How can the intelligence of monkeys and apes, and the huge brain expansion that marked human evolution, be explained? In 1988, *Machiavellian Intelligence* was the first book to assemble the early evidence suggesting a new answer: that the evolution of intellect was primarily driven by selection for manipulative, social expertise within groups where the most challenging problem faced by individuals was dealing with their companions. Since then a wealth of new information and ideas has accumulated. This new book will bring readers up to date with the most important developments, extending the scope of the original ideas and evaluating them empirically from different perspectives. It is essential reading for researchers and students in many different branches of evolution and behavioural sciences, primatology and philosophy.

*From cover illustration © Ronald Searle, June 1991. Reproduced with kind permission of the artist.*
Machiavellian Intelligence II
Extensions and Evaluations

EDITED BY

ANDREW WHITEN AND RICHARD W. BYRNE
University of St. Andrews
Contents

Preface xi

1 Machiavellian intelligence
    RICHARD W. BYRNE & ANDREW WHITEN 1

2 Friendships, alliances, reciprocity and repair
    MARINA CORDS 24

3 Why Machiavellian intelligence may not be Machiavellian
    SHIRLEY C. STRUM, DEBORAH FORSTER & EDWIN HUTCHINS 50

4 Social intelligence and success: Don’t be too clever in order to be smart
    ALAIN SCHMITT & KARL GRAMMER 86

5 Minding the behaviour of deception
    MARC D. HAUSER 112

6 The Machiavellian mindreader
    ANDREW WHITEN 144

7 Exploiting the expertise of others
    ANNE E. RUSSON 174

8 Primates’ knowledge of their natural habitat: As indicated in foraging
    CHARLES R. MENZEL 207

9 Evolution of the social brain
    ROBERT A. BARTON & ROBIN I. M. DUNBAR 240
4 Social intelligence and success: Don’t be too clever in order to be smart

ALAIN SCHMITT AND KARL GRAMMER

Consequences of behaviour and meta-learning, and social intelligence

Don’t be too clever in order to be smart

Our title alludes to Clever and Smart, comic figures created by Ibañez, which contrast in the behaviour they use to reach goals. Whereas Clever shows much refinement, Smart acts without many detours, and succeeds as often as Clever. This result would be surprising to common sense or to analysts of social interaction, Machiavellian intelligence and cognitive competence (Handel, 1982; Hinde, 1983; Anderson, 1985). Indeed, the analysis of the cognitive prerequisites of social interaction would normally lead to the conclusion that sophisticatedly planned and performed behaviour is the means to achieve social goals. Yet there is a caveat. The point we want to make is that the consequences of behaviour, not the degree of underlying cognitive complexity, determine social success. Straightforward action–reaction behaviour such as reciprocity (an eye for an eye) may be as efficacious as subtle diplomacy. For example, reciprocity may be well suited to stop overt physical aggression such as a child’s temper tantrum. Watzlawick et al. (1967) tell illuminating stories of unsuccessful communication resulting from either endless recursive mindreading or ignorance of quite simple interaction rules (a man who needs a hammer imagines that his neighbour may be unwilling to lend one, and after a lot of thinking on the neighbour’s possible motives, knocks angrily at the other’s door shouting that he would never accept even a donated hammer).

Watzlawick et al. call on interactants to communicate on their communication rules (to meta-communicate) to resolve problems, and like Dennett (1983), think that we can manage only few embedded propositions. The growing knowledge in attribution psychology (Weiner, 1991) and the notorious failures of political planning point in the same direction.

In everyday life, the consequences of behaviour are very prominent selection forces, particularly success and failure. We learn from consequences. In situations that are rare or unique or involve danger for life, the consequences are even more important selective agents. However, learning from them is then very risky. A child normally cannot learn to traverse a road by testing the consequences of a contact with a car. In this case, belief in tradition, imitation, imprinting or even innate knowledge are more effective learning mechanisms. An example of the innateness of ‘social intelligence’ is the eye-contact maintaining behaviour of newborns, which, if absent, strongly frustrates care-givers and may weaken the mother–child bond (Eibl-Eibesfeldt, 1995).

