ON *THE GALILEAN STYLE* OF LINGUISTIC INQUIRY

Rudolf P. Botha

University of Stellenbosch

STELLENBOSCH PAPERS IN LINGUISTICS

NUMBER 7

1981

i

ACKNOWLEDGMENTS

CONTENTS

iii

1   Introduction

The time has come for psychologists and linguists to adopt "the Gali-
lean style" of inquiry in the study both of mind in general and of
language in particular. Such is the position more than once argued
for by Chomsky in recent writings. On the face of it, "the Galilean
style" is a new mode of inquiry in theoretical linguistcs; the overall
aim of this essay is to see how this apparent novelty holds up under
methodological analysis. Before turning to a number of specific ques-
tions about "the Galilean style", however, it will be in order to take
a brief look at the main components of Chomsky's argument for the
adoption of this mode of inquiry.

Chomsky's argument follows a typical stick-and-carrot pattern. In the
first component of his argument a carrot is held out: Chomsky attri-
butes the enviable progress of the natural sciences to their adoption
of "the Galilean style". Thus, in his paper "A theory of core grammar"
(1978a:9-10), he states that

> "Since the 17th century the Galilean style has marked the
> natural sciences and it is the adoption of this style that
> led to their enormous success".

And in his recent book, Rules and representations (1980:218), Chomsky
again observes that

> "In the natural sciences, it is common to adopt what has
> sometimes been called 'the Galilean style'...."

The implication is clear: there is a mode of inquiry whose use may lead
to the enviable kind of success achieved by the natural sciences.

At this point a question arises: In what sense exactly can the "success"
be said to be "enormous", hence enviable? Chomsky's answer to this
question forms the second component of his argument: the success of the
natural sciences lies in the discovery of deep explanatory principles,

which (as a class) are more highly prized than descriptive generaliza-
tions that cover the data in a merely superficial manner. In the former
paper, already referred to, Chomsky (1978a:10) puts this point as follows:

> "The great successes of the modern natural sciences can be
> attributed to the pursuit of explanatory depth which is
> very frequently taken to outweigh empirical inadequacies.
> This is the real intellectual revolution of the seventeenth
> century."

In an interview with Saporta, Chomsky (1978b:14) repeats this point:

> "Now, a willingness to move towards explanatory principles
> that give insight into some of the phenomena at the cost of
> not being able to handle all of the phenomena, that I think
> was what was perhaps the most striking intellectual achieve-
> ment of the great scientific revolution."

The quoted remarks by Chomsky constitute persuasive rhetoric for the
adoption of "the Galilean style": who would knowingly prefer to pursue
mere coverage of data (the stick part) rather than depth of explanation
(the carrot part)?

A problem arises, however. "The Galilean style" is a mode of inquiry
developed (allegedly) in the natural sciences. Might not its provenance,
therefore, render it unsuitable for, inapplicable to, the human sciences
in general and theoretical linguistics in particular? The third compo-
nent of Chomsky's argument is meant to take care of just this doubt; it
purports to do so by providing an appropriate assurance: "the Galilean
style" can be used in linguistic inquiry too. Thus, Chomsky (1980:219)
asserts that

> "There is no reason to abandon the general approach of the
> natural sciences when we turn to the study of human beings
> and society. Any serious approach to such topics will at-
> tempt, with whatever success, to adopt 'the Galilean style'."

Moreover, Chomsky (1980:24) contends that certain aspects of the study
of mind/language are "particularly susceptible" to investigation in "the
Galilean style":

> "I will therefore continue to pursue the working hypothesis
> that there are aspects of the study of mind that lend them-
> selves to inquiry in 'the Galilean style' .... One aspect
> of the study of mind that seems particularly susceptible to
> this approach is the study of our knowledge of language and
> the origins of this knowledge ...."

Notice again the stick-and-carrot pattern of Chomsky's rhetoric: "the
Galilean style" is available to the non-natural sciences too (the car-
rot part); any approach that fails to adopt it runs the risk of not
being "serious" (the stick part).

There may still be linguists and psychologists, however, who take the
position that the use of "the Galilean style" is a mere option to be
taken or left at will. The fourth component of Chomsky's argument is
designed to render this position untenable. Specifically, Chomsky
(1980:219) asserts that

> "It should come as no surprise, then, that a significant
> notion of 'language' as an object of rational inquiry can
> be developed only on the basis of far-reaching abstraction"
> [which is an essential element of "the Galilean style"
> --- R.P.B.] .

Here a big stick is being wielded: what linguist or psychologist would
care to concede that he/she did not operate with "a significant notion
of 'language'" or that the enterprise in which he/she was engaged could
not be described as "rational inquiry"?

This brings us to a fifth component of Chomsky's argument for the adop-
tion of "the Galilean style". He (1978a:10) paints a highly attractive
picture of the potential benefits to be reaped by using "the Galilean
style" in linguistic inquiry: the picture of a possible "Galilean Revo-
lution".

"The study of language may also have its Galilean Revolution
if we are willing to permit this revolution to take place
and make progress that way."

The possibility of a "Galilean Revolution" is likewise held out by
Chomsky in Rules and representations (1980:24):

"....there may some day even be a kind of 'Galilean revolu-
tion' in psychology if such an approach reaches a sufficient
level of explanatory depth."

In dangling before his readers this jumbo carrot, Chomsky has mounted
a strongly persuasive case for the adoption of "the Galilean style" in
the study of mind in general and language in particular. This makes
"the Galilean style" of linguistic inquiry a subject for serious meta-
scientific analysis. With regard to Chomsky's claims about "the Gali-
lean style" questions such as the following arise:

(1)   (a)   What exactly would "the Galilean style" --- assuming
            there is such a mode of inquiry --- entail in the
            study of mind and language?

      (b)   How does Chomsky's conception of "the Galilean style"
            relate to the views held by philosophers and histo-
            rians of science on Galileo's method(s) of inquiry?

      (c)   How big a role --- assuming again that there is such
            a mode of inquiry --- can "the Galilean style" play
            in present-day linguistics?

(1)(a)-(c) and related questions are interesting from both of two points
of view: the general metascientific and the more narrowly linguistic.
As to the general metascientific point of view, informative answers to
the questions in (1) should throw more light on the nature of theoreti-
cal linguistics as an intellectual enterprise, illuminating possible
similarities and differences between so-called human science on the one
hand and natural science on the other. As to the more narrowly linguis-
tic point of view, answers to these questions should make it clear to

the practising linguist whether or not there is in fact a new methodo-
logical tool at his disposal and, if so, what the potential and the
limitations of this tool may be. In this connection, it may be noted
that Galileo has been commonly looked upon as "the father of modern
science", the one scholar whose thought and work were responsible for
the transition from medieval to (early) modern science. [1] This
appraisal of Galileo, though probably accurate, may pose a danger to
practising linguists: it may induce them to prize research that is
presented as produced by "the Galilean style" more highly than is war-
ranted by the objective properties of this work. This is to say that
linguists may, perhaps quite unintentionally, allow the expression
"the Galilean style" to function as a misleading rhetorical device in
linguistic argumentation.

The aim of this essay, then, is to provide defensible answers to (1)
(a)-(c) and related questions. In §2 an analysis is made of Chom-
sky's attempt at giving a metascientific characterization of "the
Galilean style". In §3 some of the views held by historians and
philosophers of science on Galileo's method(s) of inquiry, are exa-
mined, and then brought to bear on Chomsky's metascientific characte-
rization of "the Galilean style". In §4 a fairly detailed analysis
is presented of what may be called "Galilean elements" in the research
methodology adopted by Chomsky as a practising linguist. These elements
form part of a particular way in which a scientist may react to the
threat posed by potential counterevidence to a theory of his. The
analysis focuses on an attempt by Chomsky (1979b) to overcome certain
empirical difficulties with his most recent binding theory. In §5,
finally, an analysis is given of the consequences that Chomsky's way
of defending his binding theory has for the nature of linguistic in-
quiry in general.

2   Chomsky's characterization of "the Galilean style"

2.1   General

"The Galilean style" is used, according to Chomsky (1978b:15), for the
purpose of attaining "depth of explanation that may serve to integrate
and unify". The use of this "style" of inquiry manifests the "shift
of intellectual attitude from concern for coverage of data to concern

for insight and depth of explanation ....". But what, according to Chomsky, are the mechanisms of this mode of inquiry. That is, what are the conceptual devices --- logical, epistemological and ontological --- used by scientists practising this "style"? It is to these questions, which spell out in somewhat greater detail the content of (1)(a), that we now turn.

To begin with, let us consider Chomsky's attempt at providing in metascientific terms a characterization of the mechanisms of "the Galilean style". This characterization is taken over by Chomsky from the physicist Weinberg. Weinberg (1976:28) presents the following definition of "the Galilean style" and Chomsky quotes the italicized remarks at least twice (1980:8, 218) and presents at least once (1978a:9) a close paraphrase of them.

> "We have all been working in what Husserl called the Galilean style; that is, we have all been *making abstract mathematical models of the universe to which at least the physicists give a higher degree of reality than they accord the ordinary world of sensation.*" [2]

It appears to me that this characterization --- which, for ease of reference, may be called the "Chomsky-Weinberg characterization" --- identifies three mechanisms of "the Galilean style":

(2)   (a)   Abstraction: inquiry in "the Galilean style" entails the construction of abstract models.

        (b)   Mathematization: these abstract models are of a mathematical nature.

        (c)   Epistemological tolerance: the abstract, mathematical models are in some sense more real than the ordinary sensations of scientists.

The reason why the mechanism of (2)(c) is called "epistemological tolerance" will become clear in §2.4 below.

Let us assume for the sake of argument that (2)(a)-(c) do indeed iden-
tify basic mechanisms of "the Galilean style" as used by physicists.[3]
The question then is: In what form are these mechanisms manifested
in "the Galilean style" adopted by Chomskyan linguists? To arrive at
an answer to this question, we first turn to the more or less explicit
metascientific remarks offered by Chomsky (1978a, b, 1980) on the
mechanisms of "the Galilean style".

2.2   Abstractness

Starting with (2)(a), let us recall that the models constructed by
Chomskyan linguists take on the form of general theories of language
and theories of specific languages. Both these kinds of theories
are taken to be "abstract" in various senses.[4] Interpreted in rela-
tion to "the Galilean style", a first sense of "abstract" is 'partial/
of limited scope/not covering all apparently linguistic data'. In
this sense, linguistic theories are abstract in that they idealize
linguistic reality. Chomsky (1980) repeatedly argues that, to arrive
at the sought-after deep explanatory principles, the linguist must
undertake "far-reaching idealization" (p. 9), "substantial idealiza-
tion" (p. 11), or "radical idealization" (p. 218). Consider in this
connection the following remarks by him (1980:218):

> "A comparable approach [comparable to 'the Galilean style'
> in natural science --- R.P.B.] is particularly appro-
> priate in the study of an organism whose behavior, we have
> every reason to believe, is determined by the interaction
> of numerous internal systems operating under conditions of
> great variety and complexity. Progress in such an inquiry
> is unlikely unless we are willing to entertain radical
> idealization, to construct abstract systems and to study
> their special properties, hoping to account for observed
> phenomena indirectly in terms of properties of the systems
> postulated and their interaction."

8

The function of this "radical idealization", then, is to limit the
domain of inquiry and to simplify the problematic phenomena within
this domain.

It is not necessary to consider here the content of such well-known
Chomskyan idealizations as "the ideal speaker-listener", "instantaneous
language acquisition", "a completely homogeneous speech community",
"core grammar", etc..[5]   These idealizations are all the result of
abstracting away from what, in an early stage of inquiry, appear to
be peripheral parameters. Jointly these idealizations determine the
first sense in which the models constructed by Chomskyan linguists are
abstract. The only alternative that Chomsky (1980:219) sees to the
construction of such "abstract systems" is "a form of natural history,
tabulation and arrangement of facts, hardly a very serious pursuit
however engaging the data".

As Chomsky (1980:224) also points out, however, not just any abstract
model, not any idealization, will do:

>   "The discovery of such principles [deep explanatory princi-
>   ples underlying the generation of sentences by grammars
>   --- R.P.B.] , and that alone, will justify the idealiza-
>   tions adopted and indicate that we have captured an important
>   element of the real structure of the organism".

Moreover, to the extent that progress is made in inquiry, idealizations
may lose their fruitfulness and have to be abandoned. Thus, Chomsky
(1980:224) states that:

>   "To account for the confused and disorderly phenomena of the
>   'ordinary world of sensation', we will, in general, have to
>   move from the idealizations to systems of greater complexity,
>   considering variation of languages and grammars, the inter-
>   action of cognitive systems, and the use of language under
>   specific conditions of human life".

We see then, to return to (2)(a), that the Chomskyan linguist's use of

radical idealizations constitutes a first aspect of the use of abstract
models in linguistic inquiry. Notice, however, that none of the points
presented above in connection with the use of idealizations in Chomskyan
linguistics is particularly new. The fundamental points have been made
over and over by Chomsky, at least since 1965.[6] This implies that if
the use of abstract models and idealizations were the sole defining
characteristic of "the Galilean style" in linguistic inquiry, this style
would not represent a particularly new mode of linguistic inquiry. In
this event, all that would be new would be Chomsky's recent adoption of
the expression "the Galilean style".

Consider now a second component that the content of (2)(a) has in
Chomskyan generative grammar, a second sense in which Chomsky's models
may be said to be "abstract". In this sense, the models are abstract
in that the explanatory principles are not linked by direct inference
to the data which they explain. That is, these explanatory principles.
cannot be mere "empirical generalizations over observed structures".
Chomsky (1978a:16) specifies two conditions for such "deeper unifying
principles", the second of them reading as follows:

> "they ought to be genuinely explanatory in that they unify
> a variety of such generalizations [= empirical generaliza-
> tions over observed structures --- R.P.B.] and ground
> them in a system that has a certain degree of deductive
> structure".[7]

This quotation elucidates the second sense in which linguistic theories
may be "abstract": the explanatory principles are at several deductive
removes from the data on which they ultimately bear; in other words,
the inferential tie between these principles and these data is an exten-
ded one, hence indirect.

