# The Intensional Qualification of Quantification

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## 1. Introduction

This paper explores the possibility of defining Quantification from the intensional point of view and discusses some of its empirical consequences.

## 2. Three Types of Definition

There are three types of definition as shown in (1) below:

(1) a. Intensional definition
b. Extensional definition
c. No way

Let us illustrate how each type is related to the actual manner of defining things.

When you are confronted with the question (2a), you will answer like (2b). This is the definition by way of intension. See at the end of this paper for the abbreviations.

(2) a. What is an even number?
b. It is a number that is "divisible by two without a remainder." (COD s.v. *even*)

Intensional definition means the characterization of things in terms of the features or qualities that the things in question possess.

When you are confronted with the question (3a), you will answer like (3b). This is the definition by way of extension.

(3) a. What is the normal solar spectrum?

b. Consult Webster 3 and go to the inserted leaf between the pages 448 and 449. You will know (or see) what it is like.

Extensional definition is the definition in terms of realia, without any verbal explication.

When you are confronted with the question (4a), you have no way to answer it but to simply paraphrase the notion asked in a number of ways, for example, using such terms as *spot*, *place*, *mark*, and *dot*, as in (4c):

(4) a. What is point in Euclidean geometry?
b. (No way to define it)
c. It is "a particular spot or place; or a very small dot or mark on a surface." (COD s.v. *point*)

Therefore, the third type of definition is, in fact, not a definition. In this case, the notions asked are primitives. Primitives are, by definition, non-defined notions.

## 3. Definition of Quantification

Our primary concern in this section is (5):

(5) What is Quantification?

It seems that in the literature of linguistics, Quantification is almost always defined in the manner of (1b).[1] But I assume that Quantification

1) To show this, I can cite passages from a number of references.
(i) [Referring to "For every $x$, $x$ is a miser"]
The phrase 'for every $x$' is called a *universal quantifier*. (Suppes 1957: 48)
(ii) The prefixes '$(\exists x)$', '$(\exists y)$', etc. are called *quantifiers*; and the construction of statements with their help is called quantification. Also a statement so formed will be called a quantification. (Quine 1965: 75)
(iii) The *universal quantifier*, denoted by $\forall$, corresponds to phrases such as 'for each,' 'for all,' 'for every,' and 'for any.' The *existential quantifier*, denoted by $\exists$, has as its English counterparts 'there exists,' 'for some,' 'there is at least one,' etc. Wherever a quantifier occurs, it is associated with some variable, and we shall represent this in our notation by enclosing the symbols for the quantifier and its associated variable in parentheses; thus, $(\forall x)$,$(\exists y)$. The universal and existential quantifications of the propositional function $M(x)$ are written as in (3–4) and (3–5), respectively:

can be, and should be, defined in the following way:

(6) Quantification is predication of one and the same item $x$ that appears in more than one clause.

The notion "to quantify" can be defined like below accordingly:

(7) When there are clauses of the forms $(_A \ldots x \ldots)$, $(_B \ldots x \ldots)$, and so on, to quantify $x$ is to predicate the one and the same $x$ in each of these clauses.

Though these two definitions are gross approximations, they are clearly the definitions in the manner of (1a).[2] And they have certain empirical consequences and, in some cases, some advantages over the old definitions through which many linguists have manipulated a number of syntactic and semantic analyses.

## 4. Consequences of Intensional Definition of Quantification

It has been generally assumed that Quantification is operative both in the interpretation of quantity phrases, e.g. *all*, *some*, *ten*, *many*, *a*, and in the interpretation of WH phrases. And the latter has two major subcases, i.e. Relative WH phrases and Interrogative WH phrases.

Our first advantage due to the employment of (6) and (7) is such

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(3–4) $(\forall x)\ M(x)$
(3–5) $(\exists x)\ M(x)$ (Wall 1972: 53)

(iv) A quantifier is a word or expression that specifies which or how many of some kind of things have some property, as here, where *All/Most crooks tell lies* says which crooks or how many crooks have the property of telling lies. (McCawley 1993: 23)

There are many other authors and passages of this sort: they try to define Quantification basically in the manner of (1b). But I understand that they are not necessarily rigorously particular about the definition of the notion in question, so I will not go into this issue any further.

