Commitments in Human-Robot Interaction

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INTRODUCTION

The notion of commitments plays a pivotal role in understanding joint action (Cohen and Levesque 1991; Bratman, 1992). However, the study of commitments in the context of joint action for human-robot interaction is quite new. We discuss two specific proposals to commitments: the functional approach, which argues that the central function of commitments is to reduce different forms of uncertainty; and the normative approach, which argues that commitments create obligations towards one's co-agents who are entitled to demand that these obligations be satisfied. For demonstration purpose, we consider 2 use-cases. In the first one, a robot guide indicates a direction to a visitor by pointing/indicating a destination (e.g. Pepper in a Mall). In the second one, a robot guide brings a visitor toward its destination (e.g. Rackham at the Space City Museum).

We conclude that both approaches capture fundamental aspects to handle commitments in the context of human-robot interaction.

The Functional Approach (Michael & Pacherie, 2014)

Commitments are psychological mechanism for reducing different types of uncertainties.

Different type of uncertainties in Joint Action:

- Motivational uncertainty: participants do not know whether or not the other is motivated to engage in the joint action.
- Instrumental Uncertainty: participants do not know whether or not they agree about how to proceed (e.g. means, roles).
- Common Ground Uncertainty: it may happen that the instrumental beliefs and motivations are not mutually manifested.

By stablishing commitments, participants can stabilize and provide expectations that facilitate the prediction of the other co-actors.

Key aspects of the functional approach is to explore how commitments are established:

1. Repetition
2. Verbal Communication
3. Implicit Communication

The Normative Approach (Fernandez & Pacherie MS)

Commitments create obligations towards one's co-agents who are entitled to demand that these obligations be satisfied, giving rise to expectations that the agent will act as committed or that, if not, co-agents will demand that he/she/it does.

Although commitments serve to provide reliable expectations, these expectations are of a special kind.

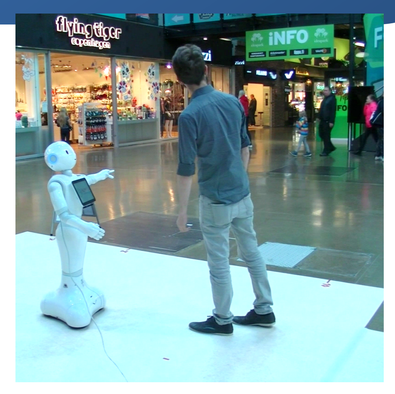
- Descriptive Expectations: expectations whose violation or frustration does not necessary triggers reactive attitudes. These expectations are tied to predictions. For example, you can expect your friend to have a beer because this is what she always does but if she doesn't, this may surprise you but not bother you.
- Normative expectations: expectations whose violation or frustration triggers reactive attitudes: blame, petitions of justification or sanctions. It is an expectation connected to the notion of putting someone on demand and when it is frustrated the reaction is more emotionally loaded and directed to regulate the other's action.

In the normative view, commitments serves to attribute to oneself or the other normative expectations, so we can ensure that everyone behaves as expected.

The key aspect of the normative approach is how we display different communicative and behavioral strategies to make explicit of our duties and make the co-partner responsible for their own: Blame, signaling expectation or apologizing.

Commitments for Human-Robot Interaction: A Scenario.

We consider a scenario where a Robot must operate autonomously in a Mall and its central function is to guide a person to a destination (see Foster et al 2016). The central task requires the robot to represent different locations and areas, be able to self-localize, possess verbal and non-verbal skills for indicating (e.g. giving instructions; pointing), recognize the human partners and her idiosyncrasies (e.g. is the person too old to walk stairs up?) or have perspective-taking (e.g. to see if the human is seeing the indicated way or target).



ACTIONS	Expectations	Signals	Violations	Reaction	Repair
Indicating with gestures	Robot expects the human to look at the direction of its indications	The robot looks at the human to make sure he is looking at the right direction	The human doesn't look in the appropriate direction	Robot: Searching for eye contact	Repeat
	The human expects the robot not to pursue the interaction before the human has understand the indicated place	-	The robot continues the interaction by asking the human if he needs something else	The human asks to come back to the explanation, -'Wait, where?"	Apologizing and coming back to the explanation
Guide the human to a destination	Robots expects the human to follow it	The robot says "I accompany you to your destiny, please follow me"" During its movement, the robot has some back and forth movement to check if the human is still here	The human doesn't follow	- Stop and Wait - Signal he is waiting	- "Please, Follow me" - Approaching the human and ask "it is everything alright?"
	Human expects the Robot to adapt Speed	The human can enforce the certainty that everything is alright by saying "keep going, I follow you"	The robot is going too fast or too slow	The human does not follow anymore or on the opposite bump the robot because it is too slow	Apologizing and slowing down/speed up

CONCLUSIONS

1. There are two approaches to commitment in joint action which emphasizes different behavioural and cognitive aspects of the role of commitment in joint action. However, the two approaches are complementary,
2. Commitments management gives roboticists a way to give meaning to monitoring, however, it comes with duties. We must give robot abilities to signal its expectations on one side and to monitor human's expectations/reactions/signals on the other side. We must give human means to understand the robot expectations/reactions/signals on one side and means to deliver its expectations to the robot on the other side.
   => we need to develop these monitoring and signaling abilities, it is not part of the action by itself but it is needed for the interaction
   => perhaps we should design a kind of code to help the management of these aspects either on the robot and on the human side(e.g. a kind of common interface that is understandable by every robot)
3. When there is a violation of expectation, we have to consider where this violation comes from.
   => perhaps it could be a way to link both functional and normative approach since a violation could come from motivational uncertainty, instrumental uncertainty or common ground uncertainty?

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