Modeling dyadic child-peer interactions
Steenbeek, Henderien

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Chapter 1

Introduction
INTRODUCTION

Interaction of children

During peer interaction, children learn and practice interaction skills that are of crucial importance for their social, cognitive, and emotional development (Kindermann, 2003; Rubin, Bukowski & Parker, 1998; Hartup & Laursen, 1999; Reis, Collins & Berscheid, 2000; Ladd, 1989). They learn to form friendships and to deal with conflicts. Accordingly, the subject of peer interaction is thoroughly studied within the field of developmental psychology research, ranging from the link between parent-child interaction and child-peer interaction to the emergence of friendship, differences between boys and girls, and the development of specific interaction skills, such as emotion regulation (see Rubin et al., 1998). There have even been debates about the question where the main influence on the development of children originates: from parents or from peers (Harris, 1998; Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000).

Nevertheless, most of these studies are often associated with three implicit assumptions that together may amount to an oversimplified image of empirical phenomena in social reality. The first assumption is that children do have particular child characteristics that apply in every context. A typical statement is that ‘a child with a rejected status shows more disruptive behavior’ (Newcomb, Bukowski, & Pattee, 1993), which may elicit the illusory impression that the rejected child will always show this behavior more than any child with whom he or she is compared. This first assumption is related to the fact that the research methodology often insufficiently accounts for the context-dependency of the child’s behavior.

The second implicit assumption is that whatever applies to a group of children, applies to each individual child belonging to this group. A typical statement is that ‘popular children are prosocial in their interaction with peers’ (Rubin et al., 1998), which may lead to the idea that each child with a popular status is equally prosocial – or at least prosocial per se - in its interactions with peers. In this implicit conclusion, there is too little attention for the eventually quite considerable inter-individual differences between children that belong to the same group.

The third assumption is that social development of individual children takes place in an orderly, systematic, and causal manner. A typical statement is that ‘the quality of a child’s relation with peers significantly predicts adult’s social adjustment’ (Parker & Asher, 1987). Relations are seen as a series of interactions over time.
(Russell, Pettit, & Mize, 1998), in which a linear relation between short-term processes and long-term development is assumed. Thus, a child’s current aggressive behavior in interaction with peers will cause her to show a proportional amount of aggressive behavior towards others in her later adult life.

Of course, researchers and users of research findings in general know that reality is more complex than what is stated above, for instance that contexts play a role in behavior. However, the issue here is that this knowledge remains a minor, secondary point in most of the theoretical and statistical models used in research. For instance, the solution for applying group-data to individual cases is often being searched in using the classical ‘error’- term in the model, added to the found ‘real’ relationships between variables. That is, if a child’s data do not confirm the group’s data, it is attributed to the ‘error’ in the model. This ‘error’-term is seen as random variability, which implies that nothing systematically can be said about it. Another illustration of the underexposure of the individual in favor of a central group property is the widespread use in psychology of p-values applied to averages as an indication of the importance of differences between groups. Analyses of the distributional properties of a group, for instance in the form of distributions or confidence intervals, are far less common.

Together, these assumptions make that most developmental research insufficiently learns about the mechanisms of context-dependency of behavior, which causes intra-individual variation in behavior. Second, these assumptions explain why current developmental research gives so little information about processes of individual children, which can differ from those inferred from group data. Third, the assumptions suggest linear relations between short-term experiences and long-term social development, whereas the developmental process of individual children is in practice much more dynamic and less predictable, due to its context-dependency and intrinsic variability.

This thesis explicitly attempts to account for these points in a study of interaction (-patterns) of children of different sociometric statuses, using dynamic systems theory (Thelen & Smith, 1994; van Geert, 1994). A micro-developmental approach is used in studying the short-term time span of one interaction, starting from a process model that provides insight in the interaction’s dynamic properties.
The dynamic systems approach

In this thesis, we will present the dynamic systems approach as a contemporary approach in developmental psychology that emphasizes studying processes and change mechanisms within individuals, and the importance of using recursiveness of consecutive time steps in a process. This process takes place in a specific context that evolves over time. That is, contexts are not viewed as static, independent variables, but as resulting from the interaction processes themselves.

