

Summer Research: Echo vs Probing Questions

Will Howe

Johns Hopkins University

whowe1@jhu.edu

Abstract

In this paper I review the work I did this summer in the Language Acquisition Lab as research assistant to PhD Student, An Nguyen. I give a cursory explanation of the linguistic theory behind probing questions, interfacing with her paper, *Distinguishing among in-situ wh-questions in English: echo versus probing questions*. Then, I focus on the work I did, memorizing the stimuli, refining the stimuli, and addressing issues. Finally, I discuss our work on the current paradigm for investigating probing questions.

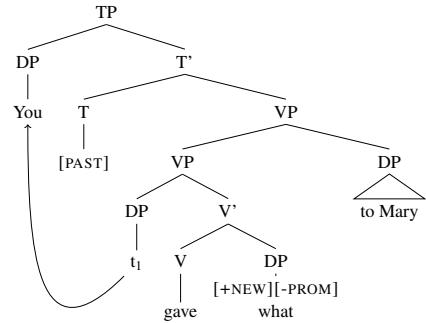
1 Introduction

The motivation for Nguyen's work on probing questions is the conventional wisdom within the field of acquisition that in-situ wh-questions strictly function as questions with rising prosody. These questions are known as echo questions, used to seek *clarification* [1]. Echo questions are frequently used to signal that the question asker misheard something the speaker said. Using corpora of child directed speech, Nguyen discovered, however, that if one considers, "questions with full structure (e.g. 'it is a what?')", then it is probing questions that appear more frequently (55%) than echo questions (45%) in child-directed speech" [2]. Crucially, instead of rising prosody at the end of the question, probing questions have constant or lower prosody at the end of the utterance. [2]. Before further exploring probing questions, I will briefly discuss wh-questions generally.

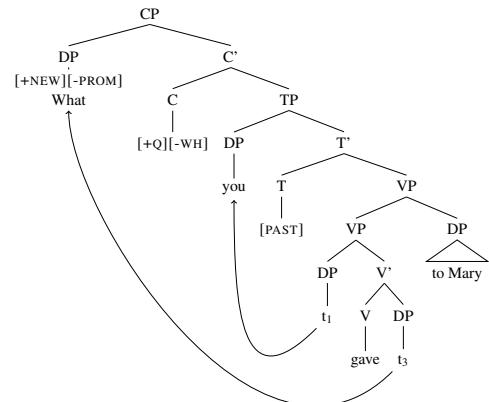
2 Three Types of wh-questions

In the initial paradigm for investigating children's ability to distinguish between wh-questions, we

dealt with *info questions*, *echo questions*, and *probing questions*. Below, these three types of questions are represented in a simplified X-bar theory tree structure.

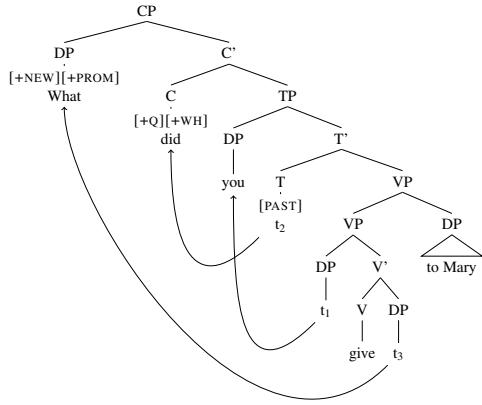


The tree above constitutes the syntactic structure of a *probing question*. However, as I will discuss later, probing questions have movement at LF, represented below:



Interestingly, the feature +NEW "represents information that has not [yet] been mentioned in the discourse. By simply switching the feature from + to -, one is able to generate an echo question, implying that the asker *misheard* something in the conversation. Both of these questions are wh-

in-situ, yet they have different information sensitivity and are thus entirely different. Finally, there are information questions which are a canonical case of A-bar movement. This question's structure is represented below.



