The Need for Methodologies

from Minimum-pluralistic Perspectives

Workshop I : Progress in Generative Grammar
Its Characterization and Assessment

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Does Generative Grammar Need Methodology?

- Chomsky once remarked that method or methodology (a system of claims about methods) has not been much talked about, and not needed in the real science such as physics, so generative grammar doesn't need it.
  (Chomsky 1988)

- Is his remark well- or ill-advised?

Methodological discussion in the history of Physics

- His remark is ill-advised for two reasons.
- First, there have been lots of discussions on method or methodology in the history of physics particularly when new methods were introduced in the field such as algebraic equations, statistical technology, probabilistic ideas, and computer simulation.

Exoticness of Physics-born Method

- Secondly, most of scientific methods such as mathematical modeling, experimentation, statistical analysis have been originally invented in physics, and then exported to other areas of science including linguistics. So those physics-born methods are *exotic* for linguistics.
- Therefore it is natural and legitimate that linguists tend to dispute over whether they should adopt one or another physics-born method and how they should modify such a method to make it suitable for their own research interests long after it has been widely accepted by physicists.

Generative Grammar Needs Methodology

- Actually many generative grammarians have talked about methodology for their research, and in particular for their empirical study to detect speakers' grammatical judgments from their acceptability ones.
- They have been doing so justly and deservedly, I think.

The Plurality of Methodologies

- Claim: There is no single ‘correct’ or ‘proper’ method or methodology in any field of science including GG.

- Why? Because there are methodological relativities (aim-relativity, and assumption-relativity) and indeterminacy.

The Aim Relativity

- Whether a method is proper or not depends on what aim one is seeking through it.
- If the aim of research is different, methods to be employed are also different.
- E.g.. if the aim of GG is not the same with that of comparative and structural linguistics, the proper method for the former may not be proper for the latter.
- There is no guarantee that all the generative grammarians have exactly the same aim in their minds.

The Assumption Relativity

- Even among generative grammarians who share the same aims; e.g. to show the existence of computational system and to characterize its functions, some of them may make a different assumption from that of others concerning how language faculty interferes with other cognitive modules.
- Given the different assumptions, researchers may have to use different methods to identify the functions of language faculty.

The indeterminacy

- Even with a fixed set of assumptions and a fixed aim, one cannot always determine single-handedly which method is to be used rather than others.
- For example,
- Whether is a statistical methodology used?
- If it is to be used, which methodology, Bayesian, classical, or others?
- If one chooses the classical, should one use estimation or hypothesis testing?
- If one chooses testing, which test? …
- For these questions, there is no single correct answer.
- Different choices may lead to different results, and different judgements.

Not ‘Anything Goes’

- Though taking the pluralistic standpoint, I don’t follow Feyerabend’s remark ‘anything goes’, because I think…

1. One can still argue that one philosophical methodology is better suited to a given research area than others.

   E.g., As I shall argue, Lakatos’ methodology is better suited to GG than Popper’s.

2. There are minimum requirements that any science is reasonably expected to satisfy.

Popper vs. Lakatos 1

- One of the key differences between Popper and Lakatos is what is judged as ‘good’, ‘bad’, ‘scientific’, or ‘pseudo- or non-scientific’.
- For Popper, that is *theory*.
- For Lakatos, that is *scientific research program*.

Popper vs. Lakatos 2

- For Popper, a theory is static in that it cannot maintain its identity as one of its components is altered over time.
- The Popperian demarcation criteria that tells ‘good science’ from ‘bad’ or ‘pseudo- or non- science’ concerns characteristic or ‘ability’ of a theory to make definite or refutable predictions.
- The more specific predictions it can make, the better it is.

Popper vs. Lakatos 3

- Lakatos' scientific research program consists of 'hard core', 'protective belt' and 'heuristics'.
- The 'hard core' is the set of most basic hypotheses that researchers must keep committing as long as they are engaged in a program.
- The 'protective belt' is the set of auxiliary hypotheses that can explain phenomena in conjunction with the hard core, and is always ready to be abandoned to protect the hard core whenever the program faces empirical anomalies.
- The 'heuristics' is the set of method for advancing the program, showing how to frame and solve problems, to make discoveries, and so on.

Popper vs. Lakatos 4

- The scientific research program is dynamic in that, as far as substantial parts of its hard core and heuristics remain the same, it can keep its identity over time.
- The program consists in successive stages at which its protective belt undergoes considerable changes in response to anomalies.

Popper vs. Lakatos 5

- The scientific research program is judged as ‘good’, ‘bad’, or ‘scientific’ according to the way in which it goes over time.
- If a program proceeds in guidance of its heuristics, it is regarded as ‘good’ or ‘progressive’.
- There are several ways of progress in Lakatos’ sense.

