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Speech acts, fallacies and dialogue systems

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ABSTRACT: The paper aims to bring together and unify two traditions in studying dialogue as a game: dialogical logic introduced by Lorenzen (1978); and persuasion dialogue systems as specified by Prakken (2006). We propose a system which allows the elimination of both informal and formal fallacies (van Eemeren & Grootendorst, 2004). To this end, we reconstruct dialogical logic in terms of speech acts as suggested in (Hodges, 2009).

KEYWORDS: dialogue systems, dialogical logic, formal fallacies, speech acts, Lorenzen-style natural dialogue

1. INTRODUCTION

The paper aims to bring together and unify two traditions in studying dialogue as a game. First tradition was initiated by the dialogical logic introduced by Lorenzen (Lorenz & Lorenzen, 1978). This system allows the representation of *formal dialogues* in which the validity of argument is the topic discussed. Persuasion dialogue systems as specified by Prakken (2006) represent second tradition which focuses on *natural dialogues* and examines processes typical for real-life communication such as e.g. informal fallacies (Hamblin, 1970).

Studies on a system in which players can not only perform a dialogue without fallacies, but also discuss about the formal means of reasoning is important for modelling communication. The need of such possibility was introduced in (van Eemeren & Grootendorst, 2004). According to the rule 6 of the critical discussion model, the antagonist may not only challenge the propositional content of premises used by the protagonist, but also the justificatory force (i.e., validity) of his reasoning. The pragma-dialectical system requires that the protagonist uses rules of some logic to defend his reasoning, but it does not provide a formal account of dialogues.

Lorenzen-style dialogue games allow players to check the validity of the formulas in a dialogical way. Yet, those games are not designed for modelling real-life communication, e.g. in the systems for natural dialogues players can use different speech acts for making their locutions (e.g. *claim*, *question*), while in Lonrenzen's game they can only attack and defend formulas (e.g. defend $A \wedge B$). This does not allow players to verify the validity of the formulas in the style of natural dialogues. The solution of this problem is to specify Lorenzen's dialogical logic in

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terms of speech acts:

> Lorenzen claimed that the rules of his games could be justified on a pre-logical basis, and so they formed a foundation for logic. Unfortunately any „justification" involves a convincing answer to the Dawkins question [i.e. what is the real aim of a game], and this Lorenzen never provided. For example he spoke of moves as "attacks", even when (...) they look more like help than hostility. To repair Lorenzen's omission, one certainly needs to distinguish between different stances that a person might take in an argument: stating, assuming, conceding, querying, attacking, committing oneself. (...) A more positive view is that this kind of refinement serves to link Lorenzen's dialogues to informal logic, and especially to the research that aims to systematise the possible structures of sound informal argument. (Hodges, 2009)

In other words, Lorenzen dialogues should be modelled in such a way that players could perform not only "technical" moves such as an attack and defence, but also moves in which their speech acts are explicitly expressed as e.g. claims or challenges. To this end the paper introducing the reconstruction of the dialogical logic according to the generic specification for natural dialogues proposed by Prakken (2006).

2. BACKGROUND

In this section two models of communication are presented: the dialogical logic for formal dialogues introduced by Lorenzen (2.1), and general specification for natural dialogue introduced by Prakken (2.2).

2.1 Lorenzen's dialogical logic

Lorenzen's system (Lorenz & Lorenzen, 1978; see also Rahman, 2006) was designed to verify the validity of logical formulas by performing a dialogue game. In each game two players can participate: *proponent P* of a formula, and *opponent O*. During the game they can perform two types of moves: *attack* or *defence* of a formula. The reconstruction proposed in this paper is limited to the rules for verification of tautologies of classical propositional logic.

A *dialogue* for a formula *A*, D(*A*), is a set of dialogue games consisting of sequences of moves. Depending on which player makes the move, we talk about *P statement* and *O statement*, where statement denotes an attack or defence of a formula. If there is an exchange of move such that after a player $X \in \{P, O\}$made a move and there is no more legal move for player $Y \in \{P, O\}$left, then *Y* loses the game. A formula $A$is valid iff *P* has a winning strategy for A.

Dialogical logic is specified by two types of rules. The *structural rules* determine the general course of the game:

(D00) *P* makes the first move, then *O* and *P* take turns in performing moves,
(D10) *P* may assert an atomic formula only after it has been previously asserted by *O*,

(D13) A *P*-statement may be attacked at most once,
(E) *O* can react only upon the immediately preceding *P*-statement.