Here, movement is motivated by the head features of the complementizer, generating an information question using [+Q] and [+WH] on C [3]. However, based on data from Hungarian, Nguyen has posited an information structure analysis which will be further discussed later.

3 Analyses of Probing Questions

Nguyen has analyzed probing questions along three linguistic areas: pragmatic, phonological/morphological, and syntactic.

3.1 Pragmatic

Despite there being no systematic analysis of probing questions in the literature, there have been minimal explanations of the phenomenon as a type of echo questions. They are typically referred to as "quiz questions, exam questions..." and "fill-in-the-blank questions" [2]. They are commonly asked when the asker already knows the answers and wants to verify that the askee *also* knows the answer. One crucial difference between echo and probing questions pragmatically is that whereas echo questions have a "closed set of answers", probing questions accept any new information or even the answer, "*I don't know!*". Because of this and further analyses, it is clear, however, that even though they are both in-situ, echo and probing should *not* be grouped together.

3.2 Phonological

As stated previously, probing questions exhibit a falling prosody toward the end of the utterance. This prosody difference (echo questions rise) is easily distinguishable for adults. Additionally, there is no *stress* on the wh-phrase in a probing question, while there *is* stress in an echo question.

3.3 Syntactic

Using an acceptability test on both echo and probing questions with *two* in-situ wh-phrases, Nguyen has discovered that native speakers find this structure *more acceptable* for echo questions than for probing questions. The questions took the structure of the following:

- (1) The man went where when? *probing*
The man went WHERE, WHEN? *echo*

This indicates that echo questions don't experience locality effects (no covert movement of the wh-phrase) whereas probing questions have locality at LF (overt and covert A-bar movement subject to same constraints) [2][4][5]. Finally, building on an information structure analysis [6] Nguyen posits a rethinking of *echo, probing, and info* summarized in a chart below:

Type	Features	Mvt
Echo	[-NEW][-PROM]	No Mvt
Info	[+NEW][+PROM]	Overt A-bar Mvt
Probing	[+NEW][-PROM]	Covert Mvt
Surprise Echo	[-NEW][+PROM]	No Mvt

The features for the wh-phrase are, "based on the part of the answer it corresponds to". This means, that if someone asked *What did you eat?* and you reply, *a cake*, the feature set for the wh-phrase is [+NEW], [+PROM] since this is the information status of the answer given. The features are outlined below:

1. +PROM - an answer to a question is prominent if the next conversation is about that answer (the answer determines the feature for the wh-phrase). Motivates overt movement.
2. -PROM - an answer is not prominent if the conversation can move on to any other topic and is not restricted to the answer itself. Motivates movement at LF.

3. +NEW - represents new information, not yet mentioned in the discourse (does not have to be used for information seeking). This feature motivates wh movement.
4. -NEW - represents information already discussed within the discourse. This feature forbids wh movement.

Here, it is tempting to consider an OT representation for the typology of wh-questions across the English language, but this is not possible since GEN generates its candidate set *cross-linguistically*. Instead one must use another form of OT since the phenomenon of probing/echo is not strictly syntactic (it is also semantic/pragmatic) and it occurs within a single language. Bidirectional OT takes into account the production of language and integrates it with the interpretational aspect of language - effectively optimizing along syntax and semantics [7]. A BiOT analysis would work for this problem, but I will not represent that here.

4 Child Stimuli

In order to investigate whether children can distinguish between different types of wh-questions, specifically in terms of prosody, Nguyen developed an initial paradigm for studying both comprehension and production.

4.1 Comprehension

This initial comprehension story presented characters in the story with three possible answers to a question they did not know the answer to. This ambiguity results in unclear/unspecific utterances from one of the characters in the story, prompting a listener of the story, *the alien*, to ask either an info question, a probing question, or an echo question, which the child is expected to answer. The three types of questions are equally distributed throughout the comprehension task. Because the children in the story always make ambiguous guesses, the participant is forced to answer based on *prosody, and pragmatics*. If they hear an echo-type question, they should repeat what the character in the story said as their guess, whereas if they hear an info or probing type question, they should give a specific answer, different from that of the interrupting alien. The voice of the alien is recorded to achieve consistent prosody.

