Metalinguistic Semantics for Echo Questions

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Abstract

This paper proposes a novel formal semantic analysis of echo questions built upon the idea that they are questions about expressions. Although similar concepts have been occasionally expressed in the literature, no formal models have been proposed that directly reflect this metalinguistic concept. Specifically, we propose a compositional semantics of echo questions formulated in the structured meanings theory of questions. The novelty of our analysis is the use of variables that range over natural language expressions, which allow natural language to express quantified statements about itself. We also criticize two previous semantic analyses of echo questions by Ginzburg and Sag (2001) and Artstein (2002), neither of which is metalinguistic unlike our model.

1 Introduction

In the literature of formal syntax and semantics, echo questions have been often mentioned as exceptions to generalizations regarding questions in general, and as a consequence, several properties distinguishing echo questions from normal questions have already been identified. Yet, being treated as a 'marginal phenomenon', they have rarely occupied the center of discussion and, compared to the copious literature on non-echo questions, research on the formal grammar of echo questions is limited (notable exceptions are Artstein 2002, Ginzburg and Sag 2001, Janda 1985, Sobin 1990, 2010). Especially, there are only a few analyses of their formal semantics. Ginzburg and Sag (2001) and Artstein (2002) among others are instances of those rare studies of the semantics of echo questions, but as we will claim, they are unsatisfactory.

The main purpose of the present paper is to propose a novel formal semantic analysis of echo questions. Our core idea is that echo questions are questions about expressions, unlike ordinary questions which are about individuals, times, manners, reasons and so on. This idea has been expressed at least in informal terms by some previous studies (cf. Janda 1985, Blakemore 1994, Huddleston 1994, Iwata 2003), but to our knowledge, no formal account that explicitly embodies it has been proposed. As will be shown in the present paper, our formal model built on this idea gives straightforward explanations to the syntactic and semantic properties of echo questions.

The organization of the paper is as follows. In the next section, we will review the core properties of echo questions that normal varieties of questions do not possess. In section 3, we will present a compositional analysis of echo questions implemented in the structured meanings theory of questions (von Stechow, 1982, 1989, Krifka, 2001, 2004). Section 4 contains criticisms against two previous formal semantic analyses by Ginzburg and Sag (2001) and Artstein (2002), and we conclude in Section 5.

2 Properties of Echo Questions

In English, to which we mostly confine our attention in this paper, echo questions are distinguished from ordinary questions in several ways. One of the notable cues of echo questions is intonation. An echo question involves an echo focused phrase that bears L+H* intonation with a HH% boundary tone (Bolinger, 1987, Hockey, 1994, Artstein, 2002). An echo focused phrase can be a normal phrase (a polar or *yes-no* echo question) or a wh-word (a constituent or *wh* echo questions).[1] We abstract away from the phonetic/phonological details of echo foci in the rest of this paper, as it is not of our central concern, and echo focused phrases are simply capitalized in the examples (examples taken from the literature are modified to fit this convention for the sake of uniformity).

Besides the echo focus intonation, prototypical echo questions are also syntactically distinguished from ordinary questions by the lack of subject-auxiliary inversion. Also, no wh-phrases in constituent echo questions undergo wh-fronting, unlike in ordinary wh-questions.

In this paper, we define echo questions as those questions that involve the echo-focus intonation and no movement (subject-auxiliary inversion or wh-fronting). This is in fact a rather conservative view, and sometimes bigger sets of questions are called echo questions (Bolinger, 1987, Huddleston, 1994, Ginzburg and Sag, 2001, Artstein, 2002). However, in order to have our theory applicable to a reasonably definable class of sentences and to avoid possible controversies, we limit our scope to this highly confined class in the present paper, and leave open whether our analysis presented below can be extended to instances of 'echo questions' of other types.

In the remainder of this section, we will look at three principal properties of echo questions so defined. It should be noted in passing here that these properties have been already known in the literature, and we have nothing new to add to this list.

2.1 Insensitivity to Syntactic Constituency

Both polar and constituent echo questions can ask about units smaller than a word, and units larger than a word including non-constituents (Janda, 1985, Ginzburg and Sag, 2001, Artstein, 2002, Sobin, 2010). For example, the echo questions in (1) are questions about a subpart of the word *epidemiologist*.

(1) A: Have you met the epidemiologist?
B: Have I met the epidemi-OLOGIST?

[1] Besides these two types of echo questions, there is a third type called *alternative echo questions*. We will come back to them in Section 3.4.

B': Have I met the epidemi-WHAT? (adapted from Blakemore 1994:203)

The echo questioned part can be as small as a syllable that is not even a morpheme, as in the following example adapted from Janda (1985:175).

(2) A: Try our new chajitas!
B: Cha-WHAT-as?

Furthermore, (3) and (4) illustrate that a non-constituent can be echo-questioned.That is, *WHAT* replaces non-constituents in these examples, namely, *dog wanted to eat the* and *his laissez-passer into tiny* respectively.

(3) A: The dog wanted to eat the cat
B: The WHAT? (adapted from Bolinger 1987:263)

(4) A: The man tore his laissez-passer into tiny pieces
B: The man tore WHAT pieces? (adapted from Janda 1985:175)

2.2 Insensitivity to Sentence Types

It is also known that echo questions are insensitive to the sententce type of the echoed utterance (Artstein, 2002, Ginzburg and Sag, 2001, Huddleston, 1994, Noh, 1998, Sobin, 1990, 2010). In all the examples we have seen so far, the utterances that the echo questions are anaphoric to are declarative sentences, but the antecedent utterance can be questions (5), imperatives (6), exclamatives (7) and vocatives (8) as well (see Ginzburg and Sag 2001:278 for examples with more sentence types).