Second type of rules are *particle rules* which describe the way a formula can be attacked and defended depending on what is its main connective:

			Attacks	Defences
(P1)	negation	$\neg A$	*A*	$\otimes$
(P2)	conjunction	$A \wedge B$	*1?*	*A*
			2?	*B*
(P3)	alternative	$A \vee B$	?	*A*
				B
(P4)	implication	$A \rightarrow B$	*A*	*B*

Table 1: Particle rules for the basic propositional language

According to the rule (P1), in Table 1 above, in order to attack a negation, a player has to assert the negation of the formula, i.e., if *X attacks* $\neg A$then he says *A*. There is no defences of $\neg A$available. If *X attacks* $A \wedge B$he attacks the first or the second element of the conjunction, i.e. he asks "*1?*'" or "*2?*" (P2). If *X defends* $A \wedge B$, he asserts the questioned formula making a statement *A* or a statement *B* (P2). If *X attacks* $A \vee B$, he performs the move "*?"* which questions the whole disjunction (P3). If *X defends* $A \vee B$, he asserts either element of the attacked disjunction (P3). If *X attacks* $A \rightarrow B$, he asserts the antecedent, making the statement *A* (P4). If *X defends* $A \rightarrow B$, he asserts the consequent of the attacked implication, making the statement *B* (P4).

2.2 Prakken's general specification for formal dialogue systems

In (Prakken, 2006), Prakken presents a general specification of common elements for dialogue systems. The core of those systems consists of three types of rules. The *locution rules* describe what speech acts players can execute during a dialogue:

1. *claim φ* - the speaker asserts that *φ* is a case.
2. *concede φ* - the speaker admits that *φ* is a case.
3. *φ since S* - the speaker provides the reasons why *φ* is a case.
4. *retract φ* - the speaker declares that he is not committed (any more) to *φ.*
5. *why φ* - the speaker challenges that φ is a case ans asks for reasons why it would be the case.
6. *question φ* - the speaker asks another participant's opinion on whether φ is a case.

The second type of rules are *effect rules* which specifies the effects of performing each locution on a commitment store of the participant (a commitment of X is a sentence that X publicly declared as his belief). For example, when a player performs *claim* φ, he commits to φ, therefore φ is added to his commitment set; when a player performs retract φ he declares that he is not committed to φ, therefore after this locution φ is deleted from his commitment store.

The last and the central element of a dialogue system is its *protocol* which determines the interaction between speech acts, i.e. it specifies which locution can be performed as a reply to another locution. For example, when a player performs *why* φ, he asks his antagonist to give some reasons that φ is a case, therefore in the next move Y can perform argumentative speech ast: φ *since* S, or declare that he is not committed to φ any more by performing *retract* φ.

3. LOCUTION RULES

In the dialogical logic no locution rules are specified. Players can only attack and defend a sentence which has a specific logical connective. Nevertheless, during those moves players perform commutative actions such as statement or questioning. This is what allows us to describe particle rules in terms of speech acts.

The procedure of reconstruction of dialogical logic in terms of speech acts is showed on an example of reformulation of therule (P3) in which attack and defence of disjunction are described (the full reconstruction is described in my MA thesis: Yaskorska, 2012 (in Polish)). According to the rule (P3) a player can attack a disjunction $A \vee B$by performing a question about this formula. In Prakken's general specification, two locutions can be used for raising questions: *question* $\varphi$and *why* φ. Yet, according to the rule (P3), a player defends a disjunction $A \vee B$by stating the truth of its element what can be interpreted as a speech act of argumentation, in which a player gives a reason why a disjunctive sentence is the case by stating its disjunct. In the language of the general specification, such an action can be modelled by a speech act: φ*since* ψ, where $\varphi$is a disjunction, and $\psi$is a sentence A or sentence B. Consequently, if we model a defence of disjunction in (P3) as an argumentation act, we should model its attack in (P3) as a challenge, i.e. by a speech act *why* φ.