When this paradigm was tested on adults the results were not perfect since about 1/3 of the participants responded by repeating what was said by Jilly (answering an echo question), 1/3 responded with a more specific answer (answering an information or probing question), while 1/3 alternated, leading us to think that adults might have different grammars for echo/probing, resulting in this unexpected distribution. This was doubtful, however, since prior results had shown that adults are capable of differentiating based on prosody alone. Additionally, we worried that adults may have been choosing one type and then sticking with it for the remainder of the story, or may have been thrown off by oddities in the story. Manifestly, the stimuli is a *story*, not a conversation. This fact may have caused confusions pragmatically since echo questions are typically used in conversation.



Figure 1: Characters in the story are given a choice between a hospital, apartment, and bookshop. A character guesses, "I think the man went to the white building", introducing ambiguity, and then creating an opportunity for an *echo question*.

4.2 Attempts to Fix the Stimuli

Since children and adults were both not responding to the stimuli as expected, we made several modifications to the comprehension story. First, we gave a disclaimer in the introduction that the alien listening to the story had (1) problems understanding human language, and (2) forgot his glasses so would have trouble seeing things on the screen. These modification were part of an effort to make more realistic the pragmatic context of the stimuli, yet, they were too subtle for both children and adults, *even* after we gave participants reminders of the alien's deficiencies *throughout* the task. Once we realized these modifications had not worked we attempted to further emphasize the pragmatic context by obstructing events

on the screen before the alien asked an info question, and also playing annoying noises, right before the alien would ask an echo question. Adding



Figure 2: This scene from the story shows an attempt to obscure the map from the alien’s view (the smoke floats over and covers it up) causing him to ask a info-seeking question.

these additional pragmatic hints did not, however, make the stimuli more clear to participants, neither child nor adult, and we realized that we had overcomplicated the stimuli too much, making it difficult for the participants to even comprehend prosodic variation.

4.3 Additional Concerns

One remaining concern was that the stimuli felt unnatural - the alien was presented as a listener to the story, yet he simultaneously asked both echo, probing, and info questions. This fundamentally didn’t make sense since there is no clear reason that peers in a classroom setting would sporadically *quiz* one another over the course of a story. This led us to make some simplifications and modifications to the stimuli resulting in a new paradigm.

4.4 Amazon Mechanical Turk

Though I did not design the AMTurk stimuli, I helped send them out to some adults to demo them before deployment. By running a meta-linguistic task on AMTurk, we came to the conclusion that adults were in fact able to distinguish between these two types of questions, yet an issue with the stimuli was preventing them from answering with greater accuracy. These issues are discussed in the section below.

4.5 New Paradigm

In the new paradigm we first eliminated information questions from the stimuli altogether since

their possible answer set is the same as that of probing questions, and this caused the stimuli to consist of 2/3 questions requiring specific answers and 1/3 questions requiring verbatim repetition. This constituted an *unbalanced* set of questions, which was deemed undesirable. Next, we removed the pragmatic hints from the story, including the disclaimer that the alien had problems seeing and hearing. Next, instead of giving the alien the role of interrupting to ask a question, now he responds to an expression of doubt by one of the characters in the story (“*Jilly: I wonder where the man went?*”), and then makes a guess himself (previously one of the characters would make this guess). Of course, his guess also is *too general* forcing the participant to distinguish between the two types of questions to form a pragmatically sensible and well-formed answer. This enables the storyteller in the task (myself) to plausibly ask both probing and echo type questions. Why? Since teachers frequently quiz their students, but also tend to mishear them when students interject their thoughts, both types of questions are allowed for the teacher/storyteller role. Now to maximally emphasize the pragmatic context, I lean forward and place my hand over my ear to signal an echo question (while also using rising intonation). This has largely fixed the stimuli for adults and eliminated much of the unnaturalness, with our first adult participant receiving a 100%. Though children still make errors and do not reach 100%, they no longer stick to one type of question for the whole story.

