

# Question answering as a Language-game

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**Abstract.** Semantic technology research has tried to add a new layer of meaning to data to make it more accessible. As part of that, question answering system has facilitated interaction between human and computer by enabling communication in natural language. The primary focus of question answering system research has been on the analysis of the question in the sense that the answer can be predicted from the syntax and the semantics of the question. The more fundamental problem, however, lies in the pragmatic use of the question-answer pair beyond the question itself. In this paper, we elucidated how pragmatics can be integrated into a question answering system by introducing Extended Speech Act Theory and presenting real-world examples from our system. With this approach, it is anticipated that errors in the system be rectified and deeper inferences be drawn beyond the surface meaning of the speech.

**Keywords:** Question answering system, Question Analysis, Speech Act.

## 1 Introduction

Semantic technology research has tried to add a new layer of meaning to data to make it more accessible. As part of that, question answering system has facilitated interaction between human and computer by enabling communication in natural language. The primary focus of question answering system research has been on the analysis of the question in the sense that the answer can be predicted from the structure(*syntax*) and the meaning(*semantics*) of the question. The more fundamental problem, however, lies in the pragmatic use of the question-answer pair beyond the question itself. The following example illustrates one of the most frequent error cases that our system created:

- **Question:** What is a Silver Surfer?
- **Expected Answer:** ‘Silver Surfer’ refers to the elderly who are familiar with smart devices including smart phones, tablets, laptops, etc.
- **Generated Answer:** The Silver Surfer is a fictional superhero appearing in American comic books published by Marvel Comics. The character also appears in a number of movies, television, and video game adaptations. The character was....

In the above example, the question is raised about the Silver Surfer and the answer does give a complete description of the Silver Surfer. In principle, the generated answer is the best in that the question is well understood in terms of syntax and semantics and

the more probable entity is selected from those that are named ‘Silver Surfer’. Yet, the generated answer is not a good one because it is not satisfying the user’s need. The user and the system have entirely different ideas in mind: the user wants to know the meaning of a sociological concept ‘Silver Surfer’, while the system describes a very popular fictional character ‘Silver Surfer’. Since this type of error case accounts for one third of total errors, emphasis should be given on the pragmatics as well as on the syntax and semantics which is responsible for the gap between the user and the system.

Here, we propose a new approach where (1) the question or the answer is considered to be a speech act with a performative function and (2) the question or the answer is processed in pairs with the consecutive response as in a turn-based game like chess, so that question answering system provides more appropriate answers to the user. First, we will give a brief introduction of Speech Act Theory and Extended Speech Act Theory upon which the idea of question answering as a language-game is grounded. Second, we will describe how the idea works in a question answering system.

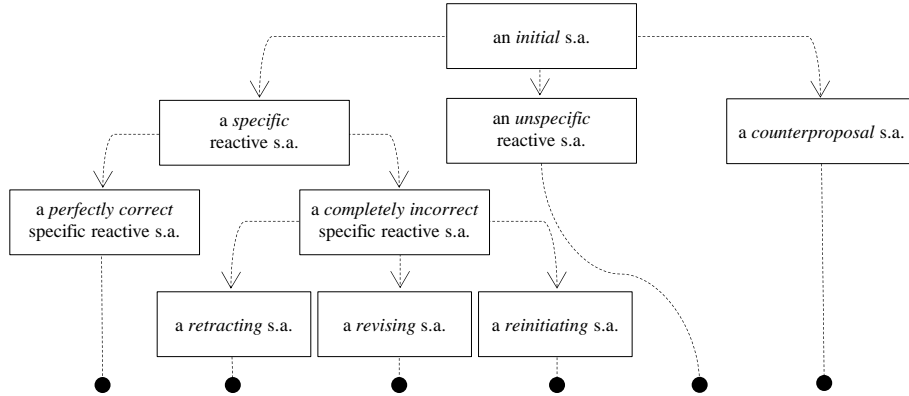
## 2 Extended Speech Act Theory

A speech act, which was first conceptualized by Austin[1] in the philosophy of language, postulates that delivering a speech(or an utterance) is an act(*a locutionary act*) accompanied by the intention of the speaker(*an illocutionary act*) and the understanding of the hearer(*a perlocutionary act*). According to Searle[5], who refined the concept of speech act and proposed Speech Act Theory, the speech act can be broadly classified into five categories: (1) *Representatives*, (2) *Directives*, (3) *Commissives*, (4) *Expressives*, and (5) *Declarations*. As researchers from linguistics accepted the theory and elaborated the categories and the subcategories, a great number of classifications have been proposed and some of them have been adopted for computer systems[2, 3].