As a result of such a reconstruction procedure, actions which players perform during attacks and defences can be modelled as the following locution rules:

L1 Claim *claim* $\varphi$is performed when a player:
(1) attacks $\neg A$, then $\varphi$is a formula A,
(2) defends $A \wedge B$, then $\varphi$is a formula Aor a formula B,
(3) attacks $A \rightarrow B$, then $\varphi$is a formula A,
(4) defends $A \rightarrow B$, then $\varphi$is a formula B;
L2 Concession *concede* φ is performed when φ is an atomic formula and P is a player:
(1) attacks A, then $\varphi$is a formula A,
(2) defends $A \wedge B$, then $\varphi$is a formula Aor a formula B,
(3) attacks $A \rightarrow B$, then $\varphi$is a formula A,

(4) defends $A \rightarrow B$, then $\varphi$is a formula B;

L3 Argumentation φ*since* $\psi$is performed when a player defends $A \vee B$, then $\varphi$is a formula $A \vee B$and $\psi$is a set which includes the formula Aor the formula B;

L4 Challenge *why* $\varphi$is performed when a player attacks $A \vee B$, then $\varphi$is a formula $A \vee B$;

L5 Question *question* $\varphi$is performed when a player attacks $A \wedge B$, then $\varphi$is a formula Aor a formula B.

4. EFFECT RULES

In the original description of the dialogical logic no commitment stores of the players are defined, therefore no effect rules for this system are also specified. The specificity of this system forces different uses of this set, e.g. in a certain situations a player has to commit to contradictory formulas and according to the rules of dialogical logic he also cannot retract his commitments. As a result a player can have contradictory commitments, which he cannot change.

In the new account of dialogical logic, we introduce the notion of hypothetical commitment store in order to show the dynamics of participants' commitments during the game. Such specification would describe the main idea of formal dialogues (see: Hodges, 2009). During those dialogues players do not discuss about the facts but verify the validity of the formula by assuming or challenging sentences of which a thesis consist.

In the reconstruction of dialogical logic effect rules are modelled using locution rules (L1)-(L5) and the description of effect rules used in Prakken's language. For a formal dialogue D'(A), the rules for hypothetical commitment base C'_s of a player $s \in \{O, P\}$are specified below, where *s(m)* denotes a move of a player *s* and φ,ψ are propositional formulas:

(E1) If $s(m_n)$= *claim* φ, then $C'_s(d, m_n)$= $C'_s(d, m_{n-1}) \cup \{\varphi\}$;

(E2) If $s(m_n)$= *concede* φ, then $C'_s(d, m_n)$=$C'_s(d, m_{n-1}) \cup \{\varphi\}$;

(E3) If $s(m_n)$= φ*since* Ψ, then $C'_s(d, m_n) \supseteq C'(d, m_{n-1}) \cup \Psi$;

(E4) If $s(m_n)$= *why* φ, then $C'_s(d, m_n)$=$C'_s(d, m_{n-1})$;

(E5) If $s(m_n)$= *question* φ, then $C'_s(d, m_n)$=$C'_s(d, m_{n-1})$.

5. PROTOCOL

After describing speech acts and commitment store which players can use during the Lorenzen's dialogue game, we can model a protocol. In the dialogical logic a player attacks and defends formulas which can have a form of negation, conjunction, disjunction, and conditional. Particle rules specify how a player can make such moves and structural rules specify the general order of making those moves. Using these two types of rules of original dialogical logic as well as the locution rules specified in the new account we can describe all possible moves which can be performed after each move during the game.

In this section we present an example of such a reconstruction procedure and rules of protocol obtained as a result of the reconstruction. The full description of protocol is presented in (Yaskorska, et al. 2012). Let's take a closer look on how a player can respond to the attack and defence of the disjunction. According to the rule (PR3) a player can attack a disjunction $A \vee B$by challenging it, i.e. asking for its justification. This move is modelled by the speech act of challenge: *why* φ, where $\varphi$is a sentence $A \vee B$. His antagonist can respond to this move by defending the disjunction what is modelled by argumentative act: φ *since* ψ, where φ is a disjunction and $\psi$is a sentence *A* or sentence *B.*

On the other hand, responses to the defence of the disjunction could be modelled in the following way. Suppose that *P* defences a disjunction using the speech act φ*since* ψ. Then, next moves of opponent depends on the structure ofψ. If $\psi$is a negation, e.g. $\neg A$, then, according to the particle rule (P1), he can attack this negation by stating the fruth of A. If a formula $\varphi$is a conjunctio, e.g. $A \wedge B$, then opponent can attack this conjunction by performing *question* ψ, where $\psi$is a formula Aor a formula B(P2). If a sentence $\varphi$is a disjunction, e.g. $A \vee B$, then opponent can attack it by performing *why* φ. If a sentence $\varphi$is an implication, e.g. $A \rightarrow B$, then a player can attack it by performing *claim* ψ, where formula $\psi$is a sentence A(P4).