From the importance of the consequences of behaviour it follows that it is not sufficient to master social interaction behaviour per se, e. g. how to fight, be polite or tell lies (subsequently called procedural rules), but it is also necessary to learn when to use which behaviour and how to combine behaviours. Establishing connections among procedural rules, and between procedural rules and particular contexts, we call social meta-learning. Such meta-rules indicate the range of social applicability of procedures. In contrast to learning how to proceed (e.g. how to lie), which can be transmitted more or less easily from teacher to pupil (make poker face, but be not too disinterested, smile but take care to include upper-face muscles), meta-learning is much more an experiential process, rules being acquired by doing. A meta-rule would say ‘never lie’, with the addition ‘unless you are in an emergency situation or there is zero chance of detection’ to enhance practicability. But what is an emergency situation? When reputation is at stake? My own or the other’s? Which other is so significant that I lie to save his face? How does one assess the probability of detection? Children need about 10 years to be perfect liars (Ekman, 1989).

Learning meta-rules is more difficult and time-consuming than learning procedural rules. The three most complicating factors are the ambivalence of sociality, the frequency dependence of social behaviour, and the combinatorial explosion arising from the many possibilities of rule–situation interactions. Ambivalence and frequency dependence are particularly
obvious in deceptive behaviour. Once deception is known as a possibility in social interaction, one can never again be sure that the other’s overt behavior is what s/he ‘really’ intends to do. Also, frequent deception increases the likelihood of both detection and development of countermeasures (Byrne, 1995). Thus, deception is predicted to be rare and actually is both among non-human primates (Byrne & Whiten, 1992) and preschoolers (see below). This however drastically reduces the real life occasions to learn meta-rules on deception. ‘Nice, fair and forgiving’ tactics such as tit-for-tat and reciprocal altruism also depend on the frequency of tactics competing with them (Maynard Smith & Price, 1973; Axelrod, 1984).

Ontogenetically, social meta-learning follows the learning of procedural rules. This is comparable to the acquisition of language and memory use. Children first acquire examples of grammatically correct language (like-liked; stand-stood), then recognise the rules (if you need past tense, add -ed to the infinitive form) and go through a phase where they make ‘errors’ that they did not make before (stand-standed). Finally, they learn exceptions to the rule and rules governing exceptions. A similar pattern holds for memory use. At first sight, 5 year olds are not able to remember a seven-digit number. This is not a problem of will, since they like to participate and predict that they can do it. It is not a problem of memory capacity either, but one of knowledge about using memory. Typically, children look at the number and turn to something else. This leads to forgetting. However, when told to mentally repeat the number, something they seldom do spontaneously, they can learn even longer numbers (Anderson, 1985).

**Meta-learning and social intelligence: Simulating the future**

We think that the need for meta-learning of social interaction rules is a major force driving social intelligence. It is at this point that cognitive complexity, memory capacity and mental simulation are really needed. Relationships between Ego and others and among others, the consequences of action on these relationships, thousands of different situations experienced with at least dozens of individuals have to be memorised and predicted for a sufficiently long time period (Smith 1988). Costs and benefits have to be assessed, risks and chances inferred, both in the case of failure and success, both for Ego and others. The other’s mind has to be read, his/her knowledge, intentions and behavioural capabilities have to be considered. Finally, the most promising tactic has to be selected from a host of available procedures (Whiten & Byrne, 1988). One has always to go beyond the information given, often under competition, time pressure and memory strains. Imagine a goal (finding a mate within a week) that can be reached after six steps and that there are three alternatives at each step. This gives at least 729 ($3^6$) possible ways to reach the goal. Often, this combinatorial explosion is reduced by the utilisation of ‘pre-existing’ time and memory saving knowledge structures (lexica of procedural rules, heuristics; Tversky & Kahnemann, 1974; Nisbett & Ross, 1980). However, there are some complications that may enforce the use of extensive mental simulation of how to proceed. Firstly, few heuristics apply to new situations, which leads to shortcomings when they are applied nevertheless (Nisbett & Ross, 1980). Secondly, ‘real’ intentions may have to be concealed and thus detours constructed. Thirdly, moves must not restrict the possibilities for further action (Chisholm, 1976). That is, one has to be able to stop action without losing face or to continue action with more pressure (imagine escalating fights alternating between show-off and retiring). Tactics made up of many steps allow such a policy of graduation, but complicate planning. Most probably high risk of failure or losing face induce gradual tactics (entering a clique among adolescents), intentions being revealed step by step. Low risk leads to direct moves (borrowing a book from a friend). Again, one of the most intricate problems is to decide when to use heuristics or to develop new tactics.

