Using Immediacy to Characterise Robot Social Behaviour in Child-Robot Interactions⋆

James Kennedy, Paul Baxter, Emmanuel Senft and Tony Belpaeme

Centre for Robotics and Neural Systems, Plymouth University, United Kingdom
{james.kennedy, paul.baxter, emmanuel.senft,
tony.belpaeme}@plymouth.ac.uk

1   Motivation, Context and Methods

With an increasing number of researchers exploring Child-Robot Interaction (CRI), it becomes desirable to compare robot social behaviour between experimental scenarios. Such comparisons would allow researchers to better account for differences between studies in child responses to robots or interaction outcomes (such as learning or behaviour change) [4]. However, there are various problems associated with executing such evaluations in CRI contexts [2]. This extended abstract considers the use of *immediacy* questionnaires to characterise children's perceptions of robot social behaviour. Challenges faced when using this measure are presented, along with some practical solutions and resources which could be of use to other researchers.

We work with the Aldebaran NAO robot, used in conjunction with a large horizontal touchscreen. Experiments are typically conducted with children aged between 7 and 9, and in schools. Depending on availability, this might be a school classroom, or a quiet communal space familiar to the children. The robot is commonly employed as a one-to-one tutor; the aim is to explore how children respond to different robot behaviours and how robot social behaviour affects child learning [4].

We use Immediacy questionnaires to characterise robot social behaviour from the perspective of children [4]. Immediacy represents the communicative availability of an interaction partner and is measured through a series of questions about verbal and nonverbal items, including gestures, gaze, touch, and facial expressions (among many others) [5]. Immediacy assesses multimodal social cues in context and high immediacy behaviours positively correlate with increased learning, making it desirable to use for CRI in educational scenarios [4,5].

2   Challenges and Solutions

Children's language ability: Children have variable language abilities at the age we work with and often do not fully understand the words used in

questionnaires designed for adults. When seeking a means to assess the perception of a robot, the Godspeed questionnaire series [1] is increasingly being used. However, the language is not appropriate for children (e.g. 'inert', 'apathetic', 'stagnant'). These words are challenging to re-phrase and it is unclear whether children can comprehend the subjective concepts behind such labels.

Immediacy deals only with overt behaviour, such as whether the robot gestures at a child or not, and so on. This makes it easier for children to understand, and for language to be simplified to be age/ability appropriate. Additionally, considering overt behaviour may mean that it is harder for the children to second-guess what the experimenter might want and to try to please with their answers [2]. We have designed and used child-friendly versions of immediacy questionnaires in several studies (e.g. [4]) and have made them available online[1].

Apparent differences to adult perception: Child and adult reported perceptions frequently do not appear to match, however, immediacy seems to suffer less from this issue. In two studies to-date (published work pending), four different robot behaviours and two human behaviours were judged by both children and adults. Whilst the child ratings are higher than the adult ones, there is a strong positive correlation between the two (r=0.79, p=0.059). This suggests that further work would be worthwhile to evaluate whether adult ratings could be used in-lieu of child ratings, thereby avoiding the many issues that arise when using questionnaires with children [2].

Evaluating child behaviour towards a robot: In the past we have used manual video coding to provide a measure of child behaviour towards different robot conditions [3]. This is a time-consuming means of analysing child behaviour. It may be that the immediacy metric could be applied post-hoc by assessing interaction videos (subject to appropriate ethical procedures) for child behaviour towards a robot. This is something that we have not attempted, but would certainly be faster than video coding and could potentially lead to valuable findings.

References

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[1] `http://goo.gl/UoL5QM`