Peer interaction is conceived of as a dynamic, complex process, consisting of mutually influencing child- and context-variables, which together determine the course of a specific interaction process (Fogel, 1993). There is no ‘blueprint’ of the outcomes of an interaction process, as chance always plays a constructive role. More precisely, the influence of chance depends on the specific moment in the process and in general affects processes in a non-linear fashion (see Thelen & Smith, 1994). This approach to chance contrasts with standard linear models, in which chance is added up in a linear fashion to the systematic effects of some independent variable.

Another starting point of this thesis is that the dynamics of interaction processes on the short-term are intrinsically related to the dynamics of long-term social development (Thelen & Smith, 1994; Lewis, 2002). That is, social development over years is the product of multiple short-term experiences and thus depends on the properties of these short-term experiences. However, the majority of social developmental studies do not contain explicit models of these short-term interactions. This thesis attempts to fill this gap by proposing such a model. By combining the short- and long-term time scales, insight can be gained about the (mostly) non-linear relations between short-term interaction and long-term developmental processes.

The question, however, is how to gain more insight in short-term interaction processes, while at the same time accounting for dynamic properties of that process, such as mutually influencing factors, recursiveness, and chance? This requires building a computational (simulation-) model of interaction (see Cristiansen, 2003; van Geert, 1994), which allows for simulating these dynamic properties, e.g., the interactions between the mutually influencing factors over time.

In this study, we constructed two computational models of dyadic interactions during a play session, based on dynamic systems principles, as described in the present thesis. An important question is whether these models sufficiently resemble the empirical interaction process.
This leads to the first research question of this thesis: Can a dynamic systems model help in increasing our understanding of interaction patterns of children, and if so, what is the empirical validity of such a model?

Children of different sociometric statuses

In social developmental processes, inter-individual differences between children emerge. Some children seem to easily go through these processes, while other children encounter all kinds of problems. For instance, there are children who have only relatively few opportunities to interact with other children, or children who have many negative experiences with peer interactions. For instance, they are often standing alone in the schoolyard during breaks, instead of playing together with their classmates. These children often have a rejected status, that is, the other children will tend to avoid this child and if they interact with it, it is often in a negative, disapproving way. On the other hand, there are children who are always surrounded by a lot of friends and are used to receiving continuous acclaim. That is, their peers evaluate them as highly popular.

This sociometric status classification of children is often used as a means to gain insight into the social structure of a group (since Moreno, 1934). Sociometric status is a group measure, providing information about how other children in a group socially judge any particular child in the group. It describes the level of acceptance and popularity of this child within this group (Asher & Hymel, 1981; Van Lier & Hoeben, 1991; Cillessen & Mayeux, 2004). The sociometric status of a child is often seen as an adequate reflection of the child’s social competence (Black & Logan, 1995; Asher & Parker, 1983). Mostly, five status groups are distinguished, namely a popular, controversial, neglected, rejected, and average status group (see Coie, Dodge, & Coppotelli, 1983; Asher & Dodge, 1986; Cillessen & ten Brink, 1991). The most extreme groups in terms of behavioral characteristics are the popular children, in that they are attributed the highest social competence, and the rejected group of children, who are seen as having the least social competence (Coie, Dodge, & Kupersmidt, 1990; Newcomb, Bukowski, & Pattee, 1993).

Research shows that children with a rejected status need extra support in their social development. First, because these children run the risk of encountering problems later in life, especially if this rejected status remains relatively stable (Haselager, Cillessen, & van Lieshout, 2002; Cillessen, 1992; DeRosier, Kupersmidt, & Patterson,
1994; Kupersmidt & Coie, 1990; Parker & Asher, 1987). Secondly, there is a relation between having a lower status and more often being involved in bullying, either as bully or as victim (Boivin, Hymel, & Hodges, 2001; Juvonen & Graham, 2001). Thirdly, the rejected group of children shows more often aggressive behavior. That is, rejected children form a heterogeneous group, but approximately half of the rejected children are known as aggressive-rejected children (as opposed to withdrawn-rejected children and a group who shows a combination of withdrawn and aggressive behavior; see Asher, 1994; Dodge & Price, 1994; de Koeyer, 2001).

In evaluating these claims drawn from the literature, it is easy to fall into the trap set by the three assumptions or biases that were introduced at the beginning of this chapter, for instance to implicitly identify all individuals in a group with the group’s average properties. Thus, what we would wish to know, ideally, is in which contexts and why the rejected or popular children show the properties ascribed to them by the above studies, whether there are contexts and individuals for which these properties do not hold, and why this is so.