Mental models simulating social situations and predicting own and other behaviour (Lorenz, 1973; Harris, 1991) may be gradually improved by trial-and-error, imitation, pretence play, Pavlovian conditioning, and instrumental conditioning (learning by consequences, the most widespread learning mechanism in higher organisms). Real life occasions to test and learn the consequences of social interaction are limited in number. This is particularly obvious with deception, events involving danger for life and mate choice. In contrast, the number of future situations where procedural rules may have to be used is very large. Thus, informed guesses on the outcomes of future situations must be based on mental simulations, or on belief in traditional rules, but can rarely be deduced from experience. In order to reach an acceptable degree of plausibility, simulations must be numerous. The need for simulation may explain our almost unquenchable curiosity for ‘stories’ modelling social situations (narrative fiction such as fairy-tales, theatre, films etc.) and for life-events
and biographies reported by gossip and mass-media. This curiosity turns into sensationalism with accounts of establishing and breaking relationships, criminal or political deception and violent death. Children enter into drama and fiction and participate in make-believe worlds within the second year of life (Harris & Kavanaugh, 1993).

What data are needed
To our knowledge, no data exist on the ontogeny and phylogeny of social meta-learning. For children there is some patchy empirical work on procedural rules that is in great need of an encompassing functional theory. Investigations are at hand on establishing contact with others, telling lies, excuses, pretence, reciprocity, helping, crying, comforting, conciliatory gestures (e.g. Hartshorne & May, 1928; Ginsburg, 1980; Eisenberg & Garvey, 1981; Sackin & Thelen, 1984; Marcus, 1986; Schropp, 1986; Darby & Schlenker, 1989; Putallaz & Wasserman, 1990; Leekam, 1991; Bussey, 1992; Grammer, 1992; Zahn-Waxler, et al., 1992; Harris & Kavanaugh, 1993; Mosier & Rogoff, 1994; Verba, 1994). In this list, naturalistic studies predominate, which is not actually representative of the published literature. However, only work based on naturalistic observation can tell something about the real life consequences of behaviour. Naturalistic data on the social consequences and on how children take account of them are essential in discovering how and when social meta-knowledge appears. They are not intrinsically difficult to collect, the major problem being that naturalistic observation is utterly time-consuming and thus not very productive in number of publications.

Theoretical work on the systematics and real life frequencies of social interaction behaviours is also needed. An open issue is the nature and complexity of problems confronting an individual, which in part determine the cognitive and behavioural methods used to solve them. Piaget (1967) saw technical, sensorimotor and cognitive problems as the driving forces of the ontogeny of intelligence, social conflicts being only important in moral development. For a long time, 'mechanical' selective agents were also postulated to be prominent in the phylogeny of intelligence (for a brief history of extracted-foraging and tool-maker hypotheses, see Lewin, 1993; Byrne, 1995) until Jolly (1966) and Humphrey (1976) suggested that sociality may have been of outstanding importance. This suggests a reassessment of human ontogeny: in fact, there seems to be a developmental lead of children's skill in the social over the technical domain (Smith, 1988). Charlesworth et al. (1976) observed that 88% of all problems 5 year olds encounter are social blocks, and concluded that the art of block removal is a major adaptive function of intelligence (Charlesworth 1978). The remaining 12% were physical and cognitive problems (an object is too heavy or complex to manipulate). Moreover, Hay & Ross (1982) have shown that even in 2 year olds, experimentally induced conflicts over objects are only apparently about objects. Actually, they are largely centred on the other child, e.g. on teasing. Common sense knowledge of adult life also suggests that most problems lie in the resistance of others, not things.