4.6 Mental Lexicon

Recently, we have noticed with some questions, children seem to default to the echo answer, repeating what the alien said. One example is outlined below:

Jilly: I wonder where the man got the apples from?

Alien: I think he got the apples from the store!

Will: The got the apples from where?

*Child: *Searches for the word supermarket in their mental lexicon, doesn't find it, produces*: From the store!*

Because children lack the words for some nouns, they default to whatever the alien said

seconds before. This is not typical, but it may explain errors in some cases. It is important to note that children, when they don't know the name for some noun in the story (and are not able to produce the name) usually point to that object on the screen. This indicates that when a child defaults to an echo question, they may have the word in their mental lexicon, but simply forgot the name, or didn't see what conspired on screen.

5 Production

The production task centers around a character in the story named *Beeple* who is an alien, unfamiliar with human culture. This motivates a game that the participant plays with Beeple, asking him questions to see if he *knows* about a given thing on Earth. The child is asked to produce questions like, "Hey Beeple, that is what on the table."



Figure 3: Will: Let's ask Beeple if he knows about the food the boy is eating! Child: Hey Beeple, What is the boy eating?

5.1 Different Registers of the Language

During the production task, it is typically very difficult to have children repeat even one probing question let alone produce them naturally. Thus, we were surprised when we heard one participant utter a question of the form, "*That is a what?*" directed to her younger sister on our walk down to the parking spot. This led us to believe that children may default to their more formal register of the language in our classroom setting. This, in turn, creates a strong bias against producing probing questions which are deemed too *informal*.

5.2 Constraints on Production

Based on the realizations noted above, it may that, for the production aspect of the language faculty, the register of the language and the pragmatics of

formality block more economical candidates such as the probing question.

5.3 New Questions

While brainstorming improvements for the production task, we considered implementing a slide in which the child is presented with a scenario involving coordination. Imagine a table with an apple *and* an orange on it. Knowing that children struggle to produce in-situ questions and in many cases find it very unnatural, it might be interesting to investigate whether children will violate the coordination constraint in order to avoid asking a probing question. From the limited testing we did with this particular stimuli, we quickly noticed that this setup posed an even greater difficulty for children. When children are asked to repeat a question such as, "Hey Beeple, that is an orange and what on the table?", they principally answer with *apple*. It then requires several repetitions of the explanation of the scenario to the child in order to get them *even* to repeat the question. This change seemed to make children even more reluctant to produce the target question.

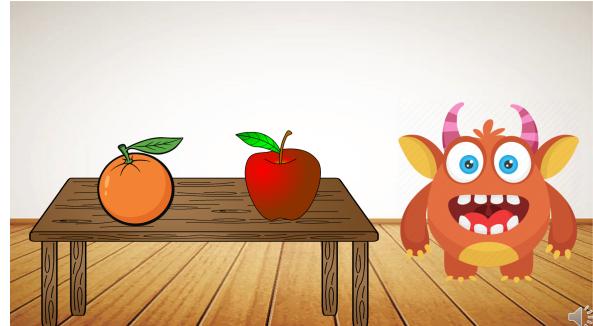


Figure 4: "Hey Beeple, that is an orange and what on the table?"

6 Conclusion

My work as a research assistant over the summer was very rewarding and valuable. I developed a stronger understanding of the field of child language acquisition and the *methodology* used to investigate questions in this domain. I learned how a linguistic theory can be studied empirically, not only through child studies, but with metalinguistic tasks, prosody identification tasks, and acceptability tasks for adults. I also spent time recruiting my friends as adult participants which usually made for some funny interactions when we asked these adults such cerebral questions as,

"Could you help Billy decide what he wants to drink: hot chocolate, milkshake, or apple juice?"
Additionally, I spent a great deal of time memorizing stimuli and working closely with children which was on the whole rather fun!

7 References

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