Theirs not to reason why:
Dialogical reasoning for conversational artificial agents.

Conversational artificial intelligence (AI) systems are notoriously bad at conversing with humans in a natural way. One of the major reasons for this is that interacting with others frequently involves making common-sense inferences linking context, background knowledge and beliefs to utterances in the dialogue. These inferences are often *enthymematic*, that is, the premises given do not by necessity lead to the conclusion. As discussed by Brandom (1994), in a dialogue, it is important to know what dialogue participants are committed to, which is underdetermined by what they say. This is apparent in the practice of 'giving and asking for reasons' (which often takes the form of 'why?' questions and their responses, Schlöder et al., 2016), as in example 1, below, where the dialogue participants make some of these implicit premises explicit.

Example 1:
        Dave: ...you're gonna be home from football until four, you gonna have your
                 dinner, want a bath.
        Lee: Yeah, but I might not go to school tomorrow.
        Dave: Why?
        Lee: Cos of my cough.
        Dave: How can you play football and not go to school then?
        Lee: Cos I was going out in the fresh air, I'm alright when I'm out in the fresh air.
        Dave: So why aren't you going to school then?
        Lee: I'm in the class room all day dad.

[BNC KBE 10554-10561]

If a dialogue participant presents the argument "P therefore Q" (as Lee does, when he states that he has a cough so therefore might not go to school tomorrow), an interlocutor must supply a warrant that P is a valid reason for Q in order for the argument to be successful (e.g. if someone has a cough then they are ill and if they are ill then they might not go to school). In rhetoric, these warrants are often referred to as topoi. To produce and interpret enthymemes, interlocutors thus draw on background knowledge or contextual information, and for an enthymeme to be accepted, some such information must be accommodated if it is not already present in the discourse model.

One of the problems for conversational AIs is that the set of topoi accessed by an agent does not constitute a monolithic logical system. This means that in the resources of an agent there can be contradicting topoi, or topoi that lead to contradicting conclusions (Breitholtz, 2014). In addition to this, which topoi apply in a particular situation, and which topos takes precedence over another is relative to the context, including the agent itself. In example 1, Dave invokes another topos that contradicts Lee's reason for not going to school, namely 'if someone is well enough to play football then they are well enough to go to school'. Thus, the pragmatic meaning conveyed by an enthymeme in relation to a listener may differ depending on which topos the listener accesses in the interpretation process.

Understanding how humans reason is important for interactive artificial intelligence (AI) in general whether it uses natural language as such or not. It is important that AI systems are able to explain why certain choices have been made by the system ("explainable AI"). This is a challenge to many current systems in particular those using machine learning, even where they

may be able to draw appropriate conclusions, e.g. in the context of medical diagnostic tools (London, 2019).

In this talk we will present an approach to dialogue modelling where enthymemes and topoi play a role for interpretation and production of conversational moves. We will present some phenomena which are frequent in dialogue and how these are related to enthymematic reasoning, and suggest how these may be formalised. This work is intended to provide a basis for building useful context-aware dialogue agents. For such agents to realise their full potential to assist humans in everyday and professional life, they need to be able to reason together with humans through interaction in the form of natural language dialogue.

Brandom, R. (1994) *Making it explicit: Reasoning, representing, and discursive commitment*. Cambridge, MA: Harvard University Press.

Breitholtz, E. (2014) *Enthymemes in Dialogue: A micro-rhetorical approach.* Ph.D. thesis, University of Gothenburg.

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Schlöder, J., Breitholtz, E. and Fernández, R. (2016) "Why?" In *Proceedings of the 20th Workshop on the Semantics and Pragmatics of Dialogue - Full Papers,* pp. 5-14.