Thus, although some bodies of data and arguments are at hand, much quantifying observation on the problems, solutions and consequences encountered in the 'wild' has to be done. The most burning question is the assessment of co-variation between the complexity of a problem, the complexity of its cognitive appraisal and behavioural solution, and the success of this solution. Do complex problems always require complex thinking and complex solutions? How successful are complex solutions as compared to simple ones? Unfortunately, no satisfactory operationalisation of the variables involved has yet been found.

Social intelligence: Arrière-pensées, or not arrière-pensées?
Social intelligence is more than manipulating others, or skillfully causing them to behave in a way we want them to. Nobody has ever empirically determined how many real life social interactions are manipulative and how many are not. For example, Ekman (1992, pp. 150–60) describes 18 kinds of felt, non-deceptive smiles, and contrasts them to one 'false' or feigned type, but he does not know how often they occur. This holds also for lying. Although a lie seems to be an outstanding social event, it is unknown how many people lie how often in everyday life (Ekman, 1989, 1992). Logically, it does not follow from the omnipresent eventuality of covert intentions that there is no behaviour without arrière-pensée [without reserve or ulterior motives]. It is only awfully difficult if not logically impossible to demonstrate that a behaviour has no arrière-pensée. This is clear with deception. Once it is raised as a serious possibility, it becomes almost immune to disconfirmation (compare the endless spiral of espionage and counter-espionage). Another case in point is altruism, which in
theory may always be discovered to be in some way self-interested (Karylowski, 1982; Heal, 1991). But take a greeting smile, which may be interpreted either as a manipulation of the other’s mood and will to communicate, or as an expression of friendly feelings towards the other. What about people co-operating in maintaining an interesting conversation, or in consoling empathically a crying child? Is the pursuit of a joint goal not rewarding enough to co-ordinate action? Does the parsimony principle not command that we first take into account that a greeting smile is an expression of friendly feelings, and nothing else? The use of the term manipulation in the above cases seems to have too much of a pejorative connotation. To sum up, in our view, social intelligence is the ability to skillfully enable or manage social interaction, with or without having something at the back of the mind.

Markl (1985, contra Dawkins & Krebs, 1978) has argued in the same direction, but from a very different viewpoint. Communication within (exclusive) social groups should, as a rule, be co-operative and mutually informative. In contrast, exploitative communication should be transitory and restricted to special cases, such as triadic and between-species interaction. The main reason for this is that communication in social groups is repetitive, prolonged, based mainly on role-switching between sender and receiver, and thus has co-evolved under mutual control to honesty and to the benefit of both interactants. Markl illustrates this by the recruiting behaviour of workers of the American desert ant Novomessor. If a worker has unsuccessfully tried to drag a piece of prey to the nest, she starts stridulating and emits a pheromone while continuing her efforts to displace the object. Others begin to help in dragging and recruiting. As soon as the prey-object is moved, signal emission stops and no more workers are attracted. Markl has never seen a finder calling for help and letting others do the carrying. Clearly, it is nevertheless possible to call the finder’s behaviour ‘manipulation’, but this would be misleading terminology.

Although deception is theoretically predicted to be rare and empirically found to be uncommon in ‘natural’ social environments (Byrne & Whiten, 1992 on non-human primates; below on children), the literature on social intelligence is somewhat overloaded with deception and manipulation, the frequency of which is quantitatively unknown, as compared to other socially intelligent behaviours. Although there are logical and methodological advantages in focusing on egoistic manipulators, animals and man may nevertheless be also altruistic socialisers (see Chapter 13). In fact, we probably are both, and each behaviour may be used in an overt, non-manipulative and non-deceptive way, but also in the contrary manner. It is a matter of empirical enquiry to determine when and how often each mode is used, and what costs and benefits each has.