Chomsky (1978a:16ff.) argues that the principle of subjacency ---
which he states informally as (3) --- is "abstract" in this sense.

(3)   Nothing can be removed from more than a single binding
         category.

Subjacency is considered by Chomsky (1978a:17) to be "a genuine uni-
fying principle ... , that is, a number of island constraints can be
deduced from it". These island constraints include the Complex Noun
Phrase Constraint (4)(a), the WH-Island Constraint (4)(b), the Senten-
tial Subject Constraint (4)(c), the Phrasal Subject Constraint (4)(d),
and the Upward Boundedness Constraint (4)(e).[8]

(4) (a) No element can be removed from an appositional clause.[9]

     (b) No element can be removed from a clause introduced by
          a (wh) question word.[10]

     (c) No element can be removed from a sentential subject.[11]

     (d) No element can be removed from a nominal subject.[12]

     (e) No element can be removed to the right from the minimal
          sentence containing it.[13]

Though the above statements of these island constraints are very in-
formal and highly simplified, they are sufficiently clear to illustrate
Chomsky's point about "a certain degree of deductive structure". These
island constraints, according to him (1978a:16), express empirical
generalizations over observed linguistic structures. The status he
assigns them is, moreover, that of "descriptive catalogues". Clearly
the data covered by these empirical generalizations are related to the
principle of subjacency only by means of a complex inferential chain.
This makes the latter principle "abstract" in relation to the former
data. Notice the unifying nature of this principle: by means of the
fundamental notion of "binding category" it expresses the deeper regu-
larity that underlies a variety of island constraints formulated in
terms of a set of apparently disparate notions.[14]

As regards (2)(a), the great deductive distance between linguistic data
and (unifying) explanatory principles manifests the second respect in
which Chomskyan linguistic theories are abstract. Notice, however,
that abstractness in this sense does not constitute a new attribute of
or desideratum for linguistic theories. Generative grammarians have
searched for such abstract principles from the start of generative
inquiry. An early example of a principle that is abstract in this sense
is the principle of the cycle, first used in generative syntax and later

generalized to phonology.[15]   If the only defining property of "the
Galilean style" were its use of models that are abstract in the sense
under consideration, this "style" would not represent a new element
in linguistic inquiry.[16]

2.3   Mathematization

This brings us to (2)(b), the second mechanism of "the Galilean style".
The models of physicists are "mathematical" in the conventional sense
of describing or portraying physical reality in terms of mathematical
concepts.[17]   In different, but equivalent terms, these models are said
to "mathematize" physical reality.[18]   In what sense(s), then, can the
abstract models used by the Chomskyan linguist be considered to be of a
"mathematical" nature?

Chomsky nowhere raises this question within the context of giving a
more or less explicit metascientific characterization of "the Galilean
style". Incidental remarks of his (1980:223) such as the following
are not particularly informative in this regard:

> "The grammar of a language, conceived as a system of rules
> that weakly generates the sentences of a language and
> strongly generates their structures, has a claim to that
> 'higher degree of reality' that the physicist ascribes to
> his mathematical models of the universe".

This remark suggests that the grammatical theories of linguistic in-
quiry are comparable to the mathematical models of physical inquiry.
It is not clear, however, in what sense grammars could be thought of
as "mathematical models".

In a different context, however, Chomsky (1979a) deals more explicitly
with the question of the relationship between generative grammar and
mathematics. He provides for two possible points of contact between
these disciplines. On the one hand, generative grammars use certain
"quasi-mathematical devices" for the purpose of the precise formula-

tion of their principles. This point Chomsky (1979a:125) clarifies by
stating that

> "... a certain quasi-mathematical mode of expression is
> presupposed in the overall program, but one that is quite
> unsophisticated. We want to formulate precise principles
> and precise rules within a formalized system. It turns
> out that the way to 'speak precisely' is by formalization,
> but it would not be correct to consider that as mathema-
> tics. For example, some variety of recursive function
> theory provides the means, in principle, to express lin-
> guistic rules. But up to that point, this is formaliza-
> tion, not mathematics".

These remarks are quite clear: the use of quasi-mathematical devices
for the purpose of formalization does not turn the linguist's abstract
grammatical theories into mathematical models.

On the other hand, the second point of contact between Chomskyan lin-
guistics and mathematics is found in the discipline of mathematical
linguistics. For Chomsky (1979a:125)

> "Mathematical linguistics begins when one studies abstract
> properties of the formalization, abstracting away from
> particular realizations. The subject exists in a serious
> sense only insofar as nontrivial theorems can be proven,
> or at least considered".

From a further remark by Chomsky (1979a:127) it is clear that work in
mathematical linguistics is not to be confused with the form of empiri-
cal linguistic inquiry that generative grammarians typically practise.
According to Chomsky (1979a:127), such work developed independently of
linguistics. In fact, generative grammarians as a rule conduct their
linguistic inquiry without paying any attention to whatever mathematical
properties their abstract theories may have. Again the point is clear:
a study of the formal/mathematical properties of abstract linguistic
theories does not turn these theories into mathematical models.

13

In sum, if a model is mathematical to the extent that it represents
reality in terms of mathematical concepts, Chomskyan linguistic
theories are not mathematical. These theories do not mathematize natu-
ral language in the way that the physicist's abstract models mathema-
tize nature. Consequently, if (2)(b) expresses an essential mechanism
of "the Galilean style", it cannot be maintained that this "style" is
in fact used by Chomskyan linguists.

The question, then, is: How central to Weinberg's characterization
of "the Galilean style" --- a characterization taken over by Chomsky
--- is (2)(b)? That is, if a mode of inquiry made no attempt at
mathematizing (a specific part of) reality, would Weinberg be willing
to regard it as representing "the Galilean style"? It appears to me
that the following remarks by Weinberg (1976:28) are particularly rele-
vant to this question:

> "We have all been working in what Husserl called the Galilean
> style; that is, we have all been making abstract mathemati-
> cal models of the universe to which at least the physicists
> give a higher degree of reality than they accord the ordinary
> world of sensation. As our knowledge increases, the abstract
> mathematical world becomes farther removed from the world of
> sensation. As Galileo said 'Whoever wants to read a book
> must know the language in which it is written. Nature is a
> book and the characters in which it is written are triangles,
> circles, and squares'. In today's language, they are quan-
> tum fields and principles of invariance. I think there is
> nothing so evocative of the Galilean style in physics as the
> idea of broken symmetry, the idea that on a true mathematical
> level there is a deep degree of symmetry between the forces
> of nature ... "

From these remarks it is quite clear that to Weinberg the construction
of models that are essentially of a mathematical nature constitutes a,
if not the, defining property of "the Galilean style". This is also the
position of Husserl, who is credited with originating the notion of "the
Galilean style". He (1970:28) considers "nature as a mathematical uni-

14

verse" to be "the basic notion of Galilean physics". A scientist would
be working in "the Galilean style" to the extent that he attempted to
"mathematize" his object of study. As Husserl (1970:43) puts it:

"Mathematization, then, with its realized formulae, is
the achievement which is decisive for life."

As the one who discovered "mathematical nature", Galileo is placed by
Husserl (1970:52, 53) "at the top of the list of the greatest discover-
ers of modern times".[19]   It appears, then, that Weinberg's emphasis
on the centrality of the mathematical element of "the Galilean style"
is in accord with the way in which Husserl originally used this notion.
The question, of course, is whether historical and philosophical analyses
of seventeenth century science bear out this position of Husserl's (and
Weinberg's). To this question we return in §3 below.

2.4   Epistemological tolerance

We still have to consider the third mechanism, (2)(c), attributed by
the Chomsky-Weinberg characterization to "the Galilean style". What
would it entail for a Chomskyan linguist to accord a higher degree of
reality to his abstract models than to the ordinary world of sensation?
Chomsky (1978a:10; 1978b:14; 1980:10) appears to deal with this
question when he describes the attitude which linguists should adopt
towards the "empirical inadequacies" of linguistic theories "that have
achieved a certain degree of explanatory depth in some limited domain".
This attitude may be called one of epistemological tolerance: theories
with these properties should not be abandoned as refuted in the face
of what appears to be conflicting evidence derived from ordinary world
sensations.[20]   According to Chomsky, such conflicts should be approached
with "a willingness to set aside apparently refuting evidence", "a readi-
ness to tolerate unexplained phenomena or even as yet unexplained coun-
terevidence". This, he (1978b:14) claims, is what Galileo did:

"If you go back to the time of Galileo, and you looked at
the array of phenomena that had to be accounted for, it was
prima facie obvious that the Galilean theory, the Copernican
theory could not be supported. That is, there were just
masses of refuting data. And, Galileo sort of plowed his
way through this, putting much of the data aside, redefining
what was relevant, and what was not relevant, formulating
questions in such a way that what appeared to be refuting
data were no longer so, and in fact, very often just disregarding
data that should have refuted the system, and did this, not
simply with reckless abandon, but because of a recognition
that explanatory principles were being discovered that gave
insight into at least some of the phenomena." [21)]

Notice that this tolerant attitude to what appears to be negative evidence complements the use made of abstractions and idealizations in
defining the scope of a theory. If not just any problematic datum needs
to be explained by a (linguistic) theory, not just any (linguistic)
datum can constitute real negative evidence for this theory. Thus,
(2)(a) and (c) in the Chomsky-Weinberg characterization of "the Galilean
style" single out closely related attributes of this mode of inquiry.

Chomsky invokes two considerations to justify the adoption of (2)(c) by
generative grammarians. The first, a general historical consideration,
is simple: epistemological tolerance is a good attitude to adopt
because it paid off handsomely in the case of Galileo, as suggested in
the quotation given above. In this connection Chomsky (1980:10), more-
over, points out that Galileo "did not abandon his enterprise because
he was unable to give a coherent explanation for the fact that objects
do not fly off the earth's surface".[22)] And as we have already seen in
§1 above, "the great successes" of modern natural sciences are attributed
by Chomsky (1978a:10) "to the pursuit of explanatory depth which is very
frequently taken to outweigh empirical inadequacies".

The second consideration adduced by Chomsky in support of (2)(c) pertains
more specifically to linguistics. He (1978a:10) asserts that at this
stage in the development of the discipline, linguists "often do not know
what kind of evidence is relevant to theories". A consequence of this,

according to Chomsky (1978a:10), is that "even the absolute true grammar
would, if it existed, be 'refuted' by masses of counterexamples, again
because we do not know what is the right kind of evidence". Chomsky's
(1980:10) latest formulation of these points goes even further in rela-
tivizing the significance of potential counterexamples:

> "As for the matter of unexplained apparent counterevidence,
> if someone were to descend from heaven with the absolute
> truth about language or some other cognitive faculty, this
> theory would doubtless be confronted at once with all sorts
> of problems and 'counterexamples', if only because we
> do not yet understand the natural bounds of these particu-
> lar faculties and because partially understood data are so
> easily misconstrued."

Chomsky's research methodology has for many years been marked by "a
readiness to tolerate unexplained phenomena or even as yet unexplained
counterevidence". This attitude is strikingly manifested, for example,
in his (1970) study of English nominalizations.[23] Consequently, epis-
temological tolerance in a general sense cannot be the sole defining
property of a new mode of inquiry in generative grammar. It is true,
however, that Chomsky has nowhere expressed this attitude of epistemo-
logical tolerance more forcefully and explicitly than in the context
of his metascientific remarks on "the Galilean style". The question
then would be whether, as a working grammarian, Chomsky has recently
given such special substance to this epistemological tolerance that it
may be taken as a defining property of "the Galilean style" as a <u>new</u>
mode of inquiry in generative grammar. To this question we will return
in §4 below.

2.5   Retrospect

The discussion of the immediately preceding sections boils down to the
following points:

1. Chomsky bases his metascientific characterization of "the Galilean style" on a definition by Weinberg in terms of which this mode of inquiry has three central mechanisms: abstraction, mathematization, epistemological tolerance.

2. Generative grammarians have always operated with linguistic theories that are abstract in the appropriate ways; abstraction, consequently, cannot be the sole defining property of "the Galilean style" as a new mode of linguistic inquiry.

3. Mathematical concepts play no significant role in the construction of Chomskyan linguistic theories; mathematization, consequently, cannot be a defining property of "the Galilean style" in linguistic inquiry.

4. In their readiness to tolerate unexplained phenomena and even unexplained counterevidence, generative grammarians have for a considerable time accorded a higher degree of reality to their abstract models than to the ordinary world of linguistic sensation; a <u>general</u> sort of epistemological tolerance, consequently, cannot be the sole defining property of "the Galilean style" as a new mode of linguistic inquiry.

These findings imply, among other things, that it is not at all evident that "Chomskyan" generative grammar has recently developed or acquired a distinct, new mode of inquiry, one that may be aptly called "the Galilean style".

3   <u>Historical and philosophical perspective</u>

3.1   <u>General</u>

We still have to consider the notion of "the Galilean style" within a wider context of philosophy and history of science. To what extent, then, is the Chomsky-Weinberg characterization of "the Galilean style" borne out by historical and philosophical analyses of Galileo's work, methods and thought? This question --- first formulated as (1)(b) above --- has to do with the historical and philosophical credibility

of the Chomsky-Weinberg characterization. Clearly, if Chomsky's notion
of "the Galilean style" lacked an adequate historical basis, his argu-
ment for the adoption of "the Galilean style" in linguistic inquiry
would lose much of its force.