2) (6) and (7) are of my own thinking. I learned independently that there are similar characterizations of Quantification by some philosopher-logicians. Roughly speaking, a quantifier is defined as a functor that assigns a relation among domains. Cf. Mostowski (1957) and Lindström (1966). I believe that formulations of the forms (6) and (7) are more congenial to linguists and linguistics than the ones the aforementioned philosopher-logicians have developed.

that the commonality between quantity phrases and WH phrases can be captured through our definition of Quantification. Consider the following cases:

(8) a. Joe has a girlfriend.
b. (There is $x$) [$x$ = a girlfriend]
c. (Joe has $x$)
(9) a. Joe ate the apple that Sue bought.
b. (Joe ate $x$) [$x$ = an apple]
c. (Sue bought $x$)
(10) a. What did Joe eat?
b. (I WANT TO KNOW THE IDENTITY OF $x$)
c. (Joe ate $x$)

(8a) involves a quantity phrase, and (9a) and (10a) involve WH phrases. Interpretation of (8a) comprises a process of predication of $x$ that appears both in (8b) and in (8c). Precisely in the same way, interpretation of (9a) comprises a process of predication of $x$ that appears both in (9b) and in (9c). And this statement applies equally to the case of (10). Therefore, since we have adopted the definitions of (6) and (7), we capture the similarity or, we should say, the identity of the manner of interpretation in both cases of quantity phrases and WH phrases.

On the other hand, suppose that we do not adopt (6) and (7) and simply say, for example, that the indefinite article *a* is a quantifier and a relative pronoun is a quantifier in the interpretation of the sentences those expressions are embedded in. In other words, suppose that we simply list quantifiers and do not give them intensional characterizations at all. Then we can say that this is only a linguists' stipulation and does not answer the question of why quantity phrases and WH phrases behave in the same manner, with respect to the interpretation of sentences in which these quantity phrases and WH phrases are predicated of. So there is no other way than to conclude that the identical process of interpretation in the cases of (8), (9), and (10) is a mere coincidence. There is no explanation made possible

here in these cases as to the striking identity of the manner of interpretation of sentences with different types of words, i.e. *a*, *that*, and *what*. So the definition of Quantification only by way of enumerating quantifiers, in the manner of (1b), is not adequate for the analysis of these cases.

As a second consequence of our adoption of the definitions (6) and (7), we may think of the following cases.[3)]

Recall that in (6) and (7) we have said that we predicate of an item $x$ and we quantify an item $x$, respectively. We do not say that we predicate of an argument nor do we say that we quantify an argument. This is mainly because there are sentences with relative clauses in which non-arguments are relativized. Observe below:

(11) Joe ate the apple that Sue bought. (= (9a))
(12) Joe left the room where Sue was sleeping.
(13) Joe was pleased with the headway that Sue made.

In (11), the argument is relativized, and in (12) what is relativized is the locative adjunct, a non-argument. In (13), the non-argument, an idiom chunk in this case, is relativized. So it is now clear that Quantification is not restricted to arguments. Non-arguments can be relativized, too. And I will point out another case of the relativization of non-arguments, namely the relativization of superlatives. But before we go to the cases of the relativization of non-argument superlatives, let us look at the cases of the relativization of argument superlatives.

(14) a. Thus, the most Gorbachev can probably expect is technical help on privatization along with limited private investment in selected projects. (Charles Lane and Carroll Bogert, "To Market, to Market," NW July 22, 1991)
b. Charles: "Just a moment. I'd like to settle the matter of that twit of a major with whom Diana had a merry roll in the hay."

3) I acknowledge that technically speaking, this consequence has resulted directly from the phrasing of the definitions and not from the intensional nature of them.

> Diana: "We did not have a roll in the hay. You know very well that I dislike hay and that it makes me sniffle and does ghastly things to my skin."
> Charles: "Well, I don't really care where you had your roll. Such details bore me. But the least you could have done was have a roll in the [sic.] whatever with a decent chap who wouldn't dash off to write a bloody book about it. My word, if Henry the Eighth were your husband, he would have had you and that major drawn and quartered." (Mike Royko, "Notes from a right royal counseling session," JT October 30, 1994)

The sentences with relatives at stake in (14a) and (14b) have, at a certain stage of semantic interpretation, the structures shown in (15a, b) and (16a, b), respectively:

(15) a. ($x$ is technical help on privatization along with limited private investment in selected projects)
b. (Gorbachev can probably expect $x$)

(16) a. ($x$ was have a roll in the whatever with a decent chap who wouldn't dash off to write a bloody book about it)
b. (you could have done $x$)

These are the cases of the relativization of argument superlatives. Now let us observe the cases of the relativization of non-argument superlatives.

