

# Identifying Topic Shift and Topic Shading in Switchboard

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## ABSTRACT

This paper highlights some of the ongoing work on the ADELE project, namely the identification and annotation of topic shift and topic shading in the Switchboard-1 Release-2 corpus. The purpose of this is to train an Artificial Neural Network to create a digital companion for the elderly that can communicate through informal, yet informed social dialogue, on a variety of topics of interest to a user over a prolonged time scale. To this end the project is focussing on topic shift and shading, the mechanisms which underpin the development of such conversations [6, 8]. In the past, dialogue systems have predominantly focussed on practical tasks due to the complexity of modelling realistic everyday social talk [1]. With increasing awareness of the need for home robots and virtual home care agents to help assist in the provision of care for a rapidly ageing population, it is necessary to develop a more caring, involved, and personalised virtual care agent capable of such social dialogue.

## KEYWORDS

Topic Shift, Topic Change, Spoken Dialog System

### ACM Reference Format:

Brendan Spillane, Emer Gilmartin, Christian Saam, Leigh Clark, Benjamin R. Cowan, and Vincent Wade. 2018. Identifying Topic Shift and Topic Shading in Switchboard. In *Proceedings of ACM Conference (Conference'17)*. ACM, New York, NY, USA, 2 pages. <https://doi.org/10.1145/nnnnnnn.nnnnnnn>

## 1 INTRODUCTION

The ADELE Personalized Intelligent Companion is a virtual agent which is being designed to be capable of engaged, yet natural and informed, casual conversation. It will assist a user not only in small tasks that the user initiates but in more prolonged dialogue to inform the user of news, events and other information of interest through natural social conversation, using a mix of user and agent-initiated interaction. To achieve these aims the companion will engage the user in conversations that employ a natural mix of linguistic and paralinguistic devices to give and seek information, but also to entertain. This may carry elements of task execution but will to a large extent comprise social talk. Accordingly, topic, style, and register must be varied at levels ranging from lexical and syntactic to socio- and dialectal pronunciation, to tone of voice, speed and rhythm.

## 2 TOPIC SHIFT AND TOPIC SHADING

In any social conversation, the topic being discussed changes based on a host of factors. As such, it is nigh on impossible to predict the path of a normal conversation between two people. It is this random, yet mostly smooth transition, from one topic to another that often differentiates real conversation between two people and that between a person and an artificial agent. In the past, many systems bounded any possible interaction by limiting the range of possible responses that could be recognised by the agent, e.g. limited speech or buttons. Such approaches meant that the agent did not have to deal with the variability of a normal conversation, but this also limited the naturalness of the interaction.

However, to properly interact with a person in a more natural conversational form, ADELE must be able to identify, strategise, render, and initiate topic shift and topic shading in a conversation. There are several reasons for this. Firstly, it will allow ADELE to be able to change the course of a conversation, thus limiting awkward disjunctions. Secondly, it will enable ADELE to more easily and more naturally follow a conversation strategy, such as reminding or prompting the user to take medication or engage in exercise. Thirdly, it will enable ADELE to form more natural dialogue. Fourthly, it will be able to better identify topic shift or shading by the user which is a sign they want to reorient the conversation.

To this end, three research questions have been formed:

- When is it the right time to interrupt the user?
- How do we render the interruption?
- How do we do it?

### 2.1 Topic Shift

It is a truism of research that when no agreed definition of a term exists, researchers tend to break it down and define different facets of it. Topic shift is one such example. With no general definition, other than the 'aboutness' of what is being discussed, several attempts have been made to define individual aspects of it. In their analysis of topic shift, Garcia and Joannette maintain that most authors agree that there are at least three, and possibly five types of topic shift; a shift to a new unrelated topic; a shift to a previously discussed topic; and a shift related to the previous utterance. They also point out that Crow categorizes two additional types of topic shift; noncoherent and insert. [3, 4].

As Ries points out in his highly relevant work on segmenting naturally occurring dialogue in meetings by topic, initiative, and style: "A theoretically pleasing definition of topic that could be applied

reliably in practice doesn't exist currently." [8]. He also points out that Passonneau and Litman have discussed the issue of definition in some detail [7]. Ries adopts the approach of Hearst, who previously demonstrated that naive, largely untrained or linguistically inexperienced coders can generate high levels of agreement even compared to trained coders when asked to place segment boundaries between and identifying topic shift in meeting dialogue.