(5) A: Who gave flowers to George?
B: Who gave FLOWERS to George?
B': Who gave WHAT to George? (adapted from Artstein 2002)

(6) A: Talk to a fortune-teller.
B: Talk to a FORTUNE-TELLER?
B': Talk to WHAT/WHO? (Noh 1998:604)

(7) A: What a great pleasure this is!
B: What a great PLEASURE this is?
B': What a great WHAT this is? (*Ibid.*)

(8) A: Hey, Sweetie!
B: Hey, SWEETIE?
B': Hey WHO/WHAT? (Huddleston, 1994:428)

2.3 Obligatory Widest Scope

Thirdly, wh-phrases in constituent echo questions always take the widest scope possible regardless of the syntactic environments they are in, and can never take an embedded scope (Karttunen, 1977, Ginzburg and Sag, 2001, Iwata, 2003, Sobin, 2010). For instance, (9) does not admit an embedded question interpretation.

(9) *Mary wonders John met WHO (Iwata 2003:198)

This restriction holds for polar echo questions, too.

(10) *Mary wonders whether/if John met the EPIDEMIOLOGIST.

We will claim in the next section that our account explains these three properties straightforwardly.

3 Metalinguistic Analysis of Echo Questions

3.1 The Idea: Echo Questions as Metalinguistic Questions

The core idea of our proposal is that echo questions are metalinguistic in nature and ask about properties of expressions. One semantic feature peculiar to echo questions is that they are anaphoric to an antecedent utterance. The antecedent utterance is typically one made by a conversational partner that immediately precedes the echo question, but it can also be an expression merely present in the pragmatic context, for example, an expression written on a sign nearby.

We propose that the non-echo-focused part of an echo question is quoted in the sense that it is treated as an expression, rather than interpreted in an ordinary way. More specifically, polar echo question asks if the echo-focused phrase is the right expression (among certain alternatives) that would make the sentence mean what the antecedent utterance expressed, and likewise, a constituent echo question asks what is an expression that would mean what the antecedent utterance meant when combined with the non-echo-focused part. For an illustration, let us consider the following simple examples.

(11) A: John speaks Uyghur
B: John speaks UYGHUR?
B′: John speaks WHAT?

A paraphrase of (11B) according to our analysis would be: Is it the expression '`Uyghur`' that when put in the frame '`John speaks X`' would mean what A meant? Here and below, we use the `typewriter font` to represent expressions in the object language (English) in our metalanguage to be explicit about the distinction between the object language and metalanguage. Similarly, the meaning of (11B′) under our analysis can be paraphrased as: What is the expression '`X`' such that '`John speaks X`' would mean what A meant? These paraphrases seem to us to be correctly describing the intuitive meanings of these echo questions, and as we will demonstrate at the end of this section, this analysis captures the properties of echo questions presented in the previous section.

It should be remarked here that we are deploying a metalinguistic variable `X` that ranges over object language expressions in the paraphrases above. This is the crucial technique in our analysis that allows as to formulate metalinguistic questions.

Below we present a compositional semantics where the meanings suggested above are compositionally derived with the help of metalinguistic variables.

3.2 Structured Meanings Semantics of Questions

Before presenting our formal theory of echo questions, we introduce the framework in which it is couched, namely, the structured meanings approach (or function approach) to questions. The choice of the framework here is basically arbitrary and the same idea in principle can be implemented in different approaches to question meanings, such as the proposition set approach (Hamblin, 1958, 1973, Karttunen, 1977) and the partition approach (Groenendijk and Stokhof, 1984), although all three approaches differ in details that do not concern us here (for overviews of the semantics of questions and comparisons of the theories, see Ginzburg 1995, Higginbotham 1996, Groenendijk and Stokhof 1997, Krifka to appear.)

The basic idea common to formal semantic theories of question meanings is that question meanings are closely related to the meanings of their (possible) answers. In the structured meanings approach (von Stechow, 1982, 1989, Krifka, 1991, 2001, 2004), question meanings are analyzed as functions that return a proposition when applied to the meaning of an answer. For example, the meaning of the constituent question *Who came* is analyzed as the pair consisting of a function $\lambda x_e.\ \mathbf{came}(x)$, and a set of possible answers, $\{x_e : \mathbf{person}(x)\}$ (abstracting away from the contextual restriction of possible answers). The function part of a question meaning is called the *background* and the set of possible answers is called the *restriction*. Similarly, polar questions are analyzed as pairs of a background and a restriction. In this case, the restriction is a two-membered set $\{\lambda p_t.p,\ \lambda p_t.\neg p\}$, representing the set consisting of *yes* and *no*, which are the possible answers for a polar question. For example, *Did John come?* is modeled as $\langle \lambda f_{(t\to t)}.f(\mathbf{came}(j)), \{\lambda p_t.p,\ \lambda p_t.\neg p\}\rangle$.[2]

Here is a compositional implementation. We assume the following type inventory (To keep the exposition simple, we ignore intensionality).

(12) $\mathsf{Type} := e, t \mid (\mathsf{Type} \to \mathsf{Type}) \mid \langle \mathsf{Type}, \mathsf{Type} \rangle \mid \mathsf{Type} \bullet \mathsf{Type}$

The domains for the primitive types are defined as usual.

(13) a. D_e is the set of individuals
b. D_t is the set of truth-values, i.e. $\{0, 1\}$

The complex types, $(\sigma \to \tau)$, $\langle \sigma, \tau \rangle$ and $\sigma \bullet \tau$, are types of functions from D_σ to D_τ, structured meanings consisting of elements of D_σ and D_τ, and Cartesian products of D_σ and D_τ, respectively.

(14) For any $\sigma, \tau \in \mathsf{Type}$,
a. $D_{(\sigma\to\tau)} := D_\tau^{D_\sigma}$
b. $D_{\langle\sigma,\tau\rangle}$ is the set of structured meanings $\langle \alpha, \beta \rangle$ s.t. $\alpha \in D_\sigma$ and $\beta \in D_\tau$
c. $D_{\sigma\bullet\tau} := D_\sigma \times D_\tau$

The latter two classes of types are used only in questions, among which bullet types appear only in multiple wh-questions.