There are some empirical data on children that indirectly illuminate this issue. All authors who by naturalistic observation have quantified friendly versus non-friendly behaviour in children have found that friendly, prosocial or co-operative behaviour prevails, the ratio of prosocial to antisocial actions ranging from 1–10 with a median of 4 (Green, 1933; Radke-Yarrow et al., 1976; Montagner, 1978, 1988; Strayer & Trudel, 1984; Kontar & Soussignan, 1987; Montagner et al., 1988; Atzwanger, 1991; see Schropp 1986 for a counter-example: objects are more often demanded than offered). None of these authors explicitly assessed intentionality of the observed behaviours, but almost all excluded feigned friendliness, e.g. ‘smiling at another child while teasing it’. Overall, these data may be interpreted as showing that friendliness prevails because it is the most successful strategy, independent of whether it is used honestly or in a deceptive manner. However, the exclusion criterion makes it more plausible that much of the friendly behaviour was indeed friendly, or at worst, aimed at socialising.

Social intelligence: Epistemological and psychological trap, and trust as a way out of it

The preceding sections have repeatedly shown that the task of acquiring knowledge about the social environment is laden with ambivalence. In particular, the omnipresent eventuality of arrière-pensées leads to an epistemological situation where there is no way out. Interestingly, Freud has found that our mind seems to function similarly: thoughts are not only determined, but over-determined, that is, influenced by a host of motives and ideas that endlessly and circularly refer to each other. This led Freud (1937) to speak of ‘endless psycho-analyses’, and Popper (e.g. 1989) to find psycho-analysis to be unfalsifiable and to deny it the status of a scientific theory (this is only one of the half-dozen of non-falsifiabilities Popper found). The same holds for the interpretation of the intentionality of a behaviour: there are many conjectures, but only very rarely definite refutations. In particular Machiavellian behaviour leaves things unsettled and evades both confirmation and falsification of what ‘actually’ happened. We have the same state of the art at the level of theory and data:
we do not (yet?) exactly know if and which social systems evolved towards honesty or deception, and when manipulation and direct tactics are expected to occur.

Although Machiavelli, Freud and Popper deserve credit for having systematically investigated the fuzziness of (social) knowledge, the morass of epistemological uncertainties caused by social complexity and ambivalence has been with us throughout our recent evolutionary history (say since 2 million years, but possibly many more, see below). An increase in cognitive complexity is one way to reduce uncertainty, but since it is self-reinforcing, it is open to run-away selection (see Chapter 12). Deception and counter-deception spirals are such arms-races of social cognitions. We propose that trust was and is the ultimate counter-measure against this trap. Some emotions may indeed be very simple social intelligence devices, which may be very well suited for reducing cognitive uncertainty, to speed decision taking and to facilitate memorising. Falling in love is another instance of such a device, love drastically diminishing uncertainty during mate choice. Clearly there are also drawbacks: cognitive complexity coupled with trust reduces uncertainty (Boon & Holmes, 1991), but coupled with distrust, it increases uncertainty and may reduce the capacity to action. Paranoia is a case in point. Trust involves some risk-taking and risk calculations, and paradoxically is even one of the prerequisites of successful deception. To reiterate two of our main theses: (a) The cognitively simple (trust) and cognitively complex (embedded mind-reading) may have similar social consequences and thus may be similarly adaptive or non-adaptive. (b) It is not sufficient to know how to let oneself into trust and how to mindread, but one has also to learn when to trust or mistrust.

There is only little empirical research on (mis)trust (Deutsch, 1973, 1983, 1991; Fincham et al., 1990, Boon & Holmes, 1991). But interestingly, Sigmund and Anna Freud, and particularly Erikson (1950), have postulated that the acquisition of fundamental trust in others is the most important and earliest developmental step in human life. If distrust then dominates, it may disturb social relationships throughout life (Boon & Holmes 1991). Research on attachment has produced similar results, both in humans and animals (for a review, see Rajecki et al., 1978): The bond to the mother is formed at birth and strongly influences the well-being and social functioning in child- and adulthood (e.g. 'secure base for exploration' effects or conflict management abilities, Suess et al., 1992).