(17) a. The state's economy is the worst it has been in recent history. (Mira Schwirtz, "Free Agreement," DC January 29, 1992)
b. It is our impression that there are very few *pure syntactic constructions*, that is, constructions which have *no* specific semantic or pragmatic functions associated with them and which mention no specific lexical items. The closest we can come to that is the *subject-predicate* construction of English. [Italics are original authors'.] (Charles J. Fillmore and Paul Kay 1987: 13)
c. Since then — and it's been almost three years — she's been through one interview after another, all of them ending with something like: "Thank you, very impressive, but . . . " [ . . . ] The closest any of them came to admitting it was at one place where the personnel person told me that he'd love to hire me, but he couldn't. (Mike Royko, "Age is no asset in U.S. job

market," JT August 3, 1990)

d. Deep Blue could have prevailed in the recent match had Kasparov not changed his style of play after his initial loss. That the chess champ was able so quickly to identify the computer's weakness and adapt his competitive strategy is testimony to human intellect. The best the computer can do to improve is accept software refinements from human programmers. (Bill Gates, "Computer will be chess champ, but so what?" JT March 18, 1996)

The sentences with relatives at issue in (17a–d) have, at a certain stage of semantic interpretation, the following structures (18a, b), (19a, b), (20a, b) and (21a, b), respectively:

(18) a. (the state's economy is $x$)
b. (it [= the state's economy] has been $x$ in recent history)

(19) a. ($x$ is the *subject-predicate* construction of English)
b. (we can come $x$ to that)

(20) a. ($x$ was at one place where the personnel person told me that he'd love to hire me, but he couldn't)
b. (any of them came $x$ to admitting it)

(21) a. ($x$ is accept software refinements from human programmers)
b. (the computer can do $x$ to improve)[4]

These are the cases of the relativization of non-argument superlatives. This is one of the consequences derived from adopting the definitions of (6) and (7).

A third empirical consequence of adopting (6) and (7) constitutes an advantage over the adoption of old extensional definitions. It has been tacitly assumed in the literature that relativization involves the syntactic process shown below. For the sake of exposition, we will confine ourselves to the case of relativization of NPs, and the structures that are of little importance to the present discussion are simplified.

4) It may be that (21) is a case of the relativization of the argument in that $x$ can be paraphrased as *the best thing*. I assumed in (21) that $x$ is the adverb.

(22) a. $[\ldots [_{NP}\ NP_i\ [_S \ldots NP_i \ldots]] \ldots]$
b. $[\ldots [_{NP}\ NP_i\ [WH_i\ [_S \ldots t_i \ldots]]] \ldots]$

Thus, in order to form a relative clause, the structure (22a) should be converted to the structure (22b). If we call the NP to be relativized a 'Coref NP'[5], then what is tacitly assumed in this process is that the Coref NP should be both WH-quantified and moved to the initial position of the clause in which it is embedded. This tacit general assumption applies, it seems, to every case of relativiation that has so far been observed, documented, and analyzed in the grammar of English. But observe the definitions of (6) and (7) closely. They dictate only the quantification of the NP, a Coref NP in this case, but never dictate the syntactic movement of that NP. So these definitions leave the possibility for the cases where the Coref NP is quantified but not moved. And this is in fact the case. Contrary to the common linguistic belief that there is no head-internal relative clause in English, Nakazawa (1991; 1999) has argued for the existence of English head-internal relative clauses, in which the Coref NP is quantified but stays where it was. Observe below:

(23) a. A friend of mine once passed out from heat on a downtown street, falling into the gutter. The closest anyone came to him was the man who leaned over, just as my friend was coming to, and said: "Hey, you're blocking my car." (Mike Royko, "Some good reasons to keep walking," CT October 1, 1987; "Woman gives aid and gets AIDS?" JT October 30, 1987)[6]
b. Mrs. Clinton did not manage to utter the magic words, "not true," and neither, really, has anyone else. The closest anyone has come is the ubiquitous Bruce Lindsey, who, rather early in the breaking scandal, was asked directly by the Associated Press whether Mr. Clinton denied having troopers assist any affairs. "Yes, he has," Mr. Lindsey responded. (Editorial in WT De-

5) 'Coref NP' is intended to mean the NP to be relativized under the coreferential condition such that the antecedent NP and the NP to be relativized should have the same referential indices.