Ordinary, non-structured meanings combine by the rule of Functional Application given

[2]Actually, this analysis of *yes* and *no* is problematic for negative polar questions where negation is in the scope of the question operator, but since echo questions do not allow negative questions, we ignore this problem here.

in (15) (Presuppositions are ignored here). We assume that the interpretation function is relativized to a pair of an assignment function g from $\mathbb{N} \times \mathsf{Type}$ to constants, and a Kaplanian context of utterance c (Kaplan, 1977).

(15) *Functional Application*
If A has B and C as its daughters such that $[\![\mathtt{B}]\!]^{g,c} \in D_{(\sigma \to \tau)}$ and $[\![\mathtt{C}]\!]^{g,c} \in D_{\sigma}$, then $[\![\mathtt{A}]\!]^{g,c} = [\![\mathtt{B}]\!]^{g,c}([\![\mathtt{C}]\!]^{g,c})$

Other compositional rules such as Predicate Abstraction are defined as usual (cf. Heim and Kratzer, 1998).

Below are new compositional rules having to do with structured meanings (cf. Krifka, 1991). Here, we do not distinguish sets and their characteristic functions, and hence the second member of a structured meaning always has a functional type $(\sigma \to t)$ for some $\sigma \in \mathsf{Type}$.

(16) a. *Inheritance from Predicate*
If A has B and C as its daughters and $[\![\mathtt{B}]\!]^{g,c} = \langle f, S \rangle$ which is of type $\langle (\sigma \to (\tau \to \upsilon)), (\sigma \to t) \rangle$ and $[\![\mathtt{C}]\!]^{g,c}$ is of type τ, then

$$[\![\mathtt{A}]\!]^{g,c} = \langle \lambda x_{\sigma}.f(x)([\![\mathtt{C}]\!]^{g,c}),\ S \rangle$$

which is of type $\langle (\sigma \to \upsilon), (\sigma \to t) \rangle$

b. *Inheritance from Argument*
If A has B and C as its daughters and $[\![\mathtt{B}]\!]^{g,c}$ is of type $(\sigma \to \tau)$ and $[\![\mathtt{C}]\!]^{g,c} = \langle f, S \rangle$ which is of type $\langle (\upsilon \to \sigma), (\upsilon \to t) \rangle$, then

$$[\![\mathtt{A}]\!]^{g,c} = \langle \lambda x_{\upsilon}.[\![\mathtt{B}]\!]^{g,c}(f(x)),\ S \rangle$$

which is of type $\langle (\upsilon \to \tau), (\upsilon \to t) \rangle$

c. *Inheritance from Both*
If A has B and C as its daughters and $[\![\mathtt{B}]\!]^{g,c} = \langle f, S \rangle$ which is of type $\langle (\sigma \to (\tau \to \upsilon)), (\sigma \to t) \rangle$ and $[\![\mathtt{C}]\!]^{g,c} = \langle f', S' \rangle$ which is of type $\langle (\zeta \to \tau), (\zeta \to t) \rangle$, then

$$[\![\mathtt{A}]\!]^{g,c} = \langle \lambda (x, y)_{\sigma \bullet \zeta}.f(x)(f'(y)),\ S \times S' \rangle$$

which is of type $\langle (\sigma \bullet \zeta \to \upsilon), \sigma \bullet \zeta \rangle$

The first rule is used when $[\![\mathtt{B}]\!]^{g,c}$ is a structured meaning, and the second rule is when the argument $[\![\mathtt{C}]\!]^{g,c}$ is a structured meaning. The third rule is used when both of them are of structured meaning types, a situation that only arises in a multiple wh-question in our fragment.

Due to the way the inheritance rules in (16) are formulated, a complex expression can denote a structured meaning only if at least one of its atomic parts does. There are two kinds of lexical item in our system that inherently have structured meanings. One is wh-phrases which are analyzed as structured meanings whose background is an identity function (we ignore the contextual restriction).

(17) a. $[\![\mathtt{what}]\!]^{g,c} = \langle \lambda x_e.x,\ \{x_e : \mathbf{thing}(x)\} \rangle$

b. $[\![\ \texttt{who}\ ]\!]^{g,c} = \langle \lambda x_e.x,\ \{x_e : \mathbf{person}(x)\}\rangle$

Another lexical item that has a structured meaning lexical entry is the covert complementizer involved in polar questions.

(18) $[\![\ \texttt{Comp}_{\texttt{yn}}\ ]\!]^{g,c} = \lambda p.\ \langle \lambda f_{(t\to t)}.f(p), \{\lambda p_t.p,\ \lambda p_t.\neg p\}\rangle$

In this semantics, questions and only questions have structured meanings.[3]

3.3 Compositional Semantics for Echo Questions

Now we extend the above semantics to echo questions in a way it embodies the idea presented in Section 3.1. In particular, as mentioned there, the use of variables ranging over object language expressions is going to play a pivotal role.

Firstly, a new atomic semantic type u, the type of object language expressions, is introduced in addition to e and t (cf. Potts 2007).

(19) a. $\mathsf{Type} := e, t, u \mid (\mathsf{Type} \to \mathsf{Type}) \mid \langle \mathsf{Type}, \mathsf{Type}\rangle \mid \mathsf{Type} \bullet \mathsf{Type}$
b. D_u is the set of expressions

Having introduced a new type u, we now propose new compositional rules referring to it. Firstly, we assume that type u elements combine syntactically (phrase level composition), morphologically (word level composition) or phonologically (sound level composition) to yield a new type u element by the following rule:

(20) *Metalinguistic Composition*
For any $\texttt{A}, \texttt{B} \in D_u$, $\overset{\frown}{\texttt{A}\ \ \texttt{B}} \in D_u$
where $\frown$ represents syntactic merger, morpheme composition or phonological grouping

In addition to (20), we introduce two compositional rules for echo questions. (21) is used for combining an ordinary expression C and a phrase containing one echo focused phrase. "$\texttt{A}[f(\texttt{X})/\texttt{B}]$" in this rule denotes that expression obtained from A by replacing every occurrence of B in A by $f(\texttt{X})$.

