our hypotheses that have given rise to the predicted schematic asymmetry. It is also such replication that would prompt us to pay serious attention to the empirical and "factual" claims put forth by others dealing with a language about which we do not have native intuitions. One may in fact suggest that it is the replication of a confirmed predicted schematic asymmetry in multiple-non-researcher-informant experiments that would make us hopeful that language faculty science as an exact science may indeed be possible.

It must be stressed that the replication of particular judgments by informants on a set of particular sentences is not our concern. We are concerned ultimately with the replication of our experimental results at a more abstract and general level. We are interested in finding out universal properties of the language faculty. We choose to work with a dependency interpretation as a probe for that purpose because we have adopted Chomsky's model of the CS, along with (4). What type of dependency interpretation can be a good probe for the purpose may differ among languages, and even among speakers of the "same language." See footnote 10.
5.9.2. Across-occasion reproducibility and its effects on the Experimental results

[Website]

5.9.3. The purpose of informant classification

—Informant classification is not for the purpose of obtaining the predicted Experimental results but it is for the purpose of obtaining Experimental results that are as significant as possible with regard to the validity of the Main-Hypotheses in our Main-Experiment.

Illustration [Website]

6. Concluding remarks

✓ The methodological proposal I put forth for language faculty science as an exact science are a consequence of adopting (4), except for the adopting of the model of the CS in Chomsky 1993 (and the model of judgment-making in Ueyama 201023, which is a crucial part of the proposal here, but I did not have the time to address it in this talk).

✓ In a multiple-informant experiment, our predictions (in the form of predicted schematic asymmetries) are not about the judgments of every informant who participates in our Main-Experiment. It is about the judgments of those informants who have been identified in the Sub-Experiments as reliable informants for the purpose of checking the validity of the Main-Hypotheses in our Main-Experiment.24

✓ In a single-informant experiment, our predictions (in the form of predicted schematic asymmetries) are about the correlation of the informant's judgments. More specifically, our predictions are that if the informant's judgments in the Sub-Experiments indicate that they understand the intended dependency interpretation and that the Sub-Hypotheses tested in the Sub-Experiments are valid for the informant, the informant's judgments in the Main-Experiment are in accordance with the predicted schematic asymmetry tested in the Main-Experiment.

✓ The fact that we have been able to obtain a confirmed predicted schematic asymmetry in EPSA [31]-11 (=[31]-4) (and other Experiments in English and in Japanese that we do not have the time to discuss here) makes us hopeful that it is possible to pursue language faculty science as an exact science in the sense discussed above.

[The following passage is copied from the end of Chapter 8 (Summary and Concluding Remarks) of the draft of Language Faculty Science:]"What I envisage is a time when we will be able to deduce definite and categorical predictions (predicted schematic asymmetries) in various languages, evaluate by experiments the validity of our universal and language-particular hypotheses, and formulate hypotheses of a successively more general nature, without losing rigorous testability. When something like that has become the norm of the research program, an experiment dealing with one language can be understood clearly in terms of the universal hypotheses (along with language-particular hypotheses) so that the implications of the result of an experiment dealing with a particular language can be transparent with respect to other

23 See the Appendix II for the details of the model in question.

24 In relation to EPSA [31]-4 (=[31]-11) and its Sub-Experiments, the prediction is about the judgments by the informants (i) for whom the instructions used in our Experiments, including how we convey what is intended by BVA(α, β), seem effective, (ii) who seem to understand what is intended by BVA(α, β), and (iii) for whom the lexical hypotheses pertaining to FD seem valid.
languages. Researchers "working with" different languages will at that point share (many of) the same puzzles and issues pertaining to universal properties of the language faculty. They will know precisely what necessary care and checks they need to do in order to design effective experiments for testing the validity of the same universal hypotheses and how they should interpret the Experimental results in accordance with the way the predictions have been deduced by hypotheses. That will enable us to proceed in a way much more robust than what has been presented in the preceding chapters, but still on the basis of confirmed predicted schematic asymmetries. The field will at that point be widely regarded as an exact science, and everyone will take that for granted. And I also suspect that, at that point, other fields of research that deal with the brain and the mind pay close attention to the research results and methodology in language faculty science because they find it useful to try to learn from how categorical experimental results obtain in language faculty science and how its methodology has guided its research efforts.25"

References

Ueyama, Ayumi. 2010. Model of judgment making and hypotheses in generative grammar. In: Iwasaki, Shoichi; Hoji, Hajime; Clancy, Patricia; and Sohn, Sung-Ock (eds.),

25 This reminds us of Chomsky's (1975: 5) remark that "it is not unreasonable to suppose that the study of this particular human achievement, the ability to speak and understand a human language, may serve as a suggestive model for inquiry into other domains of human competence and action that are not quite so amenable to direct investigation."
7. Appendix I: On language faculty science as an exact science

7.1. A common view against the scientific status of the generative enterprise

(23) Newmeyer on likening generative grammar to physics:
"My personal experience, sad to say, is that it is difficult to convince my colleagues in philosophy and the physical sciences that grammatical theory in ANY shape or form is—or has the potential to be—scientific. And nothing leads them to tune out faster than to hear grammatical theory compared to physical theory.” (Newmeyer 2008: section 1)

The remark by Newmeyer, who has been sympathetic to Chomsky's generative enterprise over the years, seems to be a typical reaction by people to the thesis that generative grammar is or has the potential of becoming a scientific research program in the sense that physics is so called. My Language Faculty Science is an attempt to articulate how the language faculty science can be pursued as an exact science in the sense addressed above, leaving aside how "grammatical theory" as intended in Newmeyer's remark is to be understood in relation to language faculty science.