Phylogeny: Comparators

Ambivalence arises with incompleteness of information and the necessity to reduce uncertainty. Uncertainty appears in phylogeny when organisms must discern useful information from noise (i.e. spurious, uninformative behaviour and transmission obstacles) and when they must compare, and take a decision on how and when to act. This happened early in evolutionary history. Feeding sites have to be assessed, and exploited or not. Females have to compare males with one another and males have to decide when to fight a rival. In such conflict situations, even lower animals such as spiders behave as if making risk evaluations (Krebs & Davies, 1978f, 1984, 1991). Semi-permeable or exclusive sociality, in contrast to solitary life and living in anonymous groups, raised many new occasions to compare. Almost all exclusive groups of animals are socially stratified, i.e. there is some form of hierarchy based on repeated comparing.

There are many ways to cope with ambivalence. Even random behaviour may be adaptive (see unpredictable 'protean' escape behaviour: Chapter 12). Flexibility varies greatly, from conditional strategies where individuals follow only one of some alternatives present in the population (e.g. silent sneaker males versus calling males in some frogs: Alcock, 1993) to tactical behaviour where each individual may switch between all alternatives available to the species (e.g. promiscuous mating or single-male centred consortship in chimpanzee females: Goodall, 1986). Man clearly has the largest behavioural flexibility. In most of the above cases, the fundamental problem is again not to know the procedural rule (e.g. fight or flight or submit when threatened), but when to use it (if the other is x-times larger, if the resource is worth n energy units, if benefits exceed costs).

Firstly, it follows from the above that the need for having some capability to compare and to choose among alternatives and thus for 'meta-learning' may have been present very early in phylogeny. Secondly, once social and other comparison mechanisms were present, a run-away process may have been started, social and other complexity intensifying itself through an increasing capacity of individuals to learn and to be flexible. Play may have a special role in acquiring this flexibility since it has often

1 We focus here on comparing, which is more relevant than noise in the analysis of social intelligence. Comparing may or may not be a conscious process.
been distinguished from 'serious' behaviour by its openness to new combinations of known procedures. Thirdly, great flexibility goes along with high centralisation of the nervous system, also seen within primates (Byrne, 1993; see Chapter 9). However, there seems to be no clear relationship between flexibility and ecological success. Indeed, aeromonads, cockroaches, gulls, rats and man are very successful ecologically, but have very different degrees of behavioural flexibility. Thus again, the consequences of behaviour, and not the underlying 'cognitive' complexity, ultimately determine success. *Homo sapiens sapiens* may be a noteworthy exception since s/he seems to be both the most flexible and the most successful. However at present, it is not easy to reliably quantify our ecological success.

Social success in children (with an essay into classification)

A functional and systematic approach

The following empirical findings illustrate some of the preceding theoretical points. We concentrate on proximate functional aspects by examining the contexts and consequences of behaviour (Hinde, 1975). A systematic approach to the consequences has to differentiate at least three interrelated dimensions: time (from the immediate to the reproductive phase of the next generation), costs and benefits, and the resources at stake (Alcock, 1993 gives a good introduction to the analysis of adaptive significance; see Borgerhoff Mulder, 1991 on human foraging and mating). There are enormous practical, methodical and logical difficulties in the study of adaptation. A complete analysis would require (a) longitudinally following many subjects and their relevant environments over a long time, (b) ensuring that the scrutinised behaviour is really adaptive, not a random by-product of other adaptations, and (c) measuring the critical consequences and their costs and benefits. This brief excursion into perfectionism shows that there is much to do.