(21) If A has B and C as its daughters and $[\![\ \texttt{B}\ ]\!]^{g,c} = \langle f, S\rangle$ which is a member of $D_{\langle (u\to u),(u\to t)\rangle}$ and $[\![\ \texttt{C}\ ]\!]^{g,c} \notin D_{\langle (u\bullet\ldots\bullet u\to u),(u\to t)\rangle}$, then $[\![\ \texttt{A}\ ]\!]^{g,c} = \langle \lambda \texttt{X}_u.\texttt{A}[f(\texttt{X})/\texttt{B}],\ S\rangle$, which is of type $\langle (u\to u),(u\to t)\rangle$

The expression B whose denotation is of type $\langle (u\to u),(u\to t)\rangle$ in this rule is an expression containing an echo focused phrase. The constituent C is not explicitly referred to in the rule, but it is contained in the complex phrase $\texttt{A}[f(\texttt{X})/\texttt{B}]$, and importantly it behaves as an expression without being interpreted as if it is quoted. In (22) is a more general format of this rule applicable to cases where B contains one or more echo focused phrases.

[3]Structured meanings are also widely used in the analysis of (contrastive) foci, but it is not of our central interest, and we assume that our restricted fragment does not contain foci.

(22) *Metalinguistic Inheritance 1*
If $\mathtt{A}$ has $\mathtt{B}$ and $\mathtt{C}$ as its daughters and $[\![\,\mathtt{B}\,]\!]^{g,c} = \langle f, S\rangle$ which is a member of $D_{\langle(u\bullet\ldots\bullet u\to u),(u\bullet\ldots\bullet u\to t)\rangle}$ and $[\![\,\mathtt{C}\,]\!]^{g,c} \notin D_{\langle(u\bullet\ldots\bullet u\to u),(u\bullet\ldots\bullet u\to t)\rangle}$, then $[\![\,\mathtt{A}\,]\!]^{g,c} = \langle \lambda(\mathtt{X}_1,\ldots,\mathtt{X}_n)_{u\bullet\ldots\bullet u}.\mathtt{A}[f(\mathtt{X}_1,\ldots,\mathtt{X}_n)/\mathtt{B}],\ S\rangle$, which is of type $\langle(u\bullet\ldots\bullet u\to u),(u\bullet\ldots\bullet u\to t)\rangle$

In addition to the rule (22), we introduce another rule for combining two constituents both containing echo foci.

(23) *Metalinguistic Inheritance 2*
If $\mathtt{A}$ has $\mathtt{B}$ and $\mathtt{C}$ as its daughters and $[\![\,\mathtt{B}\,]\!]^{g,c} = \langle f, S\rangle$ which is of type $\langle(\underbrace{u\bullet\ldots\bullet u}_{n\text{ times}}\to u),(\underbrace{u\bullet\ldots\bullet u}_{n\text{ times}}\to t)\rangle$ and $[\![\,\mathtt{C}\,]\!]^{g,c} = \langle f', S'\rangle$ which is of type $\langle(\underbrace{u\bullet\ldots\bullet u}_{m\text{ times}}\to u),(\underbrace{u\bullet\ldots\bullet u}_{m\text{ times}}\to t)\rangle$, then

$$[\![\,\mathtt{A}\,]\!]^{g,c} = \langle \lambda(\mathtt{X}_1,\ldots,\mathtt{X}_{n+m})_{u\bullet\ldots\bullet u}.\ \mathtt{A}[f(\mathtt{X}_1,\ldots,\mathtt{X}_n)/\mathtt{B}, f'(\mathtt{X}_{n+1},\ldots,\mathtt{X}_{n+m})/\mathtt{C}],\ S\times S'\rangle$$

which is of type $\langle(\underbrace{u\bullet u\bullet\ldots\bullet u}_{n+m\text{ times}}\to u),(\underbrace{u\bullet u\bullet\ldots\bullet u}_{n+m\text{ times}}\to t)\rangle$

Just as in the case of ordinary questions, structured meanings are assumed to be introduced by certain lexical items, and in particular, echo focused are assigned the following structured meanings.

(24) a. $[\![\,\mathtt{AEROPLANE}\,]\!]^{g,c} = \langle \lambda\mathtt{X}_u.\mathtt{X},\ \{\mathtt{aeroplane}\}\rangle$
b. $[\![\,\mathtt{WHAT}\,]\!]^{g,c} = \langle \lambda\mathtt{X}_u.\mathtt{X},\ D_u\rangle$
c. $[\![\,\mathtt{WHO}\,]\!]^{g,c} = \langle \lambda\mathtt{X}_u.\mathtt{X},\ \{\mathtt{X}_u : \mathbf{human}([\![\,\mathtt{X}\,]\!]^{g,c}) = 1\}\rangle$

Just with ordinary wh-phrases, the background of echo focused items is always the identity function, but in this case it is the identity function over type u elements.

In addition, we maintain that echo questions in English involve special complementizers without phonological content (cf. Artstein, 2002, Dayal, 1996, Sobin, 1990, 2010). In fact, this assumption is not unmotivated, given that an overt echo question particle can be found in some languages. For instance, Japanese has a special question particle *tte* that can only be found in echo questions. Thus, the following sentences only admit echo question readings, while the ones in (26) with the normal question particle *no* are interpreted as ordinary questions.[4]

(25) a. John-ga hikooki-o katta **tte**?
John-NOM aeroplane-ACC bought echo.Q
'John bought an AEROPLANE?'
b. John-ga nani-o katta **tte**?
John-NOM what-ACC bought echo.Q
'John bought a WHAT?'