1. A program’s hard core, say its main model, is refined for not ad hoc reasons without regard to pro- or contra- empirical findings.

   (Caution: there is no definite answer to what the ‘not ad hoc reasons’ are. So many sorts of changes of a program can be seen as ‘progress’ in one or another meaning of the ‘not ad hoc reasons’.)

2. A program succeeds in explanations of known phenomena, and in predictions of unknown ones.

- Since different programs may have different heuristics, what is ‘progress’ can be relative to program. While one program sees itself as progressive, the other might not regard it so.

Popper vs. Lakatos 6

- The scientific research program is dubbed as ‘bad’ or ‘degenerative’ when it has come to protect itself by introducing ad hoc explanations for anomalies, then abandoned one or another part of its protective belt, and finally modified its hard core or heuristics in response to further anomalies.
- But Lakatos doesn’t claim that scientists should abandon a degenerative program. Rather he regards that it is even rational for them to hold a degenerative program with a hope that it may be revived one day.
- So, for Lakatos, the difference between progressive and degenerative programs has nothing to do with how scientists ought to do. Unlike Popper, Lakatos separates the demarcation problem from the ought-to-do problem.

Popper vs. Lakatos 7

- Another key difference between Popper and Lakatos is their ideas on how to response to counterexamples or anomalies.
- For Popper, even when a single prediction fails, a theory is regarded as falsified, and therefore should be abandoned altogether.
- For Lakatos, as long as a program remains progressive, it can or even should ignore anomalies with a hope that those will be explained away in its later stages.
- To kill a progressive program over a few details would be a terrible waste.

Popper vs. Lakatos 8

- For the following two reasons, Lakatos' ideas are better suited to generative grammar (or GG) than Popper's.
- 1. Generative grammarians seem to keep committing their main hypotheses about Computational System (or CS) even with the face of failures of their predictions.
- Those main hypotheses are nice examples of Lakatos' hard core.
- Their attitude to protect the CS hypotheses is quite allowable in the Lakatosian viewpoint, whereas on the Popperian view it is simply unscientific or even irrational.

Popper vs. Lakatos 9

2.

- Since 1950’ to till today, the central ideas of GG have been changed several times; from standard theory, via extended standard theory and GB theory, to minimalist program.
- These changes don’t fit the Popperian picture of scientific progress; i.e., a new theory that survived a crucial experiment replaces an old one that was refuted by the experiment.
- Instead, those fit very well the Lakatosian picture of progress; i.e., the central model is refined in a not ad hoc way without regards to pro- or contra- empirical findings.

Popper vs. Lakatos 10

- According to Popper, GG is unscientific and the way of its major model changes is irrational.
- According to Lakatos, GG and the way of its major model changes can be scientific and progressive.
- So, obviously the Lakatosian ideas are better fitted to GG than the Popperian ones in that the former can save the major aspects of its practice while the latter can't.

Minimum Requirements 1

- A tentative and incomplete list of the minimum requirements for scientific method

1) The effectiveness and feasibility requirement:

Methods should be effective to attain the aim of research, and feasible in a given condition.

2) Standardization requirement:

Methods or techniques should be standardized as far as possible in order that other researchers can use them and reproduce experimental results obtained from them.

Minimum Requirements 2

3) Making explicit requirement:

All assumptions that are used for a method should be made as explicit as possible so that others can examine critically and/or test them empirically.

4) Public access requirement:

Experimental settings in which methods or techniques are used should be made public as far as possible so that outsiders can inspect the setting if necessary.

A Minimum Pluralism with the Lakatosian Terminology

- This list is not complete. But, like any other lists, what is to be excluded is crucially important here. I don't include into the list the requirement that method should be quantitative, mathematical or statistical, for example.
- Each of these minimum requirements is quite general so that many methods or methodologies can meet it in various ways.
- Also it is too vague to be a demarcation criterion.
- But, put together with the pluralism and Lakatos' terms, it can make non-trivial and substantial proposals and claims for methodology of the empirical study in GG.

The Object of Linguistic Explanation: Phenomena to be observed

- GG doesn't take as its primal objects the entire linguistic phenomenon, but only some 'mechanical' or algorithmic aspects of language. Cf. Kitagawa and Ueyama (2004)
- This sort of confinement of research target is very common in other fields of science such as physics, and seems to me non-problematic at all.
- But, when GG puts its claims to empirical tests, it must come to take into considerations non-mechanical aspects of linguistic phenomena that affects what is to be observed; i.e., speakers' acceptability judgments.
- Generally, as long as linguistics of any sort wants to make itself empirical science, it must explain linguistic phenomena to be observed, taking into account all the relevent factors.