The theoretical reason for using sociometric status as dividing criterion in studying differences between children is that sociometric status is a typical state-concept (“status” = “stage”, “condition”) in psychology. Two aspects of social interaction are incorporated in sociometric status, namely social preference and frequency of interaction. In a process model of short-term interaction, these aspects also play a central role: how “pleasant” is the interaction with the other child (relating to preference), and in how much is the child inclined to interact with the other child (relating to frequency)? Thus, status is a kind of long-term “state-equivalent” of short-term characteristics of social interaction, which makes it a psychological concept suited for studying it on both time scales. Long term characteristics of status such as a child’s rejected status in a group can be linked to short-term characteristics, such as the low preference of children from this group for playing with this child at the schoolyard at a certain day, and the effect this preference potentially has on the consolidation of this child’s rejected status.

This leads to the second research question of this thesis: What does the model teach us about differences and similarities in interaction patterns of children of different sociometric statuses?
Aim, design and outline of this thesis

The central aim of the study is to construct a model that generates patterns of interaction that correspond with observed interaction patterns in children of different sociometric statuses, which have been observed in our empirical study. In this study, three types of dyads were formed, comparable with the dyads distinguished in the model. The dyads consisted of two same-sex grade 1 pupils, of whom one child had either a rejected, a popular, or an average status, and in which the play partner always had an average status. We chose to study interaction by means of a play session, as this is a common situation for children of this age. In addition, during play children are free to do what they want, without being restricted by rules of a game or task (see Gerrits, 2004; de Koeyer, 2001). We think that differences between interaction patterns can easily be observed during play. The design of the study is chosen in accordance with the broader framework of this study, which comprised a collaboration between four studies of social interaction in children (the ‘aandachtsgebied’ ‘social development: longitudinal and dynamic aspects of dyadic and group processes’, for an overview see van Aken, 2003).

The outline of the thesis is as follows. Chapter 2 focuses on the cross-sectional empirical study. The aim of this chapter is to investigate the empirical association between the sociometric status of a child and the dynamics of concrete social interaction. The chapter answers the question: Is there a different interaction pattern in dyadic interaction of six- and seven-year-old children of different sociometric statuses? How can this pattern be explained? A simple, classical dynamic systems model of dyadic interaction consisting of two coupled equations, - one for each of the interaction partners -, is used to generate predictions about the interaction patterns, which are then tested against the empirical data. The theoretical model comprises general aspects of social interaction, such as goal-directedness, appraisal, reciprocity and social contagiousness, and two important differential components of dyadic interaction, namely social effectiveness and social power. The output of the model consists of one equilibrium state for one variable, a particular level of Involvement of both children, which is very appropriate for deriving predictions for groups of children. Note that this model is not the same model as the one described in chapter 3 and chapter 4, which consists of a considerably more complicated ‘agent model’, representing the components of social interactive actions.

The aim of chapter 3 is to provide a bird’s eye view of the many aspects - theory construction, model building, and empirical testing - that are involved in the con-
struction, of a general explanatory agent model of short-term social behavior in a developmental context. First, attention is given to general aspects of dynamic systems theory, and to simulation as a research tool in the social sciences. Secondly, the theoretical foundations of the model variables and input- and output parameters, and the basic processes of the model are being discussed. A central aspect is the continuous interaction between concerns, drives, emotional appraisals, emotional expressions and behavior, within each child and between two children, during each moment of the children’s play session. The output of the model consists of trajectories of emotional expression and action of each individual child, over the course of the interaction. Finally, a global overview is given of the validation procedures that are described in more detail in chapter 4.

Chapter 4 discusses the empirical validation of the agent model and the methods needed for such validation. The first research question is: what are the tools and steps for empirically validating this and comparable agent models. The second is: how good is the agent model in representing the interaction process in reality? The answers to these two questions are conditional to answering an underlying question: What does the agent model explain about differences in short-term social interaction of children, especially in relation with children’s sociometric statuses, which is a property that tends to change over the longer term? The chapter focuses on the model’s predictions, methods, and results of averages and distributions of the major variables, and on the model’s sensitivity.

Finally, chapter 5 gives a summary of the findings and a general discussion, which – among others – consists of a short discussion of linking the models of short-term interaction with a model of long-term social developmental, and of the stability of sociometric statuses over several months (the duration of the empirical study).