Non-Monotonicity and Conditionals in Dialogue Logic

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1 Introduction

In this paper we will present some results of our work in the area of so-called dialogue logic. This is an approach to the study of logics that treats the concepts of inference and proof not as pure grammatical or semantic notions — like the axiomatic and model-theoretic approach — but as inherently pragmatic notions. It is an overt, externalized argumentation that is counted as a proof by a company of language users. This idea is formalized by treating inferences as idealized formal dialogues between two parties taking up the roles of Opponent and Proponent of the issue at stake, called the principal Thesis of the dialogue. The Proponent has to try to defend the Thesis against all possible allowed criticism of the Opponent, thereby being allowed to use eventual statements that the Opponent has made at the outset of the dialogue (the initial Concessions). An inference of the formula $T$ from a set of premisses $\text{Con}$ is a proof of $T$ from $\text{Con}$ if and only if a Proponent with initial Thesis $T$ succeeds in defending $T$ against all possible allowed criticism of any Opponent that initially admits $\text{Con}$. In the jargon of game-theory: the Proponent has a winning strategy for $T$ relative to $\text{Con}$.

A series of rules specifying the initial positions, the allowed moves during the exchange and the end positions define what exactly is to be counted as a formal dialogue. Of special interest are the so-called striprules that define the meaning in use of the logical connectives. They specify what is to be counted as an allowed attack and possible defense of a statement containing these connectives. Table 1 presents these rules for the standard connectives. Using the rule for implication as an example, the table is to be read as follows. If a party $N$ — i.e. either Opponent or Proponent — utters the sentence $U \rightarrow V$ then the other party, $\overline{N}$, is allowed to attack the sentence by stating (?)$U$ (“okay, let us suppose that $U$”). The former party then has the right, indicated by the square brackets, to defend itself by stating the sentence $V$ (“all right, if you have accepted $U$ for the sake of argument, then I will continue with $V$”).

It is possible to construct rule systems for dialogues in such a way that they are provably equivalent to standard classical, intuitionistic and minimal logic.
The formal apparatus used to describe such dialogue systems is structurally similar to the techniques used in semantic and deductive tableaux. Here we refer to the work of Barth and Krabbe [BK82].

What we are going to do in the following is to extend these standard dialogue systems to non-standard systems in that we will introduce a new logical operator, \( F \), into the language. Its dialogue rules are sketched in Sect. 2. We will show in Sect. 3 how this fail-operator can be used to model indicative conditionals and counterfactuals. Finally, in Sect. 4 we will present a particular subsystem of the newly developed logics that makes maximal use of the inferential features of PROLOG. As such we expect this subsystem to be efficiently implementable as an extended PROLOG system.

## 2 A Dialogical Failure Operator

In this section we will introduce a new operator, \( F \), into the standard logical languages and present its dialogical meaning. The sentence \( F\alpha \) is to be interpreted as "\( \alpha \) is not winnable relative to the concessions in this dialogue". Thus, sentences with fail-operator say something about the dialogue in which they themselves are contained. To make the meaning of \( F \) more precise we need some extra formalization. We will limit our explanation to the case of dialogues with propositional languages. The extension to predicate-logical languages is straightforward.

In traditional dialogue logics the concept of a winning strategy is defined relative to the dialogical roles of Opponent and Proponent. For the introduction of the fail-operator we have to redefine this concept in terms of the actual parties that play these roles. We will call them Black and White. As a convention we will start all dialogues with Black playing the role of Opponent and White the role of Proponent. A formula \( T \) will be called provable, or winnable, relative to a