While topic shift may not have an agreed upon definition, there is a long history of definitions of the term 'topic'. Lambrecht's defines it as: "*The topic of a sentence is the thing which the proposition expressed by the sentence is ABOUT*". He also points out that these definitions goes back to Aristotle and has been used by several of the most prominent contemporary linguists including Kuno, Grundel, Chomsky, Dik and Reinhart [6]. Certainly, it seems that this definition is the most appropriate to draw upon and expanded to describe larger multi-sentence level topics within a conversation. Consequently, as a general definition for this research, topic shift is as a change in the 'aboutness' of the topic of the discourse.

The approach of Ries will be adopted in part by the ADELE project. Two researchers have been recruited to annotate a subsection of the Switchboard corpus for topic shift and shading. However, they will be provided with Lambrecht's definition of topic. Once a sufficient subsection of the corpora is annotated, the subsequent aim involves attempting to train a model to automatically identify or aid in the identification of topic shift in the rest of the corpus to speed up the approach.

## 2.2 Topic Shading

This research uses the definition advanced by Crow who maintains topic shading: "*introduces a new topic by first establishing its relevance to or connection with the topic that has been on the floor*" [3]. An example of topic shading is:

**Speaker 1:** "*My connecting flight was delayed in New York*"

**Speaker 2:** "*Oh that's terrible, I actually lived in New York for a summer when I was in college, it's a great city!*"

In the first sentence, the topic is the delayed flight. In the second, it is New York. Topic shading is much more common than topic shift. A topic shade may result in a topic shift, if the conversation turns to the new topic the shade introduced. In the above example, a topic shift would occur if Speaker 1 then continued the conversation about New York. If Speaker 1 does not accept the topic shift, then it is treated as an aside to the conversation.

The ADELE project aims to investigate if it is possible to identify sufficient examples of topic shift and topic shading in Switchboard and possibly other existing corpora, and then to see if it is possible to train an Artificial Neural Network to reproduce such in order to more closely simulate the chat phases of natural conversation. It will also enable us to begin answering the aforementioned three research questions.

## 2.3 Identifying Examples of Topic Shift and Topic Shading in Existing Corpora

The first of the corpora being investigated is the Switchboard-1 Release 2 (LDC97S62) [5]. This is a corpus of approximately 260

hours of speech, containing circa 2,400 two-sided telephone conversations originally collected for a project on automatic speech recognition. This corpus has already been transcribed and had its individual dialogues annotated [2].

When the original dataset was collected, a computer driven robot operator handled the calls, and introduced a topic for discussion between the two parties, from a set of 70 topics, 50 of which were used regularly. The resulting conversation was recorded into separate channels. From an initial investigation of the corpus, it is believed that there may be sufficient examples of topic shift and or topic shading to train the Artificial Neural Network.

There are three issues the ADELE project is cognisant of with identifying examples of topic shift and shading in the switchboard corpus. Firstly, it is a corpus of phone conversations between two strangers and not natural face to face conversation between friends or colleagues. As such, the dialogue is likely to contain less of the social talk ADELE is looking for. Secondly, the participants were provided with an initial topic of discussion to initiate their conversations. Consequently, there may be limited examples and quantities of topic shift compared to natural dialogue. Thirdly, if topic shift and shading do exist in sufficient quantities, they may be too formulaic, firstly because it is not natural dialogue, and secondly because many of the conversations would have started on the same initial topic.

Despite these issues, there is no more appropriate existing corpus in existence that will provide us with the data we require. Thus, Switchboard has been chosen for three reasons. Firstly, based on an initial inspection of the corpus it is believed that the appropriate and sufficient examples of topic shift exist. Secondly, complete answers to the three aforementioned issues will not be known until we begin this endeavour. Thirdly, the process will inform the possible collection of a future more appropriate corpus to train ADELE on.

It is also possible that the CallHome Corpora (LDC97S42) will also be investigated in future. It consists of 120 unscripted 30-minute telephone conversations predominantly to family members or close friends.

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