6) The same column appeared under the different titles.

cember 22, 1993; Reprinted in Sekainippou December 30, 1993)[7]

The sentences with head-internal relatives in (23a) and (23b) have, at a certain stage of semantic interpretation, the following structures, respectively:

(24) a. ($x$ was the man who leaned over, just as my friend was coming to, and said: "Hey, you're blocking my car")
b. ($x$ came (the) closest to him)
(25) a. ($x$ is the ubiquitous Bruce Lindsey, . . . )
b. ($x$ has come (the) closest)

The striking features of our head-internal relatives are such, in the first place, that the Coref NP, i.e. *anyone* in these cases, is quantified but not moved to the clause-initial position and, secondly, that the Coref NP is quantified but not WH-quantified. In our head-internal relatives, what is moved to the clause-initial position is the superlative, i.e. *the closest* in the above examples. Now recall the superlatives in the examples of (14) and (17). The former are the instances of the relativization of arguments, and the latter the instances of the relativization of non-arguments. And most importantly, the superlatives in (14), (17), and (23) all share the conspiracy relation such that they function as the clause introducers of the following clauses.[8] The second striking feature of the Coref NP in head-internal relatives is related to Quantification: it is quantified but not WH-quantified. This is the natural consequence of the definitions of (6) and (7), because Quantification is by no means restricted to the cases of WH phrases, but applicable to the cases of quantity phrases. This is the nectar of adopting the intensional definition of Quantification.

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7) I am indebted to Takao Itou, who pointed out (23b) to me.

8) The notion 'clause introducer' has theoretical status (i.e., is not a hocus-pocus entity) and thus prevails in other areas of description in the grammar of English. See, for example, Nakazawa (2000), which takes advantage of this notion and intends to describe and analyze the behavior of English adverbial NPs.

Now let us summarize the argument of the last paragraph from a different point of view. In describing and analyzing English relative clauses, suppose we have two competing grammars, G1 and G2. Suppose further that G1 employs an extensional definition of Quantification and that G2 employs an intensional definition of Quantification. Part of the description of G1 and G2 will be like those below, respectively:

(26) Part of G1 Description
  a. Coref NP is WH-quantified
  b. WH-phrase moves to the clause-initial position
(27) Part of G2 Description
  a. Coref NP is quantified
  b. WH-phrase moves to the clause-initial position

It should be clear that G1 can handle the typical cases of relatives, such as those in (9a) but cannot the head-internal relatives, as in (23). On the other hand, G2 can naturally accommodate both the typical relatives in (9a) and the head-internal relatives in (23). In G2, if the Coref NP is WH-quantified, that phrase goes to the clause-initial position, as dictated by (27b), as in (9a). And also in G2, if the Coref NP is quantified by the quantity phrase, e.g. *any*, it does not move to the clause-initial position as exemplified in (23). This is because the phrases quantified by quantity phrases do not move to the clause-initial position in syntax. See below:

(28) a. Take any chocolate, kids.
  b. *Any chocolate take, kids.
(29) a. I don't see anyone there.
  b. *Anyone I don't see there.
(30) a. Do you have any question?
  b. *Any question do you have?

Now suppose G1 theorists had encountered English head-internal relative clauses like those in (23) and got encouraged to revise their grammar G1 to accommodate these cases. Their revision would take

the form of the following:

(31) Part of the Revised G1 Description
  a. Coref NP is either WH-quantified or quantity phrase-quantified
  b. WH-phrase moves to the clause-initial position

The grammar of (31) is descriptively adequate, but it has a serious deficit. It fails to answer the questions of why WH-quantification and quantity phrase-quantification are simply enumerated in (31a), and why only these and not the other. In the G2 framework, there is never this type of problem that there is in the G1 framework.

## 5. Summary and Residuals

We have explored the possibility of intensional qualification of Quantification. This type of definition has proved to have a number of empirical consequences and advantages: we can capture the parallel structure in the interpretation of quantity phrases and WH-phrases; we can look for measures to take to accommodate English head-internal relative clauses.

If the arguments made so far are basically correct, we may have a new insight into the notions of Quantification and Predication. Quantification is a notion that is defined derivatively. But what is Predication? It may be that the very nature of Predication cannot be defined but it is only a primitive. This is a residual problem.

Another residual is the ontology of processes that govern more than one clause at a time. Why and how do humans come to manipulate certain notions only once syntactically that belong to independent clauses, rather than to deliver those clauses sequentially or paratactically. For instance, what is the real driving force that made relative clause possible out of parataxis? But this issue goes far beyond the scope of this paper.*

* I am grateful to Peter Robinson for reading an earlier version of this paper, helping improve the style of it, and giving me comments on it. Inadequacies may be found here and there, but they are entirely my own.

**Abbreviations**

COD: The Concise Oxford Dictionary Tenth Edition. Oxford University Press. 1999.
CT: Chicago Tribune
DC: The Daily Californian
JT: The Japan Times
NW: Newsweek
Webster 3: Webster's Third New International Dictionary of the English Language. G. & C. Merriam. 1981.
WT: The Washington Times

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