7.2. How hard it is to get to really know something

(24) Feynman on the principle of science and on social sciences:

a. "The principle of science, the definition, almost, is the following: The test of all knowledge is experiment. Experiment is the sole judge of scientific "truth." (The Feynman Lectures on Physics: 1-1, reproduced in Feynman 1963: xx)

b. "Because of the success of science, there is, I think, a kind of pseudoscience. Social science is an example of a science which is not a science; they don't do [things] scientifically, they follow the forms—or you gather data, you do so-and-so and so forth but they don't get any laws, they haven't found anything. They haven't got anywhere yet—maybe someday they will, but it is not very well developed, … I may be quite wrong, maybe they do know all these things, but I don't think I'm wrong. You see, I have the advantage of having found out how hard it is to get to really know something, how careful you have to be about checking the experiments, how easy it is to make mistakes and fool yourself. I know what it means to know something, and therefore I see how they get their information and I can't believe that they know it, they haven't done the work necessary, haven't done the checks necessary, haven't done the care necessary. I have a great suspicion that they don't know, that this stuff is [wrong] and they're intimidating people. I think so. I don't know the world very well but that's what I think.” (Feynman 1999: 22)

8. Appendix II: Ueyama's (2010) model of judgment-making by the informant

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26 This is a summary statement of the essential aspects of the Guess-Compute-Compare method as presented by Feynman; see footnote 3.
The model of judgment-making by the informant on the acceptability of sentence $\alpha$ with interpretation $\gamma(a, b)$ (based on Ueyama 2010):

\[ \text{Lexicon} \xrightarrow{\gamma(a, b)} \mu \xrightarrow{\text{CS}} \text{LF($\mu$)} \xrightarrow{\text{SR($\mu$)}} \beta \]

a. $\alpha$: the presented sentence
b. $\mu$: numeration (a set of items taken from the mental lexicon)
c. $\gamma(a, b)$: the dependency interpretation, pertaining to expressions $a$ and $b$, that is included in the 'meaning' of $\alpha$
d. LF($\mu$): the LF representation that obtains on the basis of $\mu$
e. SR($\mu$): the information that obtains on the basis of LF($\mu$)
f. PF($\mu$): the PF representation that obtains on the basis of $\mu$
g. pf($\mu$): the surface phonetic string that obtains on the basis of PF($\mu$)
h. $\beta$: the informant judgment on the acceptability of $\alpha$ with $\gamma(a, b)$

The "$\Rightarrow$" in (23) indicates that a numeration is the input to the CS and its output representations are LF and PF, and that SR and pf obtain based on LF and PF, respectively. What is intended by "$\approx\Rightarrow$", on the other hand, is not an input/output relation, as roughly indicated in (24).

(26) a. Presented Sentence $\alpha \Rightarrow$ Numeration Extractor: ... contributes to ...
   b. Numeration Extractor $\Rightarrow$ numeration $\mu$: ... forms ...
   c. SR($\mu$) $\Rightarrow$ Judgment $\beta$: ... serves as a basis for ...

27 In the next section, I address why the invoking of a dependency interpretation is crucial in language faculty science.
28 The introduction of SR and pf is not crucial for the purpose of much of the empirical discussion in this book, and equating LF and PF to SR and pf, respectively, would not affect much of the ensuing discussion, except for the understanding of the following aspect of the Schema.

A pf representation is a non-hierarchical phonetic sequence of audible items that is directly read off a PF representation. I assume that the PF representation, unlike the pf representation, expresses hierarchical relations among the items taken from the mental lexicon and it may contain syntactic objects that have no phonetic content (so-called "empty categories"). A Schema, such as [SA1a] and [SA1b], covers, i.e., can be instantiated by, an infinite number of pf representations. It minimally specifies where the two items mentioned in the bridging hypothesis ($\alpha$ and $\beta$ of BVA($\alpha, \beta$) in the case of BVA) occur in a phonetic sequence. The use of the square brackets in a Schema, as in [SA1] and other Schemata to be discussed below, is a reflection of the fact that the pf representation is based on a PF representation. A Schema, and hence a schematic asymmetry, can be understood as being theory-neutral insofar as the hierarchical information thus made reference to by a Schema is part of the elementary constituent structure that transcends different conceptions of the CS, reflecting the basic semantic relations among the relevant elements in question. It is in this sense that confirmed predicted schematic asymmetries are theory-neutral though the predicted schematic asymmetries in question are given rise to by our hypotheses.

29 Numeration formation does not require a presented sentence, as can be seen from the fact that a speaker can "generate" a sentence without a presented sentence. This means, given the preceding discussion, that a numeration can be formed without a presented sentence. In addition to the presented sentence $\alpha$ and the dependency interpretation intended to be included in the 'meaning' of $\alpha$ pertaining to expressions $a$ and $b$ (i.e., $\gamma(a, b)$), the mental act of numeration formation must also make reference to the mental lexicon. It must also make reference to the knowledge accumulated through the years of linguistic experiences, e.g., the knowledge about what kind of linguistic expressions go with, or tend to go with, what kind of a predicate although that is not indicated in the chart in (18).
More precisely, what serves as a basis for the informant judgment $\beta$ is the compatibility between $\text{SR}(\mu)$ and $\gamma(a, b)$ or the lack thereof. The non-distinctness between $\text{pf}(\mu)$ and the presented sentence $\alpha$ also serves as a basis for $\beta$, but that is not indicated in (18).