Echo *wh*-questions: A scope analysis

Introduction: Echo *wh*-questions (EWHQs), as a type of non-canonical question, are known to exhibit properties not amenable to the standard composition of *wh*-questions (WHQs). However, I argue that these properties do not stand in way for unifying WHQs and EWHQs. As long as we allow both content and sentential force in compositional semantics, the many differences between WHQs and EWHQs reduce to where a *wh*-phrase takes scope: in canonical WHQs *wh*-phrases take scope within the content level, whereas in EWHQs they scope over a sentential force.

Widest scope: An intriguing property of EWHQs is that echo *wh*-phrases always take the widest scope, superimposing a question meaning on a variety of speech acts (Artstein 2002; Dayal 1996; Beck & Reis 2018; a.o.). In the following examples, the echo *wh*-phrases (in small capitals) scope over a question-selecting predicate *know*, a yes-no question and an imperative, respectively.

(1) A: Lee knows who lived in Turpan. B: Lee knows who lived WHERE?
(2) A: Did Peter lend Sue his laptop? B: Did Peter lend Sue WHAT?
(3) A: Let’s move to New York! B: Let’s move to WHERE?

Moreover, scope taking of echo *wh*-phrases is not blocked by superiority effects. In (4), WHO takes scope over the WHQ with *what*, as evidenced by the fact that only the WHO-question can be answered, i.e., answering the *what*-question (4–iii) and answering both the *what*-question and the WHO-question (4–ii) are not allowed.

A: (i) Centaurus. (iii) #A pencil.

Similarities with canonical *wh*: Despite the distinguishing features between WHQs and EWHQs, there are reasons to believe that the *wh*-phrases in them have the same semantics (Beck & Reis 2018). First, cross-linguistically, all echo *wh*-phrases are morphologically the same as *wh*-phrases in WHQs. Second, the use of echo *wh*-phrases is constrained by their restrictions, just like *wh*-phrases in WHQs. For example, since the information that the *wh*-phrase in (5)-b echoes is clearly about a place, the form of the *wh*-phrase must be WHERE rather than *what*.

(5) A: Lee went to Turpan. B: Lee went to WHERE/*WHAT?*

Proposal: I propose that echo *wh*-phrases are *wh*-phrases that take scope over a sentential force. The proposal relies on the following two assumptions:

(I) A sentential force is part of compositional semantics (Krifka 2001; Davis 2011; a.o.). The meaning of a sentence is divided into content and force. The content is truth-conditional, whereas the force represents discourse dynamics. The declarative [Decl] and interrogative [Int] force are defined as follows. They are modeled as functions mapping context to context-update proposals.

\[
\text{[Decl]} := \lambda p \lambda c. \{ c \cap p \}
\]
\[
\text{[Int]} := \lambda Q \lambda c. \{ c \cap p \mid p \in Q \}
\]
c is the Stalnakerian context set. [Decl] takes a proposition p and returns a function mapping an input context c to a singleton set containing only one context update \(c \cap p\). [Int] takes a question \(Q\), a set of propositions, and returns a function mapping \(c\) to a set of context updates. (6-a) and (6-b) capture the intuition that both assertion and question are to propose updates, instead of directly updating contexts (Farkas & Bruce 2010).

(II) *Wh*-phrases denote sets of alternatives, as in (7) and take scope via the Set monad \(\langle S, \triangleright\triangleright, \eta\rangle\) (Charlow to appear), which consists of a ‘type-constructor’ \(S\) mapping any type \(a\) to a corresponding type \(Sa\) (abbreviating \(a \rightarrow t\)), a polymorphic \(\eta\) function (type \(a \rightarrow Sa\)) mapping any element \(x\) into a singleton set containing only \(x\), and a polymorphic \(\triangleright\triangleright\) operation (type \(Sa \rightarrow (a \rightarrow Sb) \rightarrow Sb\)) allowing any set \(m\) to take scope.

(7) \[
\text{what}: = \{ x \mid x \in \text{thing} \}
\]

The composition of a canonical WHQ is illustrated as follows. *What* operated on by \(\triangleright\triangleright\) undergoes Quantifier Raising and \(\eta\) is applied to its scope, generating a set of proposition, type \(St\) (t stands for the type of a set of worlds). Notice that *buy* abbreviates the intensional meaning \(\lambda x \lambda y \lambda w. \text{buy}_w x y\). This process is essentially the same as Karttunen’s (1977) composition.
(9) \[ \text{[what did Lee buy]} = \text{Int}(\text{what}^\omega \lambda x.\eta(y (\text{buy} x l))) = \text{Int}(\text{((λf.}\cup_{xϵ\text{what}} f}\ x)\ \lambda x.\{\text{buy} x l\}) = \text{Int}(\\{\text{buy} x l\mid x ϵ \text{thing}\}) = \lambda c.\{c ϵ p\mid p ϵ \{\text{buy} x l\mid x ϵ \text{thing}\}\}\]