The historical and philosophical literature on Galileo's work is both
complex and vast.[24] I cannot attempt to do more than to draw atten-
tion to a few fairly recent publications that throw some light on the
Chomsky-Weinberg characterization of "the Galilean style".[25]

3.2   A question of definition

Notice that both Weinberg's characterization of "the Galilean style"
and Chomsky's elaboration of this characterization are based on cer-
tain implicit assumptions. A first one of these may be stated as fol-
lows:

(5)   The Galilean style can be defined uncontroversially in
       terms of a small set of distinctive attributes.

Even a cursory examination of recent literature shows this assumption
to be questionable. Over the years different historians and philoso-
phers of science have singled out different (clusters of) elements of
Galileo's work and thought as representing the features that are "cen-
tral", "basic", "fundamental", etc. to his "method(ology)", "philosophy
(of science)", "metaphysical position", etc. The distinctive features
of Galileo's way(s) of doing science have been the topic of endless
controversy, as pointed out once again recently by Wisan (1978:1):

"There is general agreement that Galileo is one of the most
important figures in the history of science and scientific
method. His science, method and thought seem clearly to
reflect critical aspects of the transition from medieval to
modern science. But here agreement ends. There is no con-
sensus concerning the exact nature of the changes which took
place or Galileo's precise role with respect to these changes.

And what Galileo thought on almost every topic is subject
to endless controversy."

As noted by Wisan (1978:47, n. 1) and earlier by Drake (1967:263), it
has been alternatively claimed that the central feature of Galileo's
"method" is his use of mathematics, his insistence on observation and
experimentation, his use of abstraction, etc.[26] One of the main
reasons for this disagreement about what constitutes the essence of
Galileo's science and method is sought by Wisan and Drake, for example,
in the fact that Galileo nowhere gave a systematic clarification of
his views on philosophy and method. This, according to Crombie (1956:
1090), has had the consequence that philosophers "looking for histori-
cal precedent for some interpretation or reform of science which they
themselves are advocating, have all, ... however much they differed
from each other, been able to find in Galileo their heart's desire".
Wisan (1978:1) observes that "Crombie might well have added that his-
torians have done much the same thing, for even if they have no philo-
sophical axe to grind, nonetheless they see Galileo through eyes
accustomed to some particular interpretation of the scientific enter-
prise".

Recent historical and philosophical literature, thus, clearly fails to
bear out the assumption (5). Among the elements singled out in this
literature as in some way important to a characterization of Galileo's
way(s) of doing science are the following:

(6)   (a)   the choice of total certainty as an ultimate epistemolo-
            tical aim,[27]

      (b)   the insistence on the use of demonstrative reasoning/
            demonstration as a means of arriving at certainty,[28]

      (c)   the use of mathematics as, among other things, a means
            of providing the required demonstration,[29]

      (d)   the importance assigned to simplicity as a criterion
            for scientific hypotheses,[30]

(e)   the central role of observation and experience in the
      formation and evaluation of scientific hypotheses,[31]

(f)   the essential role of real experiments in the testing
      of scientific hypotheses,[32]

(g)   the use of thought experiments in the justification of
      scientific hypotheses,[33]

(h)   the view of the status of causal explanation in in-
      quiry,[34]

(i)   the use of abstraction and idealization in limiting the
      domain of inquiry,[35]

(j)   the ways of dealing with experiential or sense data
      which are in conflict with scientific theories or "sys-
      tems",[36]

(k)   the skilful use of rhetoric and propaganda in the justi-
      fication/defence of scientific hypotheses.[37]

Galileo scholars do not disagree only about which or which clusters of
the elements (6)(a)-(k) may be taken to represent defining properties
of Galileo's method(s) of doing science. They disagree also about the
precise content of many of the elements that can hardly be denied some
role in Galileo's work. The mathematical, observational and experimen-
tal elements are good cases in point.[38]

We seem to have arrived at two general conclusions. On the one hand,
from a historical and philosophical perspective, the Chomsky-Weinberg
characterization of "the Galilean style" is arbitrary in the way that
it singles out certain elements in Galileo's way(s) of doing science as
defining properties of "the Galilean style". On the other hand, at
this stage of the development of Galileo scholarship, the very attempt
to provide a simple characterization of "the Galilean style" appears
misguided, at least if this characterization is to have the required
measure of historical credibility. Notice also in passing that there
appear to be, in Galileo's way(s) of doing science, various elements
that are considered to be important in some sense by historians and
philosophers of science but that have played either no role at all or

only a very minor role in Chomsky's approach to linguistic inquiry.
In addition to the use made of mathematics, these include certainty as
an ultimate epistemological aim, the special status assigned to demon-
strative reasoning, the use of a general criterion of simplicity for scienti-
fic hypotheses and, to mention only one more element, the use of real
experiments in the testing of hypotheses.[39)]

3.3   A question of existence

Implicit in the Chomsky-Weinberg characterization of "the Galilean style"
there is a second questionable assumption, one that is even more basic
than the first:

(7)   There is a distinct mode of inquiry that, on the basis of
       historical and philosophical considerations, may aptly be
       called "THE Galilean style".

Notice that assumption (7) is more fundamental than assumption (5):
whereas (5) is about the identification of the defining properties of
"the Galilean style", (7) is about the very existence of such a mode of
inquiry. Leading Galileo scholars have come to reject the assumption
that Galileo had a single, unique and coherent method of inquiry which
he applied consistently and whose use resulted in the transition from
medieval to (early) modern science. In a careful analysis, Wisan (1978:
3) argues that

> "... he [i.e., Galileo --- R.P.B.] employed different
> methods and applied different standards for work in these two
> fields [i.e., astronomy and mechanics --- R.P.B.] . In
> astronomy, for example, he mixed sound scientific reasoning
> with dubious arguments which he hoped would persuade his
> readers of the truth of the Copernican system. In mechanics,
> on the other hand, he consistently sought to produce a rigo-
> rous mathematical treatise."

Moreover, according to Wisan (1978:5-6), Galileo was not certain how to present his mechanics; in the end he was "uncertain whether to present his work as a pure mathematical treatise on the one hand, or as a science of motions found in nature on the other".

McMullin (1978:211), another serious Galileo scholar, also emphasizes the diversity in Galileo's methods and, moreover, draws attention to the way in which these methods changed over the years:

> "We will see that Galileo's science is a diverse enter-
> prise, pursued in many different contexts, following
> methods which altered over the years."

McMullin (1978:219) argues that Galileo neither had "a radically new notion of science" nor was "in posession of a well-articulated coherent theory of science which he consistently employed throughout his entire scientific work". In addition, he (1978:219) identifies various "tensions within his [Galileo's --- R.P.B.] conception of science" that "would have been very difficult, indeed, for him to overcome". To substantiate these points, McMullin (1978:251-252) traces

> "two very different conceptions of science animating
> Galileo's work. One, the demonstrative ideal, he inherited
> from the Greek tradition and never abandoned, even though
> it led him into the gravest difficulties, especially in his
> cosmology. This is the conception of science he formally
> espoused throughout his career. The other is the retroduc-
> tive notion of science which is exemplified especially in his
> discussions of phenomena whose causes are either remote
> (comets, sunspots), enigmatic (the motions of the earth),
> or invisible (atoms, the force of the void)."

It is not possible to present the details of either Wisan's or McMullin's account of the various methods used by Galileo, the tensions among these methods, the ways in which these methods changed over time, and the in-consistencies in Galileo's use of these methods. It is sufficient to

note that accounts such as those of Wisan and McMullin make it impossible to uphold assumption (7) in the absence of explicit justification. Such justification has been furnished by neither Weinberg nor Chomsky.

3.4   Retrospect

What, then, can be said from a historical and philosophical point of view about the Chomsky-Weinberg characterization of "the Galilean style"?

1. The three properties --- abstraction, mathematization, and epistemological tolerance --- attributed in this characterization to "the Galilean style" do appear to be among the elements that can be discerned in Galileo's ways of doing science.

2. Without explicit justification for the omission, this characterization omits reference to other elements in Galileo's ways of doing science, elements that historians and philosophers of science have claimed to be central to Galileo's approach to scientific inquiry.

3. This characterization rests on the questionable assumption that "the Galilean style" can be defined straightforwardly in terms of a small number of distinctive attributes.

4. This characterization, finally, proceeds from the questionable assumption that there is a single, coherent and unique mode of inquiry which Galileo applied consistently and the use of which led to "the scientific revolution" of the seventeenth century.

What are the implications of these conclusions? The most important one is that Chomsky's conception of "the Galilean style" appears to be a fiction in the sense that it lacks the necessary historico-philosophical basis.[40] It might be claimed in defence of Chomsky that he never really intended his conception of "the Galilean style" to have full historical and philosophical credibility. This claim, however, would be irreconcilable with the way in which Chomsky has argued for the adoption of "the Galilean style" by linguists and psychologists. As we saw in §1 above, this argument of Chomsky's depends crucially on the idea that "the Galilean style" represents a historically real mode of inquiry. We

have therefore reached a point where it seems impossible to uphold in
an interesting way the claim that there is a distinct mode of linguis-
tic inquiry that may aptly be called "the Galilean style".

4   A Galilean episode in Chomskyan linguistics

4.1   A different tack

Given the way in which Chomsky, following Weinberg, characterizes "the
Galilean style", it can be maintained only with great difficulty that
"the Galilean style" represents a new, distinct mode of inquiry in gene-
rative grammar. This was the conclusion of §2.   In §3, moreover, we
found that, given the present state of Galileo scholarship, it appears
to be impossible to provide the appropriate kind of philosophical and
historical basis for the Chomsky-Weinberg characterization of "the
Galilean style". Are we therefore forced to adopt the position that
"the Galilean style" in linguistic inquiry is simply whatever Chomsky
stipulates it to be? Is it true that Chomsky's use of the notion "the
Galilean style" represents nothing more than a rhetorical move aimed at
persuasion?

The position that will be argued in this section is that there are
elements in Chomsky's research methodology that bear a striking resem-
blance to certain elements in Galileo's methodology. This position
implies that recent episodes in Chomskyan generative grammar can be
illuminated in a rather striking way from a Galilean perspective. To
argue this position, however, is not to defend the much stronger ---
and in my view untenable --- thesis that there is a distinct and
historically real mode of inquiry, "the Galilean style", which Chomsky
has recently adopted and which he and his followers have used consis-
tently ever since.

The argument below will derive its substance from an analysis of a
particular episode in the recent history of generative grammar, namely
Chomsky's defence of his government-binding (or GB) theory against
what appears to be threatening empirical evidence. It will be shown
that Chomsky's strategy of defusing the threat of this evidence strongly
resembles the strategy used by Galileo to defuse the so-called Tower

Argument against the Copernican theory of the earth's diurnal rotation.
The discussion will make use of Feyerabend's analysis of the latter
strategy as presented in his Against method (1979). The Galilean and
Chomskyan strategies will be compared systematically with reference
to the nature of the threatened theories, the nature of the threatening
evidence, the nature of the devices used for defusing the threat of the
evidence, and the methodological and philosophical implications of the
use of these devices.

Before turning to the substance of the comparison, however, we should
note two general points concerning Feyerabend's analysis of the way in
which Galileo defused the Tower Argument. First, this analysis has
been criticized by various scholars, including Machamer (1973), Rossi
(1975) and Worrall (1977). Feyerabend (1978, 1979), however, has suc-
ceeded in my view in showing that these criticisms leave the essence of
his analysis intact. Second, to adopt Feyerabend's analysis of Galileo's
handling of the Tower Argument is not to take a stand on the accuracy
of the more general conclusions --- specifically those constitutive
of the theory of "epistemological anarchism" --- drawn by Feyerabend
from this analysis.

4.2   The threatened theories

As was indicated above, the threatened theory in the case of the Gali-
lean episode is the Copernican idea of the diurnal rotation of the earth,
that is, the idea that the earth rotates around its own axis. (As is
noted by Feyerabend (1979:70, 95), what is at stake is not Copernicus'
view that the earth moves around the sun.)

The theory involved in the Chomskyan episode is more complex. In pre-
senting this theory, the GB theory, it is necessary to assume some back-
ground knowledge of recent theoretical developments in generative grammar.
The GB theory will be presented as outlined in Chomsky's paper "Marked-
ness and core grammar" (1979b). A central function of binding theories
in generative grammar is to account for linguistic phenomena that can
be reduced to antecedent-anaphor relations. The first binding theory
proposed by Chomsky, the so-called "OB theory",[41] suffered from a num-

ber of conceptual problems.[42)]   Chomsky's latest binding theory, the
GB theory, is presented primarily to overcome these conceptual problems.
As is pointed out by Chomsky (1979b:3), the OB and GB theories or
"frameworks", as he also calls them, share a number of basic "concepts
and systems", including the following:

(8)   (a)   principles of boundedness and locality,

       (b)   notions of abstract case, grammatical relation and govern-
              ment,

       (c)   various conditions on binding for anaphoric expressions,

       (d)   a theory of indexing and coindexing (including control).

There are various differences between the OB and GB theories: the one
relevant to our purpose has to do with the binding conditions mentioned
in (8)(c) above. The OB theory incorporates, as binding conditions,
the Nominative Island Condition (NIC) (9)(a) and the Opacity Condition
(9)(b).[43)]

(9)   (a)   A nominative anaphor in S cannot be free in $\bar{S}$ containing
              S.[44)]

       (b)   If α is in the domain of the subject of β , β mini-
              mal, then α cannot be free in β.[45)]

These binding conditions are replaced in the GB theory by the following
three principles or conditions, also called a "theory of binding" by
Chomsky (1979b:12):

(10)   (a)   If NP is lexical or a bound variable, then it is free.

       (b)   If NP is pronominal, it is free in its governing cate-
              gory.