[4]There is a question of how to define echo questions in Japanese, as our definition of echo questions is language specific. In fact, in some sense, the questions in (26) can be used as 'echo questions', but generally, *tte* forces the echo question construal.

(26) a. John-ga hikooki-o katta **no**?
John-NOM aeroplane-ACC bought Q
'Did John buy an aeroplane?'
b. John-ga nani-o katta **no**?
John-NOM what-ACC bought Q
'What did John buy?'

We postulate different complementizers for polar and constituent echo questions for technical reasons, but their common function is to relate the structured meaning denoted by the body of an echo question to the antecedent utterance, which is modeled as a pair of an expression $\mathtt{P}$, which is assumed to be a type expression as opposed to a token expression originally used in a context of utterance (g', c'). The denotation of the complementizer for polar echo questions is given in (27).

(27) $$\left[\!\left[\mathtt{Comp}^{\mathtt{P},g',c'}_{\mathtt{yn.echo}} \right]\!\right]^{g,c} = \lambda\langle\alpha,\beta\rangle_{\langle(u\bullet\ldots\bullet u\to u),(u\bullet\ldots\bullet u\to t)\rangle}.\,\langle\lambda f_{(t\to t)}.f(\left[\!\left[\alpha(\iota\vec{\mathtt{X}} : \vec{\mathtt{X}} \in \beta) \right]\!\right]^{g,c} \Leftarrow \left[\!\left[\mathtt{P} \right]\!\right]^{g',c'} \wedge$$
$$\forall\vec{\mathtt{Y}} \in Alt(\iota\vec{\mathtt{X}} : \vec{\mathtt{X}} \in \beta) : [\left[\!\left[\alpha(\vec{\mathtt{Y}}) \right]\!\right]^{g,c} \Leftarrow \left[\!\left[\mathtt{P} \right]\!\right]^{g',c'}] \Leftrightarrow [\vec{\mathtt{Y}} = \vec{\mathtt{X}}]),\ \{\lambda p_t.p,\ \lambda p_t.\neg p\}\rangle$$

Notice that just as in ordinary polar questions, the answer set is composed of *yes* and *no*. Essentially, a polar echo question asks whether the echo focused expression put in the frame α, which is a function of type $(u\bullet\ldots\bullet u \to u)$, gives an expression entailed by the antecedent utterance, and at the same time, that is the only expression among its alternatives that does so. Here is a concrete example:

(28) $\mathtt{Comp}^{\mathtt{John\ speaks\ Uyghur},g',c'}_{\mathtt{yn.echo}}$ `He speaks UYGHUR`?

$$\left[\!\left[(28) \right]\!\right]^{g,c} = \mathtt{Comp}^{\mathtt{John\ speaks\ Uyghur},c'}_{\mathtt{yn.echo}}(\langle\lambda\mathtt{X}_u.\mathtt{He\ speaks\ X},\ \{\mathtt{Uyghur}\}\rangle)$$

$$= \langle f_{(u\to u)}.f(\left[\!\left[\mathtt{He\ speaks\ Uyghur} \right]\!\right]^{g,c} \Leftarrow \left[\!\left[\mathtt{John\ speaks\ Uyghur} \right]\!\right]^{g',c'} \wedge \forall\mathtt{Y} \in Alt(\mathtt{Uyghur}) :$$
$$[\left[\!\left[\mathtt{He\ speaks\ Y} \right]\!\right]^{g,c} \Leftarrow \left[\!\left[\mathtt{John\ speaks\ Uyghur} \right]\!\right]^{g',c'}] \Leftrightarrow [\mathtt{Y} = \mathtt{Uyghur}]),\ \{\lambda p_t.p, \lambda p_t.\neg p\}\rangle$$

It should be emphasized here that the semantics of the complementizer does not require the echo question to be completely verbatim to the antecedent expression of which it is an echo, but rather it suffices for it to be just semantically entailed by it (Artstein, 2002). This has already been demonstrated by some of the examples we have seen so far. For example, in (29), the echo questioned word is weaker than the original word.

(29) A: John speaks Uyghur.
B: John speaks a FOREIGN LANGUAGE?

This is captured in our semantics by the one-way entailment in the meaning of the complementizer. Also indexicals are usually switched as demonstrated by our first example repeated here.

(1) A: I've bought you an aeroplane.
B: You've bought me an AEROPLANE?

Our theory is capable of this example too, because the original utterance is evaluated in the context of utterance (g', c') in which it was made, while the echo question is evaluated in the

current context of utterance (g, c). In order for the expressions to stand in an entailment relation, the indexicals must switch.

For constituent echo questions, a different complementizer is necessary, as the answers are not *yes* or *no*. Rather, the restriction should be simply inherited by the body of the echo question. Here is the lexical entry.

(30) $$\left[\!\left[\mathtt{Comp}^{\mathtt{P},g',c'}_{\mathtt{wh.echo}} \right]\!\right]^{g,c} = \lambda\langle \alpha, \beta\rangle_{\langle (u\bullet\ldots\bullet u\to u),(u\bullet\ldots\bullet u\to t)\rangle}.\langle \lambda(\vec{\mathtt{X}})_{u\bullet\ldots\bullet u}.\left[\!\left[\alpha(\vec{\mathtt{X}}) \right]\!\right]^{g,c} \Leftarrow \left[\!\left[\mathtt{P} \right]\!\right]^{g',c'},\ \beta\rangle$$

Below is a simple example illustrating how it works.