Deriving EWHQs: Since both >> and η are polymorphic, the scope of a wh-phrase is not restricted to type St objects. In an EWHQ, therefore, the wh-phrase can take scope over the sentential force in the same way as it does in a canonical WHQ, as in (10). The type of the echo wh-phrase with >> is \((e → S(\text{ccp})) → S(\text{ccp})\) (\(\text{ccp}:: S_\text{w} → S(S_\text{w}); ω\) is the type of possible worlds). Finally, a set of interrogative sentences is generated.

\[ \text{[what did WHO buy]} = \text{echo}(\text{[who}^\omega \lambda y.\eta(\text{Int}(\text{what}^\omega \lambda x.\eta(y (\text{buy} x y))))) = \text{echo}(\\{\text{Int}(\text{what}^\omega \lambda x.\eta(\text{buy} x y))\mid y ϵ \text{human}\})\]

Since the sentential force is the root of a sentence, echo wh-phrase scoping over the force operator must take the widest scope.

Echo: An echo operator, defined in (11), is applied to the resulting set, generating the echo interpretation. echo is interpreted relative to an antecedent sentence \(A'\) (a context-update proposal) and adds an answerhood condition (cf. Dayal 1996). The condition requires that there must be exactly one sentence \(A\) in \(Q\) that echoes the antecedent sentence \(A'\) in a context. Specifically, for any context \(c\), \((A\ c)\) echoes \((A'\ c)\) iff each of the proposed updates in \((A\ c)\) is entailed by some proposed update in \((A'\ c)\), as in (12). Then, the addressee picks out \(A\) to answer an EWHQ.

(11) \(\text{echo}_A := \lambda Q.\forall c.\ Q\) defined only if \(\exists!A \in Q\) s.t. \((A\ c)\) echoes \((A'\ c)\)

(12) \((A\ c)\) echoes \((A'\ c)\) iff \(\forall p \in (A\ c)\ \exists q \in (A'\ c). q \subseteq p\)

The existence of echo is evidenced by the fact that in some languages, like Cantonese and Japanese, EWHQs host specific sentence final particles. The ‘entailment’ relation in (12) can predict that echo wh-Qs don’t always share the same structure as its antecedent (Beck & Reis 2018).

Island insensitivity: The challenge for a scope-taking analysis is that echo wh-phrases are insensitive to scope islands (Artstein 2002), as in (13), where the echo wh-phrase is embedded in the tensed adjunct clause. However, the current analysis incorporating the Set monad predicts that echo wh-phrases should pattern like indefinites, which also uses the Set monad and are insensitive to islands according to (Charlow to appear). In (14), WHO first shifts into a scope-taker via >> and takes scope at the edge of the island. Then, the whole clause is turned into a scope-taker by >> and takes scope over the [Decl] operator.

(13) A: Lee’ll be angry if Ann is invited. B: Lee’ll be angry if WHO is invited?

(14) \(\text{echo}(\text{[who}^\omega \lambda x.\eta(\text{be.invited} x)) \lambda p.\ η(\text{Decl}(\text{if p then (angry l))))\)

Metalinguistic inquiry: EWHQs can be used to ask for information below word level (Janda 1985; Artstein 2002). In (15), what is used to request a repetition of the syllable ortho. I propose that the word with what is quoted, i.e., ‘WHAT-dontist’. Following Maier 2014 and Koev 2017, a quoted word introduces a non-at-issue meaning. I assign the denotation in (16) to ‘orthodontist’. In particular, the quoted word takes scope over the sentential force, which brings a context \(c\) into the compositional process, and requires \(c\) to entail that the word orthodontist has been uttered (cf. Barker et al. 2010).

(15) A: Bill is an orthodontist. B: He is a WHAT-dontist?

(16) ‘orthodontist’ = \(\lambda f\ λc.\ f\ [\text{orthodontist}]\ c\)
\(\quad (e → t → \text{ccp}) → \text{ccp}\)
\(\quad \text{defined only if } c \subseteq \{w \mid \text{the word orthodontist is uttered in } w\}\)

For the EWHQ in (15), what denotes a set of syllables, which are part of the quoted word. The quoted word scopes over [Decl] and what continues to take scope. By contrast, in a canonical WHQs, the wh-phrase cannot take scope over the sentential force. As a result, the LF in (18) is ill-formed: the quoted word scopes above [Decl] while what under [Decl]; what cannot bind the variable \(x\).

(17) \(\text{echo}(\text{what}^\omega \lambda x.\eta(\text{‘x-dontist’ } \lambda P.\ \text{Decl}(P\ he)))\)

(18) ‘x-dontist’ \(\lambda P.\ \text{Int}(\text{what}^\omega \lambda x.\eta(P\ he))\ \ X\)