       (c)   If NP is an anaphor, it is bound in its governing cate-
              gory.

Chomsky (1979b:24) argues that the GB theory has "many merits". It
overcomes, in Chomsky's (1979b:24) phrasing, in a "rather suggestive way"

the conceptual problems of the OB theory, giving a "more principled",
"in some ways more elegant" and "a more unified account" of the rele-
vant phenomena. The conceptual problems that arise in the OB theory
and that are overcome in the GB theory are formulated by Chomsky (1979b:
10) as follows:

(11)   (a)   redundancies, specifically, between Case theory and the
             theory of binding;

       (b)   the problem of explaining why the subject of Tense and
             the domain of a subject should be exactly the two opaque
             domains;

       (c)   the failure of correspondence between the theory of move-
             ment and of binding as reflected in the phenomena that
             are assigned to RES(NIC);

       (d)   the problem of deriving the * [that t] filter from
             more fundamental considerations, and specifically relating
             it to RES(NIC);

       (e)   the problem of simplifying the indexing conventions, and
             if possible, reducing them to the simplest possible con-
             vention, namely, random indexing;

       (f)   the problem of finding some more natural account of DR
             (that is, disjoint reference).

Within the restricted scope of this essay, unfortunately, it is not pos-
sible either to explicate the theoretical concepts involved in the formu-
lation of these six problems, or to illustrate these problems with refe-
rence to concrete linguistic expressions.

According to Chomsky (1979b:19ff.), moreover, the GB theory in certain
respects is also empirically more adequate than the OB theory. The bind-
ing conditions (10)(a)-(c), however, make incorrect predictions in certain
cases where the OB theory is empirically adequate. Thus, it is these
binding conditions that constitute the threatened aspect of the GB theory.

Before we turn to the nature of the evidence that threatens the Copernican

and Chomskyan theories, observe that both these theories are believed
by their respective propounders to comprise relatively deep explanatory
principles. Feyerabend (1979:88) notes that, according to Copernicus,
his theory made it clear how "the whole [correspond] to its parts
with wonderful simplicity" and that this theory provides the desired
"unity of understanding and conceptual presentation". As was pointed
out above, Chomsky has similar sentiments about the GB theory. This,
of course, is not to say that the GB theory is just as fundamental to
present-day linguistics as the theory of the diurnal rotation of the
earth was to seventeenth century natural science.

4.3   The threatening evidence

The evidence threatening the Copernican theory that we are interested in
here was embodied in what has become known as "the Tower Argument".
This argument is presented as follows by Galileo in his Dialogue con-
cerning the two chief world systems (1967:126):

>   "heavy bodies ... falling down from on high, go by a straight
>   and vertical line to the surface of the earth. This is con-
>   sidered an irrefutable argument for the earth being motion-
>   less. For if it made the diurnal rotation, a tower from
>   whose top a rock was let fall, being carried by the whirling
>   of the earth, would travel many hundreds of yards to the
>   east in the time the rock would consume in its fall, and the
>   rock ought to strike the earth that distance away from the
>   base of the tower".

This argument, according to Feyerabend (1979:70), not only convinced
Tycho but also was used by Galileo in his Trattato della sfera against
the motion of the earth.

In the case of the Chomskyan theory the threatening evidence is more
complex. The crux of the matter is that the GB theory, in terms of the
binding conditions (10)(a)-(c), appears to predict incorrectly that cer-
tain sentences of English are ungrammatical. Thus, according to Chomsky

29

(1979b:20-22) the GB theory predicts incorrectly that the unstarred sentences of (12) are ungrammatical.[46]

(12) (a)   they read $[_{NP}$ each other books$]$ $[(21)]$

      (b)   (i)   *they heard $[_{NP}$ my stories about each other$]$ $[(23)(i)]$

             (ii)   they heard $[_{NP}$ the stories about each other$]$

                 (that had been published last year) $[(23)(ii)]$

           (iii)   they heard $[_{NP}$ stories about each other$]$ $[(23)(iii)]$

      (c)   (i)   *they expected that $[_{NP}$ my pictures of each

                 other$]$ would be on sale $[(24)(i)]$

             (ii)   they expected that $[_{NP}$ the pictures of each

                 other$]$ would be on sale $[(24)(ii)]$

           (iii)   they expected that $[_{NP}$ several books about

                 each other$]$ would be on sale $[(24)(iii)]$

      (d)   (i)   they think it is a pity that pictures of each
                 other are hanging on the wall $[(25)(i)]$

             (ii)   *they think he said that pictures of each other
                 are hanging on the wall $[(25)(ii)]$

      (e)   (i)   I think it pleased them that pictures of each
                 other are hanging on the wall $[(26)(i)]$

             (ii)   they think it pleased me that pictures of each
                 other are hanging on the wall $[(26)(ii)]$

      (f)   (i)   they think that there are some letters from each
                 other at the post office $[(27)(i)]$

             (ii)   *they think that he saw some letters for each
                 other at the post office $[(27)(ii)]$

In regard to these sentences Chomsky (1979b:22) observes that

> "In accordance with the GB system all of these sentences
> [including the unstarred ones --- R.P.B.] are ungramma-
> tical. The distribution of *'s follows, however, from a
> properly formulated version of the Specified Subject Condi-
> tion, as in the OB framework, and indeed this and earlier
> systems of the same general sort were motivated by the
> similarities between clauses and NP's illustrated by these
> examples."

The incorrect predictions of the GB theory all follow the same pattern.
In all the sentences of (12) the minimal governing category of each
other is an NP. Each other is a lexical anaphor and must, therefore,
in terms of the binding condition (10)(c) be bound in its governing
category NP. This, however, is not the case. Consequently, on the GB
theory all the sentences of (12) must be ungrammatical. Native speakers,
however, intuitively judge the unstarred sentences of (12) to be accep-
table. The evidence that appears to threaten the GB theory thus takes
the form of acceptability judgments by native speakers of English.

Consider now the predictions of the OB theory about the sentences of
(12). As to the unstarred sentences, none of them is subject to the
Nominative Island Constraint (9)(a) or the Opacity Condition (9)(b).
Consequently, no principle of the OB theory prevents they and each
other from being coindexed in these sentences. The OB theory thus cor-
rectly predicts that the unstarred sentences will be grammatical. In
the case of the starred sentences the Specified Subject Condition
(reformulated as the Nominative Island Constraint) applies, blocking
the coindexing of they and each other. The OB theory, therefore, cor-
rectly predicts these sentences to be grammatical.

4.4   Defusing devices

4.4.1   Initial response

We come now to the really interesting part of the Galilean and Chomskyan
strategies: the devices or methods used to defuse the threat posed by
the evidence. Galileo's initial response, according to Feyerabend (1979:
71), was to admit the correctness of the sensory content of the observa-
tion that threatened the Copernican theory. That is, he admitted that it
did appear that heavy bodies falling from a height went perpendicularly
to the surface of the earth. Galileo (1967:256) proceeded, however, to
contend that it was better to put this appearance aside and "to use the
power of reason either to confirm its reality or to reveal its fallacy".

Consider now Chomsky's initial response to the threatening evidence noted
in §4.3 above. Firstly, like Galileo, Chomsky (1979b:20, 22) does not
question the correctness of the intuitive (or "sensory") basis of the
evidence. That is, Chomsky does not reject the intuitive judgements to
the effect that (12)(a), (b)(ii) and (iii), (c)(ii) and (iii), (d)(i),
(e)(i) and (ii) and (f)(i) are acceptable. Secondly, however,
again like Galileo, Chomsky goes on to examine, in a rational way, the
properties of the apparent counterevidence.

Galileo's use of "the power of reason" led to a defusing of the apparent
counterevidence presented in the form of the Tower Argument against the
Copernican theory of the diurnal rotation of the earth. In essence what
Galileo did, on Feyerabend's (1979:92) analysis, was to create "a new kind
of experience" --- one that, unlike the old sensation (of movement), was
not in conflict with the Copernican theory. The crucial question now is:
What are the devices that Galileo employed in order to achieve this end?
On Feyerabend's analysis there were two such devices: (i) the replace-
ment of natural interpretations inconsistent with the Copernican theory
by others that were consistent with it, and (ii) the concealment of the
partly unnatural new interpretations by means of the method of anamnesis.

4.4.2   Replacement of natural interpretations

At the basis of the first device used by Galileo lies, according to
Feyerabend (1979:73), the distinction between "sensations and those 'mental

operations which follow so closely upon the senses', and which are so
firmly connected with their reactions that a separation is difficult to
achieve". These mental operations Feyerabend refers to as "natural
interpretations". The essential point, now, is that in the case of
(counter-)evidence the messages of the senses may be correct but the
ensuing natural interpretations mistaken. On Feyerabend's (1979:74)
analysis, this point applies to the Tower Argument:

> "..in the arguments dealing with the motion of the earth, it
>   is this reasoning, it is the connotation of the observation
>   terms and not the message of the senses or the appearance
>   that causes trouble."

To Galileo, therefore, "confirming the reality of appearance" or "reveal-
ing its fallacy" meant identifying the natural interpretations in the
threatening evidence and examining the validity of these interpretations.

In the evidence threatening the Copernican theory, Galileo identified
two natural interpretations that he considered incorrect.[47] The First
Natural Interpretation may be stated as follows:

(13)   Except for occasional and unavoidable illusions, apparent
        motion is identical to real motion.

The First Natural Interpretation is also characterized by Feyerabend
(1979:90) as "the epistemological assumption that absolute motion is
always noticed". To hold The First Natural Interpretation is, as pointed
out by Feyerabend, to assume the "operative" character of all motion.
This represents a naively realistic view of motion. The First Natural
Interpretation, according to Feyerabend (1979:74ff.), does not speak the
language of the motion involved in the Copernican theory. Rather it
speaks the language of the traditional view of motion. That is, although
the sensory basis of the observation of the falling stone is correct,
the observation itself is incorrect because of the faulty natural inter-
pretation superimposed on it.

What Galileo then did, according to Feyerabend (1979:78-79), was not to

abandon the threatened Copernican theory, but to eliminate the trouble-
some First Natural Interpretation and to replace it with an alternative
interpretation:

(14)   Motion among things to which it is common is "non-operative",
         that is, it remains insensible, imperceptible, and without
         any effect whatever.

This alternative natural interpretation is also presented by Feyerabend
(1979:90) as "the relativity principle": "our senses notice only rela-
tive motion and are completely insensitive to a motion which objects
have in common..." By replacing the First Natural Interpretation by
the alternative (14), Galileo introduced a new observation language,
according to Feyerabend. The result is that the threat to the Copernican
theory is partly defused. Given the alternative natural interpretation
(14), the appearance of a stone falling from the top of a tower straight
down in a vertical line to its base no longer provides evidence against
the idea of the diurnal rotation of the earth.

On Feyerabend's (1979:90ff.) analysis Galileo, after replacing the First
Natural Interpretation (13) with the alternative (14), still faced the
task of explaining why the stone remained with the tower rather than being
left behind. To tackle this task, Galileo identified the Second Natural
Interpretation that he considered incorrect; it is represented by Feyera-
bend (1979:90) as the following "dynamical principle".

(15)   Objects --- such as a falling stone --- that are not
         interfered with maintain their natural motion.

This offending Second Natural Interpretation Galileo replaced with what
Feyerabend (1979:90) states as "the principle of circular inertia":

(16)   An object that moves with a given angular velocity on a fric-
         tionless sphere around the centre of the earth will continue
         moving with the same angular velocity forever.

The combination of the relativity principle (14), the principle of circular inertia (16) and what Feyerabend (1979:90) calls "some simple assumptions concerning the composition of velocities" yielded an argument which, instead of threatening the Copernican theory, gave it some support.

We can now turn to Chomsky's attempt to defuse the threat that the evidence surveyed in §4.3 poses for the GB theory. What is the strategy he uses here? He (1979b:20) first deals with the sentence (12)(a), [(21)] in his numbering:

> "In case (21), ..., the OB system correctly permits <u>each other</u> to be coindexed with <u>they</u>, whereas the GB system incorrectly assigns * to this sentence.
>
> In summary, in accordance with the GB system the sentences (18) and (20ii) are unmarked and the sentence (21) is marked, whereas in the OB system the conclusions are reversed. Thus the two theories make different predictions concerning markedness.
>
> In these cases, it seems to me reasonable to conclude that the predictions of the GB system are in fact correct as contrasted with those of the OB system. Thus, (18) is surely the normal case in the languages of the world, whereas such structures as (21) appear to be rare, and as we see, the OB principle that permits (21) does not extend to similar structures such as (20ii), which perhaps represents a more general case across languages."

Sentences (17)(a), (b) and (c) below represent Chomsky's (18), (20)(i) and (ii) respectively.

(17)　(a)　John read [$_{NP}$ his books]　　　　　　　[(18)]

　　　(b)　they'd prefer [$_{NP}$ Bill's writing the book] [(20)(i)]

　　　(c)　*they'd prefer [$_{NP}$ each other's writing the book] [(20)(ii)]

In the quotation above, it is possible to identify two devices used by
Chomsky in his attempt to defuse the threat posed for the OB theory by
the structure/sentence 'they read [$_{NP}$ each other's books]' . In both
cases the device strongly resembles that used by Galileo in defusing the
Tower Argument. Like Galileo's first device, Chomsky's first also has
the effect that a troublesome "natural interpretation" is replaced by a
more congenial alternative. In the case of the GB theory the trouble-
some "natural interpretation" has to do with the way in which intuitive
acceptability judgements are naively interpreted by linguists. It may
be stated as follows.

(18)   The acceptability/unacceptability of utterances is a necessa-
        rily correct reflection, under all circumstances, of the gram-
        maticalness/ungrammaticalness of the structures underlying the
        utterances.