(31) $\mathtt{Comp}^{\mathtt{John\ speaks\ Uyghur},g',c'}_{\mathtt{wh.echo}}$ `He speaks WHAT`?

$$\left[\!\left[(31) \right]\!\right]^{g,c} = \mathtt{Comp}^{\mathtt{John\ speaks\ Uyghur},g',c'}_{\mathtt{wh.echo}}(\langle \lambda \mathtt{X}_u.\mathtt{John\ speaks\ X},\ D_u\rangle)$$

$$= \langle \lambda \mathtt{X}_u.\left[\!\left[\mathtt{John\ speaks\ X} \right]\!\right]^{g,c} \Leftarrow \left[\!\left[\mathtt{John\ speaks\ Uyghur} \right]\!\right]^{g',c'},\ D_u\rangle$$

Our account is also capable of multiple constituent echo questions, as shown in the following example.

(32) $\mathtt{Comp}^{\mathtt{John\ speaks\ Uyghur},g',c'}_{\mathtt{wh.echo}}$ `WHO speaks WHAT`?

$$\left[\!\left[(32) \right]\!\right]^{g,c} = \mathtt{Comp}^{\mathtt{John\ speaks\ Uyghur},g',c'}_{\mathtt{wh.echo}}(\langle \lambda(\mathtt{Y},\mathtt{X})_{u\bullet u}.\mathtt{Y\ speaks\ X},\ \{\mathtt{Y}_u : \mathbf{human}(\left[\!\left[\mathtt{Y} \right]\!\right]^{g,c}) = 1\} \times D_u\rangle)$$

$$= \langle \lambda(\mathtt{Y},\mathtt{X})_{u\bullet u}.\left[\!\left[\mathtt{Y\ speaks\ X} \right]\!\right]^{g,c} \Leftarrow \left[\!\left[\mathtt{John\ speaks\ Uyghur} \right]\!\right]^{g',c'},\ \{\mathtt{Y}_u : \mathbf{human}(\left[\!\left[\mathtt{Y} \right]\!\right]^{g,c}) = 1\} \times D_u\rangle$$

Just as in the case of polar echo questions, the antecedent utterance `P` at (g', c') is only required to entail the echoed phrase, and they do not have to be identical. This is illustrated again by (1), where the indexicals switch.

(1) A: I've bought you an aeroplane.
B′: You've bought me an WHAT?

Also, the following example shows that a new word that was absent in the antecedent can be introduced in an echo question.

(33) A: John speaks Uyghur.
B: John speaks WHAT language?

This is correctly accounted for in our analysis, because the correct answer `X` is only required to be entailed by (33A) when put in the frame `John speaks X language`.

3.4 Alternative Echo Questions

There is another type of echo questions that we have not been talking about so far, namely, *alternative echo questions*. The following example is from Huddleston (1994:427).

(34) A: Give it to Anne.
B: Give it to ANNE or Anna?

In this case, an appropriate answer would be *Anne*, rather than *yes* or *no*.

Our semantics can account for alternative echo questions by assigning *or* in this use a metalinguistic semantics.

(35) $[\![\texttt{or}_{\texttt{echo}}]\!]^{g,c} = \lambda \texttt{X}_u.\lambda \texttt{Y}_u.\, \langle \lambda \texttt{Z}_u.\texttt{Z}, \{\texttt{X}, \texttt{Y}\}\rangle$

Using the complementizer in (30) for constituent echo questions containing (35), our analysis derives correct meanings for alternative echo questions. Here is an example derivation demonstrating it.

(36) $\texttt{Comp}_{\texttt{wh.echo}}^{\texttt{Give it to Anne},g',c'}$ Give it to Anne $\texttt{or}_{\texttt{echo}}$ Anna

$[\![(36)]\!]^{g,c} = \texttt{Comp}_{\texttt{wh.echo}}^{\texttt{Give it to Anne},g',c'}(\langle \lambda \texttt{X}_u.\texttt{Give it to X}, \{\texttt{Anne}, \texttt{Anna}\}\rangle)$

$= \langle \lambda \texttt{X}_u.[\![\texttt{Give it to X}]\!]^{g,c} \Leftarrow [\![\texttt{Give it to Anne}]\!]^{g',c'}, \{\texttt{Anne}, \texttt{Anna}\}\rangle$

3.5 Explaining the Properties

Our analysis explains the properties of echo questions we looked at in §1.

Firstly, the insensitivity to syntactic constituency (§1.2) is accounted for by the assumption that units smaller than or bigger than a word are also of type u.

(37) a. $\texttt{Comp}_{\texttt{wh.echo}}^{\texttt{Have you met the epidemiologist?},c'}$ Have I met the epidemi-WHAT?

b. $[\![(37\text{a})]\!]^{g,c} = \langle \lambda \texttt{X}_u.[\![\texttt{Have you met the epidemi-X}]\!]^{g,c}$
$\Leftarrow [\![\texttt{Have you met the epidemiologist}]\!]^{g,c'},\ D_u\rangle$

In particular, the rule of Metalinguistic Composition in (20) ensures that any expression can combine in some way with another expression to form a new expression.

The insensitivity to sentence types (§1.3) can be straightforwardly captured provided that the meanings of non-declarative sentences can be analyzed with our interpretation function $[\![\cdot]\!]^{g,c}$. This assumption is not at all trivial or controversial, but it is beyond the scope of the present paper to give precise analyses of the semantics of non-declarative sentences.

The obligatory widest scope requirement is also given a straightforward explanation. That is, the non-echo focused part of an echo question is quoted and does not semantically interact with the echo questioned part, just like quotations do not interact with non-quoted parts of the sentence. The only operators that can interact with echo foci are the special complementizers for echo questions that are by assumption syntactically restricted to always appear in matrix clauses.

4 Two Previous Analyses and Their Problems

Our analysis is by no means the first to give a formal account of the meaning of echo questions. In this section, we review two major previous analyses by Ginzburg and Sag (2001) and Artstein (2002), neither of which postulate variables ranging over expressions.