However, the existing speech act classifications are not suitable for question answering system because they are too numerous and too dispersed. To put it simply, a question is always classified as a *Directive* among Searle’s five main categories since it attempts to get the hearer to answer the question; and thus, the subcategories of this single category are not sufficient for question answering system to give pertinent answers to every different type of questions. On that occasion, it can be complemented by Extended Speech Act Theory[4].

According to Extended Speech Act Theory, every speech, whether a question or an answer, is a turn in a dialogue much like a turn in a chess game; that is, the speech act of a speech is determined not by the speech itself but within the relationship of the question-answer pair. For instance(see Fig. 1), when given an initial speech act of a question, there could be generally three possible reactive speech acts: (1) *a specific reactive speech act*, (2) *an unspecific reactive speech act*, and (3) *a counterproposal speech act*; and depending on the reactive speech act, there could again be a few possible re-reactive speech acts(see Table 1): assuming that the system generated a specific but completely incorrect answer, (1) *a retracting speech act*, (2) *a revising speech act*, and (3) *a reinitiating speech act*; and this process would continue recursively as there are no more than six choices in the turn-based dialogue, i.e., a language-game. Since

speech acts are greatly reduced in number to six (see Fig. 1) but contain more relational information in Extended Speech Act Theory, it is reasonable to adopt the turn-taking game metaphor for question answering system.



**Fig. 1.** A modified diagram of Extended Speech Act Theory for question answering system. The turn-taking of speech acts starts from the top to the bottom, and it can continue recursively from the six terminals of the bottom. s.a. = speech act.

**Table 1.** Re-reactive speech acts to a specific but completely incorrect reactive speech act, as for the example of Silver Surfer.

	Type of speech act	Example
(1)	A <i>retracting</i> speech act	No, thanks. / Never mind.
(2)	A <i>revising</i> speech act	Wasn't it related to a social phenomenon?
(3)	A <i>reinitiating</i> speech act	What kind of people are called Silver Surfer?

### 3 Question answering as a Language-game

When considering question answering as a language-game on the basis of Extended Speech Act Theory, it is possible not only to correct an error but also to make use of the user's response to extend the comprehension between the user and the system. In the following, we will give examples for each case.

- **Question:** When is the Ugly Duckling on?
- **Expected Answer:** Friday night at 11:20 p.m.
- **Generated Answer:** The Ugly Duckling is a literary fairy tale by Danish poet and author Hans Christian Andersen.
- **Expected Re-reaction:** I was talking about the Ugly Boy.

In the above example, the user made a mistake in replacing the name of a Korean TV show 'the Ugly Boy' with the name of a classic children's story 'the Ugly Duckling', as dominated by the more familiar phrase 'the Ugly Duckling'. Yet, the user recognizes something went wrong as soon as the specific but completely incorrect answer

is generated. Then, by means of the turn-taking functionality, the user is to react with a revising speech act and the system is to give the right answer in a few revising steps. After all, the user and the system are interacting conversationally, narrowing the gap and correcting the error in search of the final answer.

- **Question:** What is the nationality of the author of the Big Picture?
- **Expected Answer:** United States.
- **Generated Answer:** The Big Picture is written by Eric Latigo, Laurent de Bartillat, Douglas Kennedy, Emmanuel Berco, or Bernard Jin.
- **Expected Re-reaction:** What is the nationality of Douglas Kennedy?

The above example shows a double-layered question where the system should first find the author of the Big Picture and then the author's nationality. As the system failed to narrow down the author, it has brought all of them out as the answer. As for this turn-taking question answering system, the user is to choose one on the list relying on his or her intuition and the system is to give the answer, reflecting the user's intuition and thereby deepening the understanding of the user and the context.

## 4 Conclusion

In this paper, we elucidated how pragmatics can be integrated into a question answering system by introducing Extended Speech Act Theory and presenting real-world examples from our system. With this approach, it is anticipated that errors in the system be rectified and deeper inferences be drawn beyond the surface meaning of the speech. To reify the idea of question answering as a language-game, we are planning to conduct an experiment for future work, so as to build a small corpus from which to analyze and classify human reactions.

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