Embodied in the "natural interpretation" (18) is a view of the unaccepta-
bility of utterances that is naive and absolute in a sense to be clari-
fied below. In terms of this "natural interpretation" the acceptability
of the utterance they read each other's books threatens the GB theory
because on this theory the structure --- (12)(a) or Chomsky's [(21)]
--- underlying the utterance must be ungrammatical.

Chomsky now attempts to remove this threat to the GB theory by replacing
the "natural interpretation" (18) with an alternative that may be stated
as (19) (--- this replacement, as will be shown below, is not carried out
in a wholly overt way).

(19)   The acceptability/unacceptability of utterances is a necessa-
        rily correct reflection of the grammaticalness/ungrammatical-
        ness of the structures underlying them only if these structures
        are unmarked.

(19) embodies a relative view of the unacceptability of utterances:
(un)acceptability is interpreted relative to (un)markedness. In this
respect (19) is more sophisticated than (18). In conjunction with Chomsky's

assertion that 'they read $[_{NP}$ each other's books$]$' is a marked struc-
ture, (19) partly defuses the threat held by to the GB theory that arises
from the acceptability of <u>they read each other's books</u>.

Consider now the unstarred sentences (12)(b)-(f), Chomsky's $[(23)]$ -
$[(27)]$. The GB theory predicts, incorrectly, that these sentences must
be ungrammatical. Chomsky attempts to defuse the threat of these sen-
tences to the GB theory in the same way as that of (12)(a): by bringing
into the discussion the notion of markedness which entails the replace-
ment of the "natural interpretation" (18) with (19). Thus, having posed
the question whether the sentences in question are marked, he (1979b:23)
proceeds:

> "... it seems to that a positive answer is perhaps not unreason-
> able. The unstarred constructions seem somewhat marginal,
> judgments tend to vary and there appear to be differences in
> judgment depending on lexical choice. In general, this seems
> to be a rather hazy area, and the construction appears to be
> a rather unusual one. Furthermore, nonstructural factors seem
> to enter, as we see from the distinction between lexical and
> non-lexical subjects (i.e., unpersonal <u>it</u> and <u>there</u> as dis-
> tinct from referential NP's). Further questions ... arise when
> we replace <u>each other</u> by reciprocals and pronouns in these
> cases, as has often been noted."

Chomsky clearly considers the unstarred sentences of (12)(b)-(f) to be
marked. Their unacceptability, consequently, threatens the GB theory
only if the "natural intepretation" (18) is adopted. The adoption of the
alternative interpretation (19), in conjunction with a special (marked)
principle of English grammar to deal with the unstarred sentences of (12)
(b)-(f), allows Chomsky to retain the binding conditions (10)(a)-(c) in
an unmodified form.[48]

4.4.3   <u>Concealment</u>

We come now to the second device used by Galileo to defuse the threat of
the Tower Argument to the Copernican theory. On Feyerabend's (1979:80ff.)

analysis this device took on the form of a method of concealment: the method of anamnesis.[49] Using this method, Galileo performed a "psychological trick" --- to take over an expression of Feyerabend's (1979: 81) --- to conceal the fact that he was replacing the First Natural Interpretation (13) with the alternative (14).

Precisely how did Galileo use the method of anamnesis? Feyerabend (1979:83ff.) provides the following reply to this question. Part of seventeenth century Italian artisan common sense or conventional wisdom was the concept of the operative character of all motion: except for occasional and unavoidable illusions, apparent motion was identical to real motion. What Galileo did was to "remind" his opponents that this common sense or thought contained a second concept of motion too: a concept providing for situations in which the nonoperative character of shared motion was evident. In these situations, exemplified by the events in a boat or in a smoothly moving carriage, apparent motion was evidently not identical to real motion. Galileo thus urged his opponents to "remember" the conditions under which the non-operative character of shared motion could not be denied. Then he persuaded them to interpret the motion of the falling stone --- which so far they had interpreted in terms of the concept of the operative character of all motion --- in terms of the concept that in certain circumstances motion was non-operative. Thus, after arguing that the motion of the sail yard of a ship is non-operative for someone travelling on the ship (for him that is, the sail yard is motionless), Galileo (1967:250) proceeded as follows:

> "Now transfer this argument to the whirling of the earth and
> to the rock placed on top of the tower, whose motion you
> cannot discern because in common with the rock you possess
> from the earth that motion which is required for following
> the tower; you do not need to move your eyes. Next, if you
> add to the rock a downward motion which is peculiar to it
> and not shared by you, and which is mixed with this circular
> motion, the circular portion of the motion which is common
> to the stone and the eye continues to be imperceptible.
> The straight motion alone is sensible, for to follow that
> you must move your eyes downward."

On Feyerabend's analysis Galileo did not only want to turn an observa-
tion that contradicted the Copernican theory of the rotation of the
earth into one which confirmed this theory. He also wanted to persuade
his opponents that no real change took place. This he did by "remind-
ing" them --- in the Platonic sense --- of something that they did
not consciously know/agree to. The result, according to Feyerabend
(1979:84), was that they quite automatically started confounding the
conditions of the two cases --- the operative vs. the nonoperative
case --- and became relativists. The idea of anamnesis functioned,
according to Feyerabend (1979:88) "as a psychological crutch, as a
lever which smooths the process of subsumption by concealing its exis-
tence". The result was a readiness on behalf of Galileo's opponents
to apply the relative notion not only to boats, coaches, etc. but to
the earth as a whole. And, according to Feyerabend (1979:89), Galileo's
opponents had the impression that this readiness had been in them all
the time, although some effort was needed to make it conscious.
Feyerabend (1979:89) concludes that "this impression is most certainly
erroneous: it is the result of Galileo's propagandistic machinations".

The second device used by Chomsky in his attempt to defuse the threat
to the GB theory bears a more than superficial resemblance to Galileo's
method of concealment. Chomsky uses this device to create the impres-
sion that if anyone, when faced with a conflict between the predictions
of a linguistic theory and the acceptability judgements of a native
speaker, switches from the "natural interpretation" (18) to the alter-
native (19), he is doing a normal and non-problematic thing. This
impression is created by three elements in the quotation presented on
p. 34 above.

First, there is Chomsky's use of the expression "In summary ...". This
creates the impression that he is going to repeat the essence of some-
thing that has already been argued for. The "summary" comprises a
number of claims about the markedness of the sentences/structures (12)
(a), (17)(a) and (17)(c) --- Chomsky's [(21)] , [(18)] , [(20ii)] .
But these claims are new in Chomsky's analysis; prior to presenting
his "summary", Chomsky had nothing to say about the markedness of these
forms. By creating the impression that he and his readers have always
taken considerations of markedness into account when interpreting accep-

tability judgements, Chomsky's "In summary" formulation has the effect
of partly concealing his switch from the "natural interpretation" (18)
to (19).

Second, in the remarks under analysis Chomsky operates with an incorrect
claim as if it were evidently true. This is the claim that the two
alternative theories make predictions about markedness, a claim implicit
in the following remark of Chomsky's:

> "Thus the two theories make different predictions con-
> cerning markedness."

In their present formulation, however, neither the OB nor the GB theory
makes <u>any</u> predictions about the markedness of linguistic structures.
Neither of these two theories, nor indeed any other linguistic theory
of Chomsky's, contains any of the principles of markedness that would
be needed for deriving such predictions. At a later stage of his dis-
cussion, Chomsky (1979b:21) in fact concedes that the required princi-
ples (theory) of markedness have still to be developed:

> "We are therefore left with the problem of constructing a
> theory of markedness that will account for the purportedly
> exceptional character of (21) $[$= they read $[_{NP}$ each other's
> books$]$ --- R.P.B.$]$".

Without such a theory, however, no predictions about the markedness of
the relevant structures can be derived from either the OB or the GB
theory. But if these two theories do not make the required predictions
about the markedness of linguistic structures, then quite simply Chom-
sky is <u>not yet able</u> to take the step whereby the acceptability judge-
ments threatening the GB theory are interpreted in accordance with the
principle contained in (19). In other words, it is essential to his
attempt at defusing the threatening evidence, that he should operate
with the claim that the theories in question do make predictions about
markedness. Moreover, it is essential to this attempt that Chomsky
should present this claim as if it were evidently true and non-proble-
matic to his readers.

40

Third, Chomsky initially attempts to create the impression that there
is no real need for any special justification of the judgement that
the sentence "they read [$_{NP}$ each other's books]" is marked. Consider
in this connection the following formulation:

> "Thus, (18) is surely the normal case in the languages of
> the world, whereas such structures as (21) appear to be
> rare ...."

It is crucial, to Chomsky's attempt at defusing the GB theory posed by
his [(21)] , that this structure should be "rare" or that it should
not represent "the normal case". Unlike acceptability judgements
about linguistic expressions, however, "markedness/normalness/rareness"
judgements do not represent linguistic intuitions and are in need of
justification. Later on, this point is implicitly conceded by Chomsky
(1979b:20-21) when he portrays the judgement about the markedness of
his [(21)] as an empirical assumption from which predictions can be
derived that may be checked empirically:

> "... let us tentatively accept the GB system that has been
> sketched here and take (21) to be a marked structure, thus
> supposing it to be rare and specifically learned in English
> on the basis of explicit data that indicates that somehow
> the conditions of core grammar are to be relaxed. We would
> predict, then, that a child learning English who was not
> presented with explicit data to this effect would take (21)
> to be ungrammatical. Note that this is an assumption with
> specific empirical content, though the obvious experiment
> to test it cannot be carried out, for ethical reasons."

Let us assume for the sake of argument that the assumption in question
can be tested empirically. This assumption, however, in no way alters
the fact that, as presented by Chomsky, the claim that [(21)] is
marked lacks the proper justification. And Chomsky makes no mention of
this fact, a fact detrimental to his attempt at defusing the threat of
[(21)] to the GB theory.

Notice that there is a further similarity between the devices used by Chomsky and those used by Galileo. As in the case of Galileo, Chomsky's use of these devices does not merely remove the threat to a theory. The use of these devices in fact changes evidence threatening the theory into evidence apparently supporting the theory. Moreover, in Chomsky's case, the use of these devices turns evidence which initially threatened the GB theory into evidence which ultimately threatens the alternative theory, the OB theory. In the quotation given on p. 34, Chomsky is careful to point out this threat to the OB theory.

4.4.4   Justification of new natural interpretations

Feyerabend (1979:90ff.) discusses in some depth the question of the justification furnished by Galileo for the new natural interpretation (14), that is, the relativity principle, and for (16), namely, the principle of circular inertia. On Feyerabend's analysis Galileo defended the relativity principle in two ways. First, he showed how this principle helped the Copernican theory to withstand the threat of the evidence presented in the Tower Argument. This defence of the relativity principle was "truly ad hoc", according to Feyerabend (1979:90). Second, Galileo pointed to the function of this principle in common sense and surreptitiously generalized that function. The important point, however, is that Galileo gave no independent argument for the validity of the relativity principle.

Turning next to (16), Feyerabend (1979:91) argues that "Galileo's support for the principle of circular inertia is of exactly the same kind" as his justification of the relativity principle. Again Galileo did not introduce the principle by reference to experiment or independent observation. Again he introduced it solely by reference to what everyone was already supposed to know. Feyerabend (1979:91) argues that at best it would have been possible to connect the principle to experiments --- such as the fictitious ones in Galileo's Discorsi --- with the aid of ad hoc hypotheses.

All of this means that, of the claims central to the strategy used by Galileo to defuse the threat to the Copernican theory, two in particular

were poorly justified. To furnish the justification required for the principles (14) and (16) Galileo, according to Feyerabend (1979:99), needed two new theories: a theory of solid objects and a theory of aerodynamics. These "sciences" were, in Feyerabend's (1979:99) phrasing, "still hidden in the future".

Much the same can be said about the basic assumptions and claims involved in Chomsky's strategy for defusing the threat to the GB theory. Specifically, in so far as these claims and assumptions relate to the markedness of linguistic structures they lack proper justification. .Consider in this respect the new "natural interpretation" (19), the claim that the relevant linguistic theories make predictions about markedness, and the various assumptions about the markedness of specific structures such as Chomsky's $\lceil$(18)$\rceil$, $\lceil$(20)$\rceil$ and $\lceil$(21)$\rceil$. Clearly, in the absence of a proper theory of markedness, it is simply not possible to furnish the appropriate sort of justification for such assumptions and claims. It is not sufficient to explain why such a theory is needed and what its aims should be, as Chomsky (1978a:12-13; 1979b:3-4) has done more than once; nothing less than an explicit and non-empty markedness theory is required. At present such a theory represents a "science" that is very much "still hidden in the future".

There are, then, striking similarities between the devices used by Galileo and those used by Chomsky to defend their threatened theories. Like Galileo, Chomsky changes the "natural" way of interpreting potentially harmful raw data, redelimiting in the process the data base of the field. Like Galileo, Chomsky does not furnish appropriate justification for the assumptions involved in this change. And, like Galileo, Chomsky draws attention neither to this change nor to fundamental problems resulting from it.

There are also differences, however, between the circumstances under which Galileo and Chomsky operated. At least one of these is worth noting here. It has to do with the status of relativity in seventeenth-century natural science vis-à-vis markedness in twentieth--century linguistics. On Feyerabend's analysis the concept of the relativity of motion had, prior to Galileo's use of it, been part of seventeenth-century "common sense" or Italian-artisan thought but not

part of seventeenth-century natural science. In twentieth-century lin-
guistics "markedness" has a more complex status. The idea that certain
linguistic structures are in some sense "marked" has been around in
different forms for approximately fifty years.[50] In the late sixties
Chomsky and Halle (1968:chap. 9) made an attempt to reconstruct their
phonological theory in terms of a non-Praguian concept of markedness.[51]
As regards generative syntax, however, the idea of markedness has
remained a common sense or pretheoretical notion. A syntactic theory
incorporating explicitly formulated and well-justified principles of
markedness has yet to be proposed.