4.1 Ginzburg and Sag (2001)

In Chapter 7 of their book, Ginzburg and Sag (2001) discuss what they call *reprise questions*, which they define as "queries whose meaning is partially determined directly from the immediately prior utterance" (p.255). This class of questions is larger than what we have been calling echo questions in the present paper (cf. §2.1). For example, a question like (38) that involves no wh-movement just like echo questions, but that bears an intonation pattern distinct from the echo intonation is classified as a reprise question.

(38) A: They're mad at Bustamente y Bacigalupo.
B: Who's mad at Bustamente y Bacigalupo? (Ginzburg and Sag, 2001:255)

Unlike echo questions, these types of questions ask for a clarification about the intended referent of a referential term, rather than about the expression *per se*.

We will mainly review their treatment of echo questions, putting aside non-echo reprise questions. Also as Ginzburg and Sag (2001) employ a framework distinct in several respects from our theory presented in the previous section, we will not go into the technical details of their account, which we think are largely orthogonal to our main concern here.

The central tenet of Ginzburg and Sag's (2001) is that the meaning of an echo question refers to the illocutionary force of the utterance that it is anaphoric to, but in other respects "there is nothing fundamentally different going on—syntactically or semantically—from other uses of interrogatives" (p.256). It is thus a crucial difference from our account that echo questions are regarded not as questions about expressions, but about individuals, places, manners, times, reasons, etc. on a par with normal questions.

Under this analysis, echo question meanings operate on the illocutionary force of the previous utterance that its utterer tried to convey, unlike ordinary information seeking questions. Ginzburg and Sag point out that echo questions can be paraphrased by normal questions that refer to the illocutionary force of the previous utterance, as the following examples taken from Ginzburg and Sag (2001:259) demonstrate.

(39) a. You like WHO?
b. Who did you say (just now) that you like?

(40) a. [Go home, Bo!] Go WHERE?
b. Where did you order me (just now) to go?

(41) a. Who likes WHICH MOVIE?
b. (?)Which movie did you (just now) ask me who likes?

However, one problem of this account is that echo questions possess grammatical features that distinguish them from ordinary questions. For example, as we already saw in §2, echo questions below the word level and echo questions of non-constituents cannot be properly analyzed under this analysis (Iwata, 2003).

(42) A: Have you met the epidemiologist?
B: Have I met the epidemi-WHAT?
B': *What did you (just now) ask me if I have met the epidemi-?

(43) A: The dog wanted to eat the cat

B: The WHAT?
B': *What did you say (just now) that the?

These types of echo questions suggest that it is not just the meaning that echo questions are special about. Ginzburg and Sag (2001) are aware of such examples, and claim that these are not actually grammatical English sentences. More precisely, while admitting that the example in (44) below, which is originally due to Janda (1985), is acceptable, they remark as follows: "we are somewhat skeptical about the status of [(44)] as a well-formed string of English. Rather, we would view it as some kind of extension of the language: a play on words [...]" (p.258)

(44) A: I've been reading a bit recently about (auditory disturbance in the room) jacency
B: Sorry, you've been reading about WHAT-jacency

To buttress this, they show that a normal constituent question with *jacency* can be formed as in (45):

(45) I've been reading about subjacency, abjacency etc. In short, a wide range of [pauses jacencies]. Now you tell me:
What kind of jacency have *you* been reading about?

However, even if they are correct for this particular example, it appears that Janda's (1985) other example in (46) reproduced from §2, insofar as it is acceptable, is more problematic.

(46) A: Try our new chajitas!
B: Cha-WHAT-as?

It is not clear to us in what kind of extension of the language or play on words would allow a normal question involving such a phrase as *cha-what-as*.

In addition, non-constituent cases like (43) can hardly be given a similar explanation. It seems to us that these examples constitute strong evidence against a view like Ginzburg and Sag where echo questions and normal questions are distinguished only in one corner of their meaning.

4.2 Artstein (2002)

Artstein (2002) is another attempt to give a non-metalinguistic semantics to echo questions. He proposes that echo questions are nothing but sentences with foci and have the set of possible answers as their focus meaning. The underlying idea behind this is that echo focused phrases have the same syntactic properties as (contrastive) foci occurring in ordinary sentences, and receive the same semantics. Thus, unlike in our theory presented in the previous section, echo questions are not analyzed as metalinguistic questions, but sentences with non-trivial focus alternatives.

In the framework of alternative semantics of focus (Rooth, 1985, 1992), which Artstein (2002) adopts, each word or phrase has a focus semantic value in addition to the ordinary semantic value. A focus semantic value is the set each of whose member is obtained by

replacing the ordinary value of the focused material, if any, with an alternative of the same semantic type. We adopt the standard convention where the ordinary semantic value of a phrase α is denoted by $[\![\,\alpha\,]\!]^o$, and its focus value is denoted by $[\![\,\alpha\,]\!]^f$. It is assumed that a focused phrase bears a syntactic feature (Selkirk, 1995, Schwarzschild, 1999), and here we represent it by a pair of brackets with a subscript F. The focus semantic value is computed compositionally in the following manner.

(47) For any constituent α such that $[\![\,\alpha\,]\!]^o \in D_\tau$ for some type τ,
   a. if α is a terminal node, $[\![\,\alpha\,]\!]^f = \{[\![\,\alpha\,]\!]^o\}$
   b. if $\alpha = \overbrace{\beta \quad \gamma}$ such that $[\![\,\beta\,]\!]^o \in D_{(\sigma\to\tau)}$ and $[\![\,\gamma\,]\!]^o \in D_\sigma$,
   $[\![\,\alpha\,]\!]^f = \{f(x) : f \in [\![\,\beta\,]\!]^f \wedge x \in [\![\,\gamma\,]\!]^f\}$
   c. $[\![\,[\alpha]_{\mathtt{F}}\,]\!]^f = D_\tau$

For example, the focus semantic value of (48a) is the set of propositions in (48b).