The Need for Phenomenology

- In the empirical study of speakers' acceptability judgments, researchers are required, by the making explicit requirement, to make explicit as far as possible their assumptions about what, how, and to what extent grammatical and extra-(non-) grammatical factors influence their judgments.
- They must construct an explicit model of how observed phenomenon; i.e., speakers' acceptability judgments, are affected by various factors; i.e., 'phenomenology' in terms of physics.
- This model or phenomenology itself is an object of empirical testing.

The Need for a Linear Model

- If generative grammarians want to apply statistical techniques to analysis of their empirical data, they should set up a mathematical model.
- Among many possible mathematical models, one or another form of linear equation; e.g., $Y = aX_1 - bX_2 + \varepsilon$, is to be adopted inevitably given the present situation of available mathematical tools.
- No statistical technique can be applied for non-linear equation that contains such terms as XY or X^2.
- As the result, the linear model is exclusively used as a phenomenal model in any field of science including physics and economics.
- So, by the feasibility requirement, a linear model has to be employed for phenomenology in GG.

A Simplest Linear Model

- Take one of the simplest linear model;

$$Y = X_1 – X_2 + X_3 + \varepsilon .$$

- Y: the degree of acceptability of a sentence that can take any values between 0 and 1, corresponding the totally unacceptable and acceptable respectively.
- X_1: an indication function whose value takes 1 if the sentence is grammatical, and 0 if otherwise.
- X_2: an interfering factor that can take any value between 0 and 1, and decrease the acceptability even when the sentence is grammatical.
- X_3: another interfering factor that can take any value between 0 and 1, and increase the acceptability even when the sentence is ungrammatical.
- ε ：probability error. The frequency of occurrence of its values follows a Gaussian curve.

X_3 should not be dropped

- Prof. Hoji pointed out a remarkable empirical finding that if a sentence is ungrammatical, its degree of acceptability is almost always very close to zero. On the other, when a sentence is grammatical, its degree of acceptability has fluctuated much more across examples and speakers.
- This empirical finding can be expressed into the model as constant small valuations of X_3 and instability of values of X_2.
- But if the variable X_3 is dropped altogether from any phenomenal model, no other researcher can test the validity of Hoji's empirical claim on the basis of one or another phenomenal model.
- So, by the making explicit requirement, X_3 should be made explicit and retained in a model so that others can test Hoji's idea.

The symmetry between grammatical and ungrammatical predictions

- Even when a grammatical prediction apparently fails, one can save the prediction, by saying that the interfering factor X_2 rather than the grammaticality factor X_1 is responsible for a small degree of acceptability.
- Even when an ungrammatical prediction apparently fails, one can also save the prediction, by saying that the interfering factor X_3 rather than the grammaticality factor X_1 is responsible for a high degree of acceptability.
- So, contrary to Hoji (2003) (2006), under the simplest linear model, there is no logical difference between the prediction that says a sentence grammatical (grammatical prediction) and the one that says a sentence ungrammatical (ungrammatical prediction).

How to Reduce the Effects of Interfering Factors

- To test grammatical/ungrammatical predictions, it is crucially important to reduce the values of interfering variables, X_2 and X_3 to zero as nearly as possible.
- To achieve that reduction, it looks quite promising to use a modified version of the idea of ‘licensed generalization (observation)’. Cf. Hoji and Ueyama (2007)
- What is licensed generalization? How to use it?

Licensed Generalization

- According to Hoji & Ueyama (2007), a licensed generalization is a speaker's acceptability judgment that can be approved or 'licensed' to be a direct reflection of his/her computational system.
- Then how is this license to be given?

Hoji & Ueyama's License-giving Procedure

- 1. Set up presumably a necessary condition of grammaticality; *Cn,* such that a sentence is grammatical only if it satisfies *Cn*.
- 2. Take an example of sentence that does not satisfy *Cn*, called *****_Example_.
- 3. Take another example of sentence that is minimally different from the *****_Example_ and satisfies *Cn*, called **ok**_Example_.
- 4. Check if speakers judge *****_Example_ as unacceptable and at the same time **ok**_Example_ as significantly more acceptable than the *****_Example_.
- 5. If their judgments are found as predicted, those judgments are *licensed*.

A modification of Hoji & Ueyama Procedure

- If a sentence doesn't meet a necessary condition of grammaticality, it is ungrammatical.
- But, even if a sentence does meet the necessary condition, it can be either grammatical or ungrammatical.
- So, what can be predicted for **OK***Example* is only that it is either grammatical (or acceptable) or ungrammatical (or unacceptable).
- To make a grammatical (or acceptable) prediction for **OK***Example,* one need to set up a necessary and sufficient condition of grammaticality, *Cns*, of a scheme of sentences, and to construct an **OK***Example* that satisfies the *Cns*.
- Thus let me replace a necessary condition in the Hoji & Ueyama procedure with a necessary and sufficient condition, assuming one can find presumably such a condition.