4.5   Consequences

We turn now to the consequences that Galileo's treatment of the Tower
Argument had for natural science and those that Chomsky's handling of
the threatening linguistic evidence may have for theoretical linguistics.
As to the former, Feyerabend identifies some that were of immediate
occurrence and more restricted scope and others that took longer to
crystalize and were more far-reaching, affecting the character of natu-
ral science as a whole. We will see below that the consequences of
Chomsky's way of handling the threatening linguistic evidence may also
have consequences of these two types. In the case of Chomsky's actions,
however, consequences of the more far-reaching sort lend themselves to
no more than tentative and speculative discussion: we have to manage,
here, without the sort of hindsight that makes Feyerabend's analysis
of the consequences of the Galilean episode possible.

4.5.1   Survival of "interesting" theories

A first and more immediate and restricted consequence of Galileo's
actions is that an "interesting" theory or hypothesis was saved, was
given "a breathing space" in Feyerabend's phrasing. By saving this
hypothesis, Galileo kept the Copernican system intact as a whole. As
noted by Feyerabend (1979:88), it had been a strong desire of Copernicus
to see "the whole [correspond] to its parts with wonderful simplicity".
The desired "unity of understanding and conceptual presentation" would

have been destroyed by the abandonment of the hypothesis of the diurnal
rotation of the earth.

Chomsky's actions seems to have a similar first consequence: his
treatment of the threatening evidence gives the GB theory "a breath-
ing space". The GB theory is an "interesting" theory in the sense that
its conceptual properties are superior to those of the alternative OB
theory. As noted in §4.2 above, Chomsky (1979b:10) argues that in
overcoming the six conceptual problems of (11) that arise in connection
with the OB theory, the GB theory provides a less redundant, "more
unified", "more principled", and "more elegant" account of the rele-
vant phenomena. This theory, moreover, forms an integral part of Chom-
sky's more inclusive revised extended standard theory. It is conse-
quently of some importance to Chomsky that a theory with such desirable
conceptual properties should not be abandoned at the first hint of empi-
rical trouble. The adoption of the strategy under consideration enables
Chomsky to retain the GB theory.

4.5.2   Conception of "new sciences"

A second consequence of Galileo's treatment of the Tower Argument is
more far-reaching: the conception of a number of "new sciences".
Initially, the new natural interpretations --- the relativity prin-
ciple (14) and the principle of circular inertia (16) --- lacked
proper justification. These "assumptions" were, however, on Feyera-
bend's (1979:99) analysis, "sufficiently clear and simple to prescribe
the direction of future research". To provide the independent support
needed for these assumptions, it was necessary to develop two "new
sciences" --- a theory of solid objects and a theory of aerodynamics.
In effect, therefore, Galileo's strategy of defusing the threat of the
Tower Argument acted as the spur to work by which the substance of the
natural sciences came to be vastly expanded.

Chomsky's handling of the threat to the GB theory may have a similar
consequence. His defence, that is, shows just how acute the need for
an entire new linguistic theory is: a theory of syntactic markedness.
This defence, after all, crucially depends on the ability of the GB

theory --- and theories of linguistic structure in general --- to
make predictions about the (non)markedness of linguistic structures.
The required markedness theory would have to draw a principled dis-
tinction between the syntactic structures belonging to the "core" and
those belonging to the "periphery" of grammars. Moreover, as noted by
Chomsky (1979b:4), this theory would probably also have to rank the
parameters within the "core" or to connect these parameters by "impli-
cational and preferential relations". To justify the required marked-
ness theory it would be necessary --- as we will see below --- to
gain a better understanding of such "external" linguistic phenomena as
non-idealized language acquisition, various kinds of linguistic varia-
tion, language pathology, pidginization and creolization, etc..[52]
Clearly, a theory of syntactic markedness that met the desiderata men-
tioned above would represent a major advance in terms of the new insights
offered by it. Thus Chomsky's defence of the GB theory may one day
turn out to have "borne the seed of a new science": a theory of syntac-
tic markedness.

4.5.3   Creation of new "scientific experience"

Galileo's actions had a third consequence that was even more far-reaching
than the second: the data or evidential base of natural science was
changed. Recall that Galileo used "the power of reason to reveal the
fallacy" of certain naive observations about moving bodies. In the pro-
cess he substituted certain new natural interpretations for old, "falla-
cious" ones. This substitution led to the introduction of a new obser-
vation language and, in Feyerabend's (1979:92) terms, to "the invention of
a new kind of experience that is not only more sophisticated but also far
more speculative than is the experience of Aristotle or of common sense".
It is by the creation of this new kind of scientific experience that,
according to Feyerabend, "the transition from a geostatic cosmology to
the point of view of Copernicus and Kepler is achieved".

Chomsky's defence of the GB theory has a related consequence: it affects
the evidential or data base of binding theories in particular and of lin-
guistic theory in general. On the one hand, the range of data central to
the development of binding theories has been changed in a specific way.

Chomsky (1979b:24) explicates this point as follows:

"... if something like this GB theory turns out to be more
nearly correct, as I rather suspect given its more princi-
pled character, then it follows that a certain range of
evidence that has been quite central in the development
of theory in some recent work, in particular my own, is in
fact not central but rather represents a category of marked
phenomena of English and in part a few other languages."

The evidence alluded to in this quotation includes the acceptability
judgements which favour the OB theory over the GB theory.

On the other hand, Chomsky's handling of the evidence that threatens
the GB theory affects the nature of linguistic evidence in a <u>general</u> way.
The evidential base of syntactic theory is extended to include marked-
ness judgements of the general format illustrated below:

(20)   (a)   The structure S is (un)usual in human language.
        (b)   The structure S is (un)common in human language.
        (c)   The structure S is (un)natural in human language.

Claims of the format illustrated in (20) provide the evidence needed to
validate predictions to the effect that certain linguistic structures
are (un)marked.

To include markedness judgements of the format of (20) in the evidential
base of syntactic theory is to change this base in two related respects.
First, these judgements add to this base an element that is hypothetical
in principle and that may be speculative in practice. The element is
hypothetical in principle in the sense that markedness judgements have
the status of hypotheses: unlike linguistic intuitions, they do not
represent "basic sensations" or "primary linguistic data".[53] The ele-
ment may be speculative in practice in the sense that linguists may pre-
sent these hypothetical judgements --- as in fact Chomsky does ---
without providing the proper kind of justification for them.

Second, the validation of markedness judgements requires the evidential base of syntactic theory to be extended so as to include what has come to be known as "external linguistic evidence".[54] This evidence is "external" in a clear sense: in terms of the abstractions and idealizations that Chomsky has adopted in defining the aims of linguistic theory, it represents data about phenomena that fall outside the specific part of linguistic reality that Chomskyan linguists initially attempt to account for. It has been argued that the only proper way to justify a judgement to the effect that a given structure S is (un)marked is to furnish evidence about the functioning of S in such external phenomena and/or processes as non-idealized language acquisition, speech production and perception, language pathology, linguistic change, linguistic variation, pidginization and creolization, etc..[55] That is, the judgement that S is marked --- or the claim of the format of (20) representing it --- must be validated with recourse to external linguistic evidence represented in statements of the general format illustrated in (21).

(21) (a) S is (not) acquired under the conditions C_1, ..., C_n.

      (b) The production/perception of S is (not) affected in the manner M by the factor F.

      (c) S is (not) affected in the manner M by the pathology P.

      (d) S is (not) affected in the manner M by the process C of linguistic change.

      (e) S varies/does not vary in the manner M in socially/regionally distinct parts of the linguistic community C.

      (f) S is (not) affected in the manner M by the process P/C of pidginization/creolization.

To include external evidence in the evidential base of Chomskyan syntactic theory is to modify this base in a significant way. Recall that Chomsky (1980:190-201) has adopted the position that, although it may be possible to use external linguistic evidence in the validation of linguistic theories, the linguist is not obliged to do so.[56] The point now is that this position of Chomsky's becomes untenable in the present context. That is, the abandonment of this position is dictated by the two factors noted above: first, the obligatory extension of the evidential base so as to include markedness judgements and, second, the need for external evidence to validate such judgements.[57]

4.5.4   Changing of scientific norms

A fourth and radical consequence of Galileo's treatment of the Tower
Argument was the effect on the norms for scientific merit and scientific
progress. Speaking generally, Galileo's way of defusing the Tower Argu-
ment showed the value of a more tolerant and less empiricist approach to
the appraisal of scientific theories. Feyerabend (1979:113) puts this
point as follows:

> "In order to progress, we must step back from the evidence,
> reduce the degree of empirical adequacy (the empirical con-
> tent) of our theories, abandon what we have already achieved,
> and start afresh."

Experience, in Feyerabend's (1979:89) words, ceased to be "the unchange-
able fundament [sic] which it is both in common sense and in the Aristote-
lian philosophy". The heart of the lesson here is that in the event of
a conflict between theory and experience, it may pay off to keep the
theory intact and to change the experience. There is always the possi-
bility that what looks like a threat to a theory may turn out to be due
not to the theory's being incorrect but simply to the fact that, in
Feyerabend's (1979:67) words, "the evidence is contaminated".

In addition to taking a less empiricist stance in the appraisal of
theories, Galileo, on Feyerabend's analysis, further "deviated" from
conventional standards by using counterinduction, ad hoc hypotheses and
psychological tricks.[58)]   On Feyerabend's analysis, then, Galileo's
success resulted from his disregard of what may be described as "conven-
tional standards of good science".

Chomsky's handling of the evidence threatening the GB theory potentially
has similar consequences for the norms for appraising linguistic theories.
In the strategy adopted by Chomsky, reduced weight is assigned to the
empiricist norm which says that conflict with (what appear to be) "the
facts" is a serious, if not fatal, defect of the theory. Chomsky, as we
have seen, waives this norm in the case of a theory, the GB theory, that
is "less redundant", "more principled", "more unified", and "more elegant"
than the obvious alternative, the OB theory. To maintain a theory with

49

such desirable properties, the threatening data are changed in a non-empiricist way. This gives rise to the expectation that norms formulated in terms of such notions as "deductive depth", "unifiedness", "principledness", "naturalness", "elegance", "simplicity" and the like will play an increasingly important role in the validation of linguistic theories in time to come.[59] Such notions are notoriously resistant to precise explication in objective terms. This, in turn, gives rise to the further expectation that the appraisal of linguistic theories will become increasingly complex. Agreement on the merit of linguistic theories, and "rational" argument about disagreement on such merit, will be confined to an increasing extent to those linguists who, in one way or another, have come to share the same conceptions of "principledness", "naturalness", "unifiedness", "elegance", "simplicity", etc.

4.6   Retrospect

The following points have been central to the discussion of the preceding paragraphs:

1.   Certain aspects of Chomsky's mode of linguistic inquiry can be elucidated by analyzing specific episodes in the recent history of generative grammar against the background of revealing philosophical reconstructions of historically real episodes in the work of Galileo: Chomsky's defence of his GB theory, for example, can be illuminated by comparing it with Galileo's defusing of the threat that the Tower Argument posed for the Copernican theory of the earth's diurnal motion.

2.   Like Galileo, Chomsky is concerned with the defence of a theory claimed to have such desirable conceptual properties as "unifiedness", "naturalness", "principledness", "elegance".

3.   Like Galileo, Chomsky in dealing with the threatening evidence adopts a strategy under which he

      (a)   concedes the correctness of the content of the "sensory" core of the threatening evidence;

50

(b)   identifies an incorrect "natural interpretation" within the "sensory" core of the evidence and replaces this with an alternative interpretation in terms of which the evidence loses its threat to the theory and even can be claimed to support the theory;

(c)   ensures that the replacement of the incorrect "natural interpretation" with the more congenial alternative is concealed by means of psychological and rhetorical devices.

4.   Like Galileo's use of the strategy, Chomsky's use of it has the following consequences:

(a)   the threatened theory is granted "a breathing space";

(b)   assumptions and claims are made whose justification requires the development of an entire new theory;

(c)   the evidential base of the field is modified in crucial respects;

(d)   conventional (empiricist) norms of scientific merit are modified or replaced with others.

Perhaps it is not superfluous to note two ways in which these points should not be interpreted. They do not constitute an argument about the question whether Chomsky's position in present-day linguistics is, or is not, similar to that occupied by Galileo in seventeenth-century natural science. Nor do these points jointly imply that Chomsky's defusing of the threat to the GB theory will, or will not, turn out to be as crucial to the development of theoretical linguistics as Galileo's defence of the Copernican theory was to the development of natural science.

5   <u>Conclusion</u>

Let us briefly reconsider two of the conclusions reached in preceding sections:

51

(22) (a) Chomsky's notion of "the Galilean style" is not itself
           adequate as a conceptual tool for gaining a better under-
           standing of the way in which inquiry in generative syntax
           is currently conducted.

      (b) Such understanding can, however, be deepened by analyzing
           specific episodes in the recent history of Chomskyan syn-
           tax against the background of similar episodes in Galileo's
           own work.

The question to which we now turn is this: What is the exact nature of
the relation between these two conclusions?

It may be contended that conclusions (22)(a) and (b) are mutually incom-
patible in that (b) contradicts the essence of (a). It is possible to
illuminate certain specific episodes in Chomskyan linguistics, so it
might be argued in support of this contention, precisely because in these
episodes Chomsky acts in "the Galilean style". For example, the argument
might continue, to say that there are striking similarities between
Chomsky's defence of the GB theory and Galileo's defence of the Coperni-
can theory is merely to say in a roundabout way that in his defence of
the GB theory Chomsky has adopted "the Galilean style".