(48) a. $[\text{John}]_{\mathtt{F}}$ came to the party
   b. $\{x$ came to the party $: x \in D_e\}$

According to Artstein (2002), the echo question in (49) has the exact same ordinary and focus values as the declarative sentence in (48a).

(49) JOHN came to the party?

He then argues that what makes an echo question a question, not just a sentence with a focus, is a Gricean inference. The major difference between a declarative sentence with a focus and an echo question is that all the expressions contained in the latter are discourse given. In fact, the antecedent must entail the ordinary semantic value of the polar echo question. Artstein claims that because given phrases generally cannot be focused, focusing them induce a pragmatic inference. In his words, "the proposition expressed by the echo offers no new information and the echo itself signals that the speaker considers part of it not to be given, so the interlocutor infers that the speaker intends to question this information" (p.87). In fact, the focus semantic value of (49) is the set of alternative propositions in (48b), which is the question denotation of *Who came to the party?* under Hamblin's (1973) analysis of questions.

For constituent echo questions, Artstein assumes that echo focused wh-phrases do not have ordinary semantic contents, while its alternatives are denotations matching in type.

(50) a. $[\![\,\texttt{WHO}\,]\!]^o$ is undefined
   b. $[\![\,\texttt{WHO}\,]\!]^f = D_e$

(51) a. $[\![\,\texttt{John likes WHO?}\,]\!]^o$ is undefined
   b. $[\![\,\texttt{John likes WHO?}\,]\!]^f = \{\text{John likes } x : x \in D_e\}$

Notice that under this account, *WHO* and *WHAT* in echo questions receive the same meaning. Artstein claims for this that their difference lies in the contextual appropriateness, although he does not make it explicit what component of these lexical items is responsible for it.

Artstein further maintains that this analysis provides an explanation of echo questions below the word level, because parts of words can be contrastively focused. Also, because non-declarative sentences can contain foci, their echo question versions are predicted to be possible, which is correct. We will not go into the details of these explanations here.

The crucial difference between our novel account and Artstein's is whether echo questions are analyzed as metalinguistic questions or not. Instead of treating them as questions about expressions, Artstein assimilates echo questions with focus phenomena. However, we think it is problematic to assume that polar echo questions have the same semantics as declarative sentences with contrastive foci. As Artstein himself remarks, echo foci bear distinct intonation patterns from ordinary foci, indicating that there is something special about their form/syntax. However, under his account, the difference between an echo question and the corresponding declarative sentence only lies in the pragmatic context in which they are used. That is, the former is used in a context where all the material in the sentence is given. In other words, his account does not explain why the echo intonation pattern is necessary to form an echo question, and conversely, why it cannot be used to mean a normal assertion with a focus. We show below two concrete cases showing that the echo intonation and ordinary focus intonation are not interchangeable.

First, he claims that because of the Gricean inference, the hearer infers that the utterer of the echo question intends to ask about the preceding utterance, rather than asserting its content. However, it is not clear which Gricean maxims give rise to this inference. In fact, if a non-echo focus intonation is used instead, the discourse would be just infelicitous, as demonstrated by (52).

(52) A: John only gave a [flower]$_{\mathtt{F}}$ to Mary.
B: #John only gave a [flower]$_{\mathtt{F}}$ to Mary.

At best, in this context, A could only say *That's what I just said!*. But if the echo question interpretation is brought about through pragmatic inferences as Artstein concedes, (52b) should be interpreted as an echo question, contrary to fact.

Also, the assumption that echo foci are just normal foci gives rise to an empirical problem, which is closely related to the above point. Specifically, Artstein's theory cannot adequately capture cases where echo questions interact with other focus phenomena. Consider the example in (53).

(53) A: John only gave a [flower]$_{\mathtt{F}}$ to Mary.
B: John only gave a FLOWER to Mary?

In (53B), there is a focus operator *only* that is standardly assumed to unselectively operate on the focus value of its sister, and assert that the ordinary value is the only true member among the alternatives. This accounts for the meaning of (53A). However, since the sister of *only* in (53B) has the same meaning as in (53A), it is predicted that *only* operates on the focus alternatives, and as a consequence, (53B) means (53A) does, rather than an echo question. One possible remedy of this would be to resort to selective binding by a focus operator (Wold, 1996) so that *only* does not bind the echo focused phrase *FLOWER* in (53B). However, this only solves one side of the problem. That is, if *FLOWER* in (53B) has the same semantics as *[flower]*$_{\mathtt{F}}$ in (53A), it is expected that (53B) can mean whatever

(53A) means (in a context that lacks (53A)). However, this does not seem to be the case.

Another empirical problem of this theory is that it does not give a straightforward account as to why the wh-phrases in constituent echo questions obligatorily take the widest scope. According to Arstein, the difference between ordinary and echo constituent questions is the pragmatics. He writes "a direct question asks for a true proposition, while an echo question asks for the proposition that was asserted or intended" (p.90). It is unclear from this what accounts for this pragmatic difference, but also, if echo and non-echo constituent questions share the meaning, there is no principled reason why the former cannot be embedded.

5 Conclusions

We claimed in this paper that an echo question is a metalinguistic question about linguistic expressions. We formalized this idea by the aid of variables ranging over linguistic expressions, give natural language an enough expressive power to express quantificational statements about itself.

This result, insofar as it is on the right track, is not at all theoretically inconsequential, despite the general tendency in the literature to regard echo questions as occupying a peripheral position in grammar. We think it is a highly intriguing fact that natural language is equipped with distinguished forms for expressing questions about itself that are different from forms for expressing questions about other things in the world.

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