In the reconstruction of protocol we must also take into account structural rules of dialogical logic according to which proponent cannot introduce an atomic formula (D10). Consequently, we need to add a rule which describes in which cases proponent can use a proposition. After reconstruction, the procedure of which is presented above, structural rule (D10) and particle rule (P2) can be implemented via following rules:

(1) A player P cannot perform *claim* $\varphi$where $\varphi$is a proposition; he can state that φ is true executing *concede* φ but this move can be performed only if O claimed φin some previous move;

(2) After *claim* φa player can perform:

1. *claim* ψ, if $\varphi$is a negation of the formula and $\psi$is a contradiction to φ, (P has to follow the restriction described in (1)),

2. *concede* ψ, if P is a player and $\psi$is a proposition, and $\varphi$is a negation of the formula and $\psi$is a contradiction to φ,

3. *question* ψ, if $\varphi$is a conjunction and $\psi$is one of its operands, *why* φ, if $\varphi$is a disjunction;

(3) After *why* φa player can perform:

1. φ*since* ψ(P has to follow the restriction described in (1)).

6. RIGOROUS PERSUASIVE DIALOGUE (RPD)

In this section the new account of dialogical logic is compared with the system RPD (*Rigorous Persuasive Dialogue*) introduced by Walton & Krabbe (1995). Let's look at a sample game during which the validity of the formula $(p \vee q) \wedge \neg p \rightarrow q$is investigated.

	O			P	
				$(p \vee q) \wedge \neg p \to q$	(0)
(1)	$(p \vee q) \wedge \neg p$	0	1	*1?*	(2)
(3)	$(p \vee q)$	2	3	*?*	(4)
(5)	q	4	1	q	(6)

Table 2: Example 1

In this example, proponent P in move (0) states the formula, which is the topic of the discussion. The main connective of the formula is an implication, so opponent O in (2) attacks this formula by stating its antecedent (P4). According to (D10), proponent cannot defend attacked formula by asserting its consequent, because it is an atomic formula, therefore he attacks opponent's assertion which is a conjunction by asking about the truth of its first element (P2). In (4) opponent defends this conjunction by asserting the truth of the questioned sentence. In (5) proponent attacks the sentence uttered by opponent in the third move. This time a disjunction is a main connective, so proponent challenges the whole sentence (P3). Opponent defends this disjunction by stating the truth of its element, i.e. the sentence q. Using the rule (D10) proponent repeats this statement and defends the main formula (P4). Opponent does not have any legal move, which means that proponent wins and formula $(p \vee q) \wedge \neg p \to q$is a tautology.

Let's consider now how this game can be modelled in the LND system which is based on the reconstruction proposed in this paper (the full description of LND system is introduced in (Yaskorska et al., 2013)).

P_1: *InitLor*$(p \vee q) \wedge \neg p \to q$
O_2: *claim*$(p \vee q) \wedge \neg p$
P_3: *question* $(p \vee q)$
O_4: *claim* $(p \vee q)$
P_5: *why* $(p \vee q)$*?*
O_6*:* $(p \vee q)$*since* q
P_7*:* *concede* q
O_8: *EndLor* $(p \vee q) \wedge \neg p \to q$

In this dialogue the first move begins with proponent's locution *InitLor* $(p \vee q) \wedge \neg p \to q$, which starts dialogue game about formula $(p \vee q) \wedge \neg p \to q$(see Yaskorska et al. 2013). Next the game is performed as it was presented in Table 2 using speech acts defined in the reconstruction. For example, according to the protocol rule (2.3) (see section 5), after move O_2, which is *claim* $(p \vee q) \wedge \neg p$ proponent performs claim $(p \vee q)$ in order to attack opponent's utterance. O ends the game via locution *EndLor* $(p \vee q) \wedge \neg p \to q$, which according to the rules of LND system means that he loses the game and the main formula is a tautology.