This argument, however, does not go through: it trades on an ambiguity
in the use of the expression "the Galilean style". If this expression
is taken to denote the Chomsky-Weinberg conception of "the Galilean
style" the argument is in fact incoherent. In §§2 and 3 this concep-
tion of "the Galilean style" was shown to be unsuitable as an instrument
of methodological analysis. To be minimally coherent, the argument
under consideration has to use the expression "the Galilean style" in a
different sense, namely the sense of 'the style that Galileo adopted in
defusing the threat that the Tower Argument posed for the Copernican
theory'. But then the argument loses its force: it purports, after
all, to be directed at a conclusion, (22)(a), about the Chomsky-Weinberg
conception of "the Galilean style'. Moreover, to call the style adopted
by Galileo in his handling of the Tower Argument "the Galilean style"
would be to miss the gist of §3 above: in the present state of Galileo
scholarship, it is not possible non-arbitrarily to assign one, or any
small number, of elements of Galileo's methodology the status of defining

property/ies of "the Galilean style".

Finally, here is a question about the possibility of using the expression <u>the Galilean style</u> in a more liberal way with specific reference to Chomskyan linguistics. If the historical implications of this expression were not taken too seriously, would it not be possible to conceive of the mode of inquiry characterized in (23) as "the <u>lax</u> Galilean style of (linguistic) inquiry"?

(23)   (a)   To make progress in the scientific study of language (and mind), we should set, as the fundamental aim of inquiry, depth of understanding in restricted areas --- and not gross coverage of data.

         (b)   To get serious inquiry started, we should make radical abstractions and idealizations in defining the initial scope of the inquiry.

         (c)   To capture the desired understanding or insight, we need unifying, principled theories deductively removed (perhaps far removed) from the primary problematic data.

         (d)   To keep up the momentum of the inquiry, we should adopt an attitude of epistemological tolerance towards promising theories that are threatened by still unexplained or apparently negative data.

The mode of inquiry characterized in (23) undeniably represents one of the major methodological tools of theoretical linguistics. This point is borne out by Chomsky's recent work, for example by his work on the principle of Subjacency. This mode of inquiry, however, cannot be the sole methodological tool of theoretical linguistics. In conclusion, let us briefly examine the reason why this is so.

Consider again the use made by Chomsky of the mode of inquiry (23) in developing the principle of Subjacency. Recall that Chomsky (1978a:17) made the following observation on this matter:

"... the principle meets the condition of being a genuine
unifying principle ... that is, a number of island con-
straints can be deduced from it."

As we saw, these island constraints, according to Chomsky (1978a:16),

"... constitute a descriptive catalogue: each one expresses
a certain empirical generalization over observed structures
..."

The question now is whether it would have been possible for Chomsky to
formulate Subjacency as "a genuine unifying principle" in the absence
of the empirical generalizations embodied in the individual constraints?
The answer is clear: unifying principles can be conceived of only in
the event that there exist "things", typically empirical generaliza-
tions, to be unified. To say this, of course, is to allow for a mode
of inquiry by means of which empirical generalizations such as those
embodied in the island constraints can be established. There cannot
be an approach to theoretical linguistics therefore, that is distinct
from and superior to other approaches in the sense that this approach
countenances only one mode of inquiry, namely (23) or "the lax Galilean
style".[60)

54

NOTES

1. For this view cf., e.g., Koyré 1978:200; McMullin 1978:211.
    Hall (1967:68) typically depicts Galileo as "a pivotal figure,
    the giant in an epoch of decision".

2. The italics are mine.   A point of orthography: unlike Wein-
    berg, Chomsky encloses the expression the Galilean style in in-
    verted commas. For reasons that will become clear as we proceed,
    I will follow Chomsky's orthographical practice.

3. The validity of this assumption will be examined in §3 below.

4. For some discussion of this point cf., e.g., Botha 1980:7-8.

5. For an expository account of some of these idealizations cf. Botha
    1981:§§3.3.1.2, 3.4.1.2 and for a critical analysis of certain
    idealizations cf. Botha 1980:64ff..

6. For an early discussion of the use of idealizations in linguistic
    inquiry cf. Chomsky 1965:§1.   Outside the context of a characte-
    rization of "the Galilean style", the basic points in connection
    with the use of (particular) idealizations have been stated and
    restated in, e.g., Chomsky 1968:23-24; 1975a:171-172, 194;
    1975b:119, 149; 1979a:54, 57-58; Chomsky and Halle 1968:331-332.

7. The first condition Chomsky (1978a:16) states as follows: "they
    ought to be natural as principles of mental computation".   The
    implications of this condition are critically examined in Botha
    1980.

8. The informal definitions to be presented in (4) are based on
    Huybregts 1979:139-146.   Also from this publication are the sen-
    tences to be used in notes 9-13 to illustrate the various con-
    straints.   Severely simplified in various respects, these illus-
    trations are meant to serve only one purpose here: to enable

readers who are not trained linguists to gain some idea of what
the five constraints are about.

9.   In contrast to (i), (ii) violates the Complex Noun Phrase Con-
     straint: in (ii), an element realized as <u>who</u> in sentence-initial
     position has been removed from the underscored appositional clause
     (complex NP):

     (i)   who do you think that Ed claimed that Joan married?
     (ii)   *who do you think that Ed made <u>the claim that Joan married?</u>

10. In contrast to (i), (ii) violates the WH-Island Constraint:
     in (ii), an element realized as <u>what</u> in sentence-initial position
     has been removed from the underscored clause introduced by <u>who</u>:

     (i)   what did he notice (that) the CIA discovered (that) Joan
             had read?
     (ii)   *what did he notice (that) the CIA discovered <u>who had read?</u>

11. In contrast to (i), (ii) violates the Sentential Subject Condition:
     in (ii), an element realized as <u>what</u> in sentence-initial position
     has been removed from the underscored sentential subject, which
     also occurs in (iii):

     (i)   what was it expected that Joan would read?
     (ii)   *what was <u>that Joan would read</u> expected?
     (iii) <u>that Joan would read this</u> was expected

12. In contrast to (i), (ii) violates the Phrasal Subject Constraint:
     in (ii), an element realized as <u>who</u> in sentence-initial position
     has been removed from the underscored complex nominal subject:

     (i)   who did you find a picture of?
     (ii)   *who did <u>a picture of</u> frighten Joan?

13. In contrast to (ii), (iii) violates the Upward Boundedness Con-
straint: in (iii), an element, the sentential subject <u>that the</u>
<u>moon is a piece of green cheese</u>, has moved rightwards out of the
clause containing it:

    (i)   that ⎡that the moon is a piece of green cheese⎤ is ob-
           vious is not clear

    (ii)   that it is obvious ⎡that the moon is a piece of green
           cheese⎤ is not clear

    (iii)   *that it is obvious is not clear ⎡that the moon is a
           piece of green cheese⎤

14. Chomsky's (1978a:16) informal characterization of the notion "binding
category" reads as follows: "... we identify a class of what is
called binding categories, including NP and S which are alike in
many respects, that is, each of them involves the basic grammatical
relations of subject etc., each serves as the domain of transforma-
tional rules and so on."

15. For the introduction of the cycle into syntax cf. Fillmore 1963.
For the cycle in phonology cf. Chomsky and Halle 1968:15ff., 59ff..

16. Chomskyan linguistic theories may be said to be "abstract" in a
third sense as well: interpreted as mentalistic theories they are
"abstract" in the sense of not describing "actual mechanisms" such
as those functioning in the brain. For this point cf. also Chomsky
1980:197.

17. Cf. e.g., Butts and Pitt 1978:xiv-xvi.

18. For the notion of "the mathematization of nature" cf., e.g., Hall
1967:74ff.; Gurwitsch 1967:400-401.

19. For a discussion of Husserl's analysis of Galileo's work cf., e.g.,
Gurwitsch 1967.

20. In generative grammar, linguistic intuition is the source of such
    sensations or naive observations.

21. Chomsky (1979a:107-108) also expresses these views in his inter-
    view with Ronat, where he gives various examples of the problematic
    data handled in this way by Galileo.

22. Nor, according to Chomsky (1979a:107-108), was Galileo able to ac-
    count for "the 'facts' of sorcery or of astrology which seemed very
    well established by the standards of empirical research in the
    period when classical Galilean physics became established scienti-
    fic doctrine" or many "observations by telescope" or the fact that
    "the apparent size and brightness of the planets did not vary as
    predicted by Copernican theory, as the distance between the planets
    changes".

23. Cf. Botha 1976:16ff.; 1981:§11.3.1.2 for an illustration of this
    point.

24. From McMullin 1967:iff. it is clear that the various volumes of
    Bibliografia Galileiana (and their addenda) compiled up to 1964
    list more than 6000 works "relevant to Galileo scholarship".

25. It should be noted that not all philosophers use the expressions
    Galileo and Galilean to denote to the historical figure Galileo.
    Gurwitsch (1967:391) elucidates this point with reference to
    Husserl: "... we can assume that when Husserl speaks of 'Galileo',
    he does not really mean the historical figure bearing that name.
    Rather, as he says himself, he uses the name as a symbol. It
    symbolizes for him the 'spirit of modern physics', a spirit of
    which the real Galileo was, of course, a pioneer. This is what
    he means by a 'physics of Galilean style'."

26. Wisan (1978:47, n.1) puts it as follows: "Speaking very generally,
    I believe it is fair to say that the focus of interest in Galileo's
    method tends to shift back and forth from his empiricism and expe-
    rimentation to his abstractions from physical reality and use of
    mathematics. A widely accepted thesis in the nineteenth century

was that Galileo destroyed abstract Aristotelian science by invent-
ing modern experimental method. This traditional empiricist inter-
pretation came under attack early in this century until it was vir-
tually reversed by A. Koyré, who characterized the scientific
revolution in general, and the work of Galileo in particular, as the
victory of Platonic rationalism over Aristotelian empiricism (1939).
Koyré's more tempered rationalism or a modified empiricism [sic] .
On the whole, however, emphasis in the last few decades has been on
Galileo's mathematical as opposed to his experimental method. But
now, with discovery of evidence in Galileo's manuscript notes show-
ing that he did, in fact, perform some experiments (Drake, 1973,
1975b), and the emergence of new evidence linking Galileo with the
scholastic tradition (Wallace, 1974, Crombie, 1975, paper by Wallace
in this volume), there will doubtless be a general resurgence of
interest in Galileo's empiricism (see, for example, Naylor, 1974a,
b, c, 1976a, b)."

27.   Cf., e.g., Crombie 1975:158; McMullin 1978:220; McTighe 1967:371;
       Wisan 1978:5.

28.   Cf., e.g., McMullin 1978:211.

29.   Cf., e.g., Butts and Pitt 1978:xiv-v; Clavelin 1974:414; Drake
       1967:264; McTighe 1967:375; Koyré 1978:200; Shapere 1974:128-129,
       133, 138; Wisan 1978:44.   That mathematics was more to Galileo
       than a tool for providing the required demonstration is clear from
       the following observations by Butts and Pitt (1978:xiv-xv): "... he
       [= Galileo --- R.P.B.] was one of the first major scientists to
       insist that science is thoroughly mathematical. Mathematics must be
       used in the determination of experimental limits, it must be used in
       calculating the implications of experimental results, and it must be
       used for the very specification of what counts as an 'object of
       reality'." On the role of mathematics in Galileo's thought cf. also
       Gurwitsch 1967; Hall 1967:77-75.

30.   Cf., e.g., Clavelin 1974:421; McMullin 1978:229. Shapere (1974:
       105-106, 108, 119) shows how "unity" and "naturalness", as desiderata
       for theories, are related to "simplicity" in Galileo's work. On the
       role of "unification" in Galileo's approach to scientific inquiry cf.
       also Hall 1967:77-78.

31. Cf., e.g., Clavelin 1974:393; Drake 1967:263; Shapere 1974:
    126ff.; Wisan 1978:27.

32. Cf., e.g., Butts 1978:59; Clavelin 1974:401; Drake 1975:144;
    Shapere 1974:126ff.; Wisan 1978:11.

33. Cf., e.g., Shapere 1974:127, 137.

34. Cf., e.g., Butts and Pitt 1978:xiii-xiv; Pitt 1978.

35. Cf., e.g., Butts 1978:74; Crombie 1975:157-158; Hall 1967:73-74;
    McMullin 1978:230ff.; Wisan 1978:47, n.1.

36. Cf., e.g., Butts 1978:8; Feyerabend 1979:67ff.. Feyerabend's
    analysis of this aspect of Galileo's method(s) of doing science
    will be presented in detail in §4 below.

37. Cf., e.g., Butts 1978:60; Feyerabend 1975:81; Shapere 1974:8,
    112, 113-114, 131; Rossi 1975:247; Wisan 1978:26.

38. The literature referred to in notes 29, 31 and 32 above also pro-
    vides some idea of the extent of the controversy about the content
    of these elements in Galileo's work.

39. On the point that these elements are absent from Chomskyan metho-
    dology or at most play a minor role there cf. a discussion such
    as Botha 1981.

40. This is the reason why so far in this essay the expression "the
    Galilean style" has been used in quotation marks. This may be the
    reason why Chomsky too has used this expression in quotation marks.

41. In referring to this theory as "the OB theory/framework/system"
    Chomsky (1979b) reflects the fact that it was first outlined sys-
    tematically in his paper "On binding" (1978c).

42.   For these problems, to which we return below, cf. Chomsky 1979b: 5-10.

43.   The Nominative Island Condition represents a revision of Chomsky's Specified Subject Condition, the Opacity Condition being a revision of his Tensed S Condition and Propositional Island Constraint.

44.   Cf. Chomsky 1978c:17.

45.   Cf. Chomsky 1978c:17.

46.   Chomsky's original numbering is represented in the square brackets to the right of these sentences. Notice that Chomsky alternatively refers to the expressions of (12) as "sentences" and "structures".