Mutual Support of Two Provisional Assumption

- In giving a license to speakers' judgments, Hoji & Ueyama make two provisional assumptions that support each other.
- One is that the *Cns*, is genuine. Or a couple of *****_Example_ and **ok**_Example_ (the star-ok couple) is a genuine representation of *Cns*.
- The other is that the speakers' judgments are proper reflections of their CS. Or the speakers who made such judgments are reliable in that they can reduce the influences of interfering factors to a considerable degree.
- This mutual support is not a vicious circle as far as they are regarded as just provisional, and they can be revoked later in a way I shall show soon.
- I'd like to call genuine star-ok couple of example of sentences and reliable speakers as 'licensed'.

Newly Licensed Speakers

- Then suppose that we recruit new speakers, give them licensed star-ok couples, and see how they respond to those.
- We can calculate a correlate coefficient between original and new speakers responses to the same star-ok couples.
- What we are doing is, statistically speaking, a reliable test for the original and the new speakers.
- We can select only the new speakers who show a high correlation with original speakers as ‘newly licensed speakers’, and include them exclusively into further empirical studies of GG.

Inclusion/exclusion Criteria

- In so doing, statistically speaking, we are making explicit an inclusion/exclusion criteria for empirical studies of GG in the light of the degree of correlation in conformity with the making explicit requirement.
- If different research groups include their own new speakers according to the same criteria, we can standardize the qualification of speaker-as-subject across research groups in conformity with the standardization requirement.

A Newly licensed star-ok couple

- Next let us introduce a new candidate of *Cns* for another sentence schema, and new star-ok couples accordingly.
- Then we can examine how licensed speakers respond to these new couples, and calculate a correlation coefficient between their responses to the original and the new couples.
- What we are doing is, statistically speaking, a reliable test for the original and the new couples.
- If the correlation is shown strong, the new couples are seen as licensed, and can be used for further empirical researches.
- By so doing, we can establish an inclusion/exclusion criteria for the couple, and standardize the qualification of examples that can be used in the studies of GG.

Network of licensed speakers and examples

- By repeating the above procedures, we can construct a network of licensed speakers and star-ok couples.
- If a network building goes wrong; i.e., weak correlations are recurrently obtained among the licensed and new speakers and/or star-ok couples, we must go back to our original licensed speakers and couples, revoke them, and restart the whole procedure.
- The resulting network is not that of reliable data but that of reliable devices that produce data.
- Those devices (speakers and examples) are reliable in that they are not susceptible to the interfering factors.
- So by building an network of reliable devices through the idea of licensed generalization, we can reduce the values of the interfering factors to zero as nearly as possible.

Progress of Science

- What is ‘progress’ from the perspective of minimum-pluralistic and Lakatosian viewpoint?
- There can be always several research programs with their own methodologies that can meet the minimum requirements.
- Any program should be allowed in GG as far as it satisfies the requirements.
- Some programs are progressive, and others degenerative.
- But the meaning of progress is not equivocal in the Lakatosian viewpoint.
- For Lakatos, researchers are encouraged to pursue their favorite program even when it is in the phase of degeneration.
- The idea of ‘progress’ may not be central in this view of science.

The Maturity of Science

- So I’d like to mention to ‘maturity’ of science, and ask what the maturity is.
- The maturity of science is not to be characterized as the state of affairs where a single or small number of programs has been dominate, while others obscure. The maturity doesn’t mean monopoly.
- Nor is it a chaotic situation where a large number of programs are competing without any proper understanding with each other.
- Let me appeal once again to the minimum requirements.
- The fulfillment of some of those can make one program understandable or ‘transparent’ to others.
- Plural programs are pursued with proper understanding with each other. That is, I think, a mark of mature science.

References

- Chomsky N., 1988, *Language and Problems of Knowledge: The Managua Lectures*, MIT Press.
- Hoji, H., 2003, Falsifiability and Repeatability in Generative Grammar: A Case Study of Anaphora and Scope Dependence in Japanese, *Lingua* 113/4-6, pp.377-446.
- Hoji, H., 2006, Assessing Competing Analysis: Two Hypothesis about 'Scrambling' in Japanese, in Ayumi Ueyama, ed., *Theoretical and Empirical Studies of Reference and Anaphora – Toward the establishment of generative grammar as an empirical science*, Report of the Grant-in-aid for Scientific Research (B), pp.139-85.
- Hoji, H., and Ueyama, A., 2007, Licensed Generalizations, unpublished draft.
- Kitagawa, Y., and Ueyama, A., 2004, *The Way of Thinking of Generative Grammar*, (in Japanese), Kenkyusha.