The same dialogue can be modelled according to the rules of RPD dialogue game (Walton & Krabbe, 1995) as follows:

Concessions: (1) $(p \vee q)$
(2) $\neg p$
Thesis: q
1. O: ??
2. P: ? (concess. (1))
3. O: q
4. P: *!*

First, the preliminary situation of the dialogue is described by listing opponent's concessions and the thesis of the game stated by the proponent. In the first move of the game opponent attacks the thesis of the dialogue by challenging it. According to the rules of RPD game, proponent can not respond to this challenge, so he uses an option of *free-question* and attacks first concession. The main connective of attacked formula is disjunction, so according to the RPD logical rules opponent asserts one of it's element, i.e. states q. In the fourth move proponent performs speech act *You said so yourself* (*!*), which is a final remark indicating the end of the dialogue game.

The first difference between LND and RPD systems can be described by the uses of locution rules, i.e. in both systems locution rules are described in a different way: in LND moves are based on illocutionary force of the speech act. In the RPD approach players utter only contents of the locution. For example, in the LND dialogue in P_5 in order to attack a disjunction proponent uses speech act *why* $(p \vee q)$and in the move opponent uses an argumentative act to defend it. In the PPD dialogue players during the attack and defence of disjunction in the second and third perform a content of the speech acts.

The second difference concerns the definition of players' commitment stores. In LND players use the hypothetical commitment store, when in RPD players have at their disposal two types of store: for concessions and potential defences of the player. In both systems these elements play a different role. For example, during the O_6 sentence q is added to the C' which means that O is hypothetically committed to this sentence. In the RPD dialogue after the third move sentence q is added to the concessions of the opponent and his set of potential defences is empty.

Protocols in the two systems differ in a way that the games are described. In LND the protocol describes the interaction between locutions, while in RPD between propositional contents. For example, in LND dialogue move O_6 is made on base of the protocol rule, which describes the order in which speech acts can be performed. In the RPD dialogue opponents reply on the attack made by proponent in the second move bases on logical move, which illustrate particle rules of dialogical logic.

7. CONCLUSION

In the paper we present a description of Lorenzen's dialogical logic in terms of speech acts. Reconstructed dialogical logic is specified using three types of rules: locution rules which describes the speech acts a player can perform during the dialogue; effect rules which describes what effect the performance of certain speech act has on speaker's commitment store; and protocol which describes which speech act a player can perform during the certain stage of the game.

The reconstruction of dialogical logic was extended to include branching rules, and the protocol of LND (*Lorenzen Natural Dialogue*) system was introduced in (Yaskorska et al., 2013). Next, the LND system was combined with similar reconstruction of Hamblin's formal dialectic (Hamblin, 1970) and a dialogue system for modelling communication in which formal fallacies can be identified was introduced in (Kacprzak & Yaskorska, 2013).

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REFERENCES

Eemeren, F.H. van, & Grootendorst, R. (2004). *A Systematic Theory of Argumentation. The pragma-dialectical approach.* Cambridge University.

Hamblin, C. L. (1970). *Fallacies.* London: Methuen.

Hodges, W. (2009). Logic and Games. In: Zalta, E. N. (eds.). *The Stanford Encyclopedia of Philosophy*.

Lorenz, K., & Lorenzen, P. (1978). *Dialogische Logik*. Darmstadt, 1978.

Prakken, H. (2006). Formal systems for persuasion dialogue. *The Knowledge Engineering Review*, 163-188.

Rahman, S., & Tulenheimo, T. (2006). From games to dialogues and back: towards a general frame for validity. *Games: Unifying Logic, Language, and Philosophy*

Searle, J. (1969). *Speech Acts: An essay in the philosophy of language.* Cambridge: Cambridge University Press.

Walton, D., & Krabbe, E. C. W. (1995). *Commitment in Dialogue: Basic concepts of Interpersonal Reasoning*. State Universrity of New York Press .

Yaskorska, O., (2012). *Dialogue as a game. The methodological foundations of formal accounts of a dialogue for Lorenzen's and Hamblin's systems*, MA-thesis, Cardinal Stefan Wyszynski University in Warsaw.

Yaskorska, O., Kacprzak, M., & Budzynska, K. (2012). Rules for Formal and Natural Dialogues in Agent Communication. *Proceedings of the International Workshop on Concurrency, Specification and Programming CSP2012 (pp. 416-427),* Berlin: Humboldt-Universitat zu Berlin.

Yaskorska, O., Budzynska, K., & Kacprzak, M. (2013). Proving Propositional Tautologies in a Natural Dialogue, *Fundamenta Informaticae*, accepted for publication.