47.   For a discussion of the way in which such natural interpretations may be identified cf. Feyerabend 1979:75ff..

48.   Generative grammarians of a rationalist bent --- cf. the various contributions to Bever, Katz and Langendoen (eds.) 1977, especially Katz and Bever 1977 --- have modified the natural interpretation (18) in another way as well. At the basis of this modification is the view that in certain cases the (un)acceptability of utterances is determined by non-competence factors. In such cases the (un)acceptability of utterances is not indicative of the (un)grammaticalness of the sentences underlying the utterances. This modification of (18), however, is distinct from the one with which we have been concerned above.

49.   Anamnesis refers to the Platonic doctrine of reminiscence or recollection. In terms of this doctrine, there are certain kinds of knowledge which are acquired neither on the basis of sensory experience nor by means of direct instruction, but which are latent and can be recalled under certain circumstances. For a fuller explication of the doctrine of anamnesis cf. Ryle 1967:325 and Hamlyn 1967:10.

50. The Linguistic School of Prague has traditionally been credited
with being the first to introduce a concept of markedness into theo-
retical linguistics. Trubetzkoy (e.g. 1939) formed such a concept
for the study of phonological structure; Jakobson (e.g. 1932) gene-
ralized it to the study of morphological structure.

51. During the past decade various other generative phonologists, inclu-
ding Schane 1972, Stampe 1973, Bjarkman 1975, Hooper 1977, have
followed Chomsky and Halle in this, often coming up with phonological
theories that differ from the Chomsky-Halle approach in fundamental
respects.

52. As will be explained in §4.5.3 below, "external" in this context
means 'from which the linguistic theory (initially) abstracts away'.

53. For the notion "primary linguistic data" cf. Botha 1981:34, 59.

54. Cf., e.g., Botha 1980:35ff.; 1981:321ff. for a discussion of the
nature and role of external linguistic evidence in Chomskyan lin-
guistics.

55. For this argument cf., e.g., Botha 1980:79-80; Lightfoot 1979:77ff..

56. Cf. Botha 1980:42ff. for a critical discussion of this position.

57. This position had to be abandoned in generative phonology as well,
where linguists --- e.g., Chomsky and Halle (1968:400ff.),
Postal (1968:169ff.) --- were forced to have recourse to external
linguistic evidence for the justification of phonological marked-
ness judgements.

58. Counterinduction, in Feyerabend's (1979:77) analysis, involves
retaining or even inventing theories that are inconsistent with
the facts.

59. Cf. also Chomsky 1979c:24, 27, 50 for the notions of "unified expla-
natory theory" and "general unifying principles" as well as pp. 22,

23 for the notions of "generality", "methodological and conceptual grounds" and "conceptual simplicity". Notions such as these show up increasingly in the work of close followers of Chomsky's ---cf., e.g., Koster 1978:8ff.; 1980. Chomsky's (1980:51-58) recent use of thought experiments in an attempt to clarify the notion of "knowledge of language" is perhaps a further manifestation of his non-empiricist stance. A true empiricist would not have been satisfied with anything less than the results of real experiments.

60. In their present state of development such sub-domains of Chomskyan linguistics as interpretive semantics (in the spirit of, e.g., Jackendoff 1972) and word-formation (in the spirit of, e.g., Aronoff 1976) cannot fully use this mode of inquiry. As yet, these domains offer little --- e.g. empirical generalizations such as the island constraints --- to unify.

63

BIBLIOGRAPHY

Aronoff, Mark

   1976   Word formation in generative grammar (= Linguistic
Inquiry Monograph One). Cambridge, Massachusetts:
MIT Press.

Austerlitz, Robert (ed.)

   1975   The scope of American linguistcs. (= Papers of the
First Golden Anniversary Symposium of the Linguistic
Society of America). Lisse: The Peter de Ridder Press.

Bever, Thomas G., Jerrold J. Katz and D. Terence Langendoen (eds.)

   1977   An integrated theory of linguistic ability. Hassocks,
Sussex: The Harvester Press.

Bjarkman, P.C.

   1975   "Toward a proper conception of process in natural phono-
logy", CLS 11:60-72.

Boffito, Giuseppe

   1943   Bibliografia Galileiana: 1896-1940. Rome: Ministero
della Educazione Nazionale.

Bonelli, M.L. Righini and William R. Shea (eds.)

   1975   Reason, experiment, and mysticism in the scientific
revolution. London/New York: The Macmillan Press.

Botha, Rudolf P.

   1976   'The theory comparison method' vs. 'the theory exposi-
tion method' in linguistic inquiry. Reproduced by IULC.

   1980   "Methodological bases of a progressive mentalism", Syn-
these, Vol. 44:1-112.

   1981   The conduct of linguistic inquiry. A systematic intro-
duction to the methodology of generative grammar.
The Hague, Paris, New York: Mouton.

Butts, Robert E. and Joseph C. Pitt

   1978   Introduction to Butts and Pitt (eds.) 1978:ix-xvi.

64

Butts, Robert E. and Joseph C. Pitt (eds.)
1978   New perspectives on Galileo. Dordrecht/Boston: Reidel Publishing Company.

Butts, Robert E.
1978   "Some tactics in Galileo's propaganda for the mathematization of scientific experience". In Butts and Pitt (eds.) 1978:59-85.

Chomsky, Noam
1965   Aspects of the theory of syntax. Cambridge, Mass.: MIT Press.

1968   Language and mind. New York, etc.: Brace and World.

1970   "Remarks on nominalization". In Jacobs and Rosenbaum (eds.) 1970:184-221.

1975a   "Questions of form and interpretation". In Austerlitz (ed.) 1975:159-196.

1975b   Reflections on language. New York: Pantheon Books.

1978a   "A theory of core grammar", Glot, Vol. 1:7-26

1978b   Interview with Sol Saporta, Working Papers in Linguistics, Number Four Supplement, Department of Linguistics, University of Washington.

1978c   On binding . Mimeographed. Published later in Linguistic Inquiry, Vol. 11:1-46.

1979a   Language and responsibility. (Based on conversations with Mitsou Ronat.) Hassocks, Sussex: The Harvester Press.

1979b   Markedness and core grammar. Mimeographed.

1979c   Principles and parameters. Mimeographed.

1980   Rules and representations. New York: Columbia University Press.

Chomsky, Noam and Morris Halle
1968   The sound pattern of English. New York, etc.: Harper and Row Publishers.

65

Clavelin, Maurice

1974   The natural philosophy of Galileo. Essay on the origins
            and formation of classical mechanics. Translated by A.J.
            Pomerans. Cambridge/London: MIT Press.

Crombie, A.C.

1956   "Galileo: a philosophical symbol", Actes VIIIe Congrès
            International d'Histoire des Sciences, Vol. 3:1089-1095.

1975   "Sources of Galileo's early natural philosophy". In
            Bonelli and Shea (eds.) 1975:157-175.

Drake, S.

1967   "Galileo Galilei". In Edwards (ed. in chief) 1967:
            262-267.

1973   "Galileo's experimental confirmation of horizontal
            inertia: unpublished manuscripts", Isis 64:291-305.

1975   "Galileo's new science of motion". In Bonelli and Shea
            (eds.) 1975:131-156. (Cited as "Drake 1975a" in Wisan
            1978.)

Edwards, Paul (ed. in chief)

1967   The encyclopedia of philosophy. New York and London:
            The Macmillan Press.

Favaro, Antonio

1942   Bibliografia Galileiana: 1568-1895. Reprinted.
            Venice. (First published in 1896 in Rome: Ministero
            della Pubblica Instruzione).

Feyerabend, Paul K.

1979   Against method. Outline of an anarchist theory of
            knowledge. Verso Edition. Second Printing London:
            (First published in 1975).

1978   Science in a free society. Thetford, Norfolk: NLB.

Fillmore, Charles

1963   "The position of embedding transformations in a gram-
            mar", Word, Vol. 19:208-231.

Galileo, Galilei

1967   Dialogue concerning the two chief world systems
            - Ptolemaic & Copernican. Translated by Stillman Drake,
            foreword by Albert Einstein. Second Revised Edition.
            Berkeley and Los Angeles: Univ. of California Press.

Gentili, Elio

1964/5   "Bibliografia galileiana fra i due centenari". In
            Scuola Cattolica, 92 (suppl.) 1964:267-309; 93 (suppl.)
            1965:82-86.

Gurwitsch, Aron

1967   "Galilean physics in the light of Husserl's phenomenology".
            In McMullin (ed.) 1967:388-401.

Hall, A. Rupert

1967   "The significance of Galileo's thought for the history
            of science". In McMullin (ed.) 1967:67-81.

Hamlyn, D.W.

1967   "History of epistemology". In Edwards (ed. in chief)
            1967, Vol. 3:8-33.

Hooper, Joan

1977   An introduction to natural generative phonology.
            New York: Academic Press.

Husserl, Edmund

1970   The crisis of European sciences and transcendental
            phenomenology. An introduction to phenomenological
            philosophy. Translated, with an Introduction, by
            David Carr. Evanston: Northwestern University Press.

Huybregts, Riny

1979   "De biologische kern van taal". In Huybregts and
            Des Tombe (eds.) 1979:97-189.

Huybregts, Riny and Louis des Tombe (eds.)

1979   Verkenningen in taal. Utrecht: Instituut voor Algemene
            Taalwetenschap, RUU.

Jackendoff, Ray S.

1972   Semantic interpretation in generative grammar.
                Cambridge, Mass.: MIT Press.

Jacobs, Roderich and Peter Rosenbaum (eds.)

1970   Readings in English transformational grammar. Waltham,
                Mass.: Ginn and Co.

Jakobson, Roman

1932   Zur Struktur der russischen Verbums. Charisteria
                Guilelmo Mathesio quinquagenario oblata. Prague.

Katz, Jerrold J. and Thomas G. Bever

1977   "The fall and rise of empiricism". In Bever, Katz and
                Langendoen (eds.) 1977:11-64.

Kenstowicz, M.J. and C.W. Kisseberth (eds.)

1973   Issues in phonological theory. The Hague, etc.: Mouton.

Koster, Jan

1978   Locality principles in syntax. Dordrecht: Foris Publi-
                cations.

1980   "Configurational grammar", Gramma, Vol. 4:212-233.

Koyré, Alexandre

1978   Galileo studies. Translated from the French by John
                Mepham. Hassocks, Sussex: The Harvester Press.
                (French version cited as "Koyré 1939" in Wisan 1978.)

Lightfoot, David L.

1979   Principles of diachronic syntax. (= Cambridge Studies
                in Linguistics 24). Cambridge, etc.: Cambridge Univer-
                sity Press.

Machamer, Peter K.

1973   "Feyerabend and Galileo: the interaction of theories,
                and the reinterpretation of experience", Studies in
                the History and Philosophy of Science, Vol. 4:1-46.

68

McMullin, Ernan

1967   Bibliografia Galileiana: 1940-1964.   In McMullin (ed.)
                1967:i-xciii.

McMullin, Ernan (ed.)

1967   Galileo. Man of science. New York/London: Basic
                Books, Inc.

McMullin, Ernan

1978   "The conception of science in Galileo's work". In Butts
                and Pitt (eds.) 1978:209-257.

McTighe, Thomas P.

1967   "Galileo's 'Platonism': a reconsideration". In McMullin
                (ed.) 1967:365-387.

Naylor, R.H.

1974a   "Galileo and the problem of free fall", The British Jour-
                nal for the Philosophy of Science, Vol. 7:105-134.

1974b   "Galileo's simple pendulum", Physis, Vol. 16:23-46.

1974c   "The evolution of an experiment: Guidobaldo del Monte
                and Galileo's Discorsi demonstration of the parabolic
                trajectory", Physis, Vol. 16:323-346.

1976a   "Galileo: The search for the parabolic trajectory",
                Annals of Science, Vol. 33:153-172.

1976b   "Galileo: real experiment and didactic demonstration",
                Isis, Vol. 67:398-419.

Pitt, Joseph C.

1978   "Galileo: causation and the use of geometry". In Butts
                and Pitt (eds.) 1978:181-195.

Postal, Paul M.

1968   Aspects of phonological theory. New York, etc.:
                Harper and Row Publishers.

Rossi, Paolo

1975   "Hermiticism, rationality and the scientific revolution".
                In Bonelli and Shea (eds.) 1975:247-273.

Ryle, Gilbert

1967   "Plato". In Edwards (ed. in chief) 1967, Vol. 6:314-333.

Schane, Sanford A.

1972   "Natural rules in phonology". In Stockwell and
              Macaulay (eds.) 1972:199-229.

Shapere, Dudley

1974   Galileo. A philosophical study. Chicago and London:
              The University of Chicago Press.

Stampe, David

1973   "On chapter nine". In Kenstowicz and Kisseberth (eds.)
              1973:44-52.

Stockwell, R.P. and R.K.S. Macaulay (eds.)

1972   Linguistic change and generative theory. Bloomington:
              Indiana University Press.

Trubetzkoy, N.S.

1939   Grundzüge der Phonologie. TCLP 7.

Wallace, W.A.

1974   "Galileo and the Thomists". In St. Thomas Aquinas Com-
              memorative Studies 2:293-330. Toronto: Pontifical
              Institute for Medieval Studies.

1978   "Galileo and the Doctores Parisienses". In Butts and
              Pitt (eds.) 1978:87-138.

Weinberg, Steven

1976   "The forces of nature", Bulletin of The American Academy
              of Arts and Sciences, Vol. XXIX:13-29.

Wisan, Winifred Lovell

1978   "Galileo's scientific method: a reexamination". In
              Butts and Pitt (eds.) 1978:1-57.

Worrall, John

1977   Review of Feyerabend 1979 (1975), Erkenntnis 1977:
              243-97.