Resources in children's lives: Material and socio-emotional

Material resources are those necessary to the physiological homeostasis of the organism (food, shelter, etc). Quite early, a sense for ownership develops that may encompass any accessible object or area such as food, toys or bed. Socio-emotional resources are body-contact and interaction with one, a few and many others that provide relief from distress and are objects of attachment, friendship, sociality and group affiliation. The need for autonomy and control coupled with playfulness and curiosity appear early. Moreover, children tend to demand to be the centre of attention from which they gain prestige, dominance, self-confidence and identity. From birth, material resources can almost only be acquired through interaction with others. Once acquired, some material resources such as food and toys, and later money and its analogues, may be used to gain socio-emotional resources such as interaction, friendship or regard, which in turn may lead to a social standing that facilitates access to resources, and so on.

Since almost all resources are limited, and since their acquisition is very often blocked by others, social conflict is one of the most important dimensions of life in groups. Most conflicts occur with familiar and friendly individuals (Hartup et al. 1988). Thus social block avoidance and removal, conflict management, and interaction and relationship repair are prominent elements of children’s daily lives.

Short-term resource acquisition (immediate to weeks)

Short-term social goals that kindergarteners try to reach are contact to talk (20%), access to an object (7%) or play group (7%), getting information (16%) or attention (16%), changing the behavioural flow of others (11%) and asking for help, persuading others to common play and searching for affection (21%). Others resist about equally often (average 40%) to all of these attempts, which is one resistance about every 2 minutes in a group of 15 children (Krasnor & Rubin, 1983). Overall and in the end, children are successful in about one third of all attempts, quite independent of whether they begin by verbally commanding, suggesting, describing, demanding, proposing co-operation or non-verbally using physical aggression, pointing or patting (Charlesworth et al., 1976; Charlesworth, 1978; Krasnor & Rubin, 1983). B resists A’s first attempt with a simple ‘no’ (35%), which leads almost always to A’s insistence, or with a justified ‘no’, which is accepted by A in about half of the cases (Eisenberg & Garvey, 1981). A for its part insists either unsuccessfully by repeating its first attempt, or by somewhat more successfully justifying its demand. Child A rarely proposes a compromise (4%), although it is a very efficient tactic (75% success). Most conflicts in young children consist only of a few turns and are then skipped (Shantz, 1987).
Thus, there are many occasions to remove blocks, many ways to proceed, and tactics vary in effectiveness. Subsequently, we describe more of preschool children's problems and solutions, but focus on interaction dynamics. All this indicates that there is ample room for meta-learning.

Managing conflicts by crying Infants' crying typically elicits care-giving, but might also produce anger and other negative emotions (Murray, 1979; Zahn-Waxler et al., 1983). Thus, the typical benefits of crying are to be comforted and nourished, and to have contact. However, babies that cry incessantly may activate anger, neglect and even abuse.

Effectiveness of crying is also frequency dependent in peer groups. In most kindergarteners, crying is very efficient since it elicits helping and comforting in about 95% of cases (Sawin, 1970 in Radke-Yarrow et al., 1983; Grammer, 1988). However, counter-measures develop against children who cry too often. They are branded as 'cry-babies' and ignored. Most kindergarteners, crying is very efficient since it elicits helping and comforting in about 95% of cases (Sawin, 1970 in Radke-Yarrow et al., 1983). However, counter-measures develop against children who cry too often. They are branded as 'cry-babies' and ignored.

Effectiveness of crying is also frequency dependent in peer groups. In most kindergarteners, crying is very efficient since it elicits helping and comforting in about 95% of cases (Sawin, 1970 in Radke-Yarrow et al., 1983; Grammer, 1988). However, counter-measures develop against children who cry too often. They are branded as 'cry-babies' and ignored.

This label may stick on them for weeks. Once their rate of crying has been low for some time, the effectiveness of their cries increases again. A similar social dynamic applies to sneakers who 'tell the teacher' to resolve conflicts, to discovered liars and to cheaters feigning conciliatory intentions. Note that crying and telling-the-teacher are tactics that are quite easy to learn, to perform and to understand for an observer, as compared with pretending conciliation and lying. Despite this, they elicit similar social dynamics when overused.

Resuming play and relieving stress: Conciliatory gestures Co-operative propositions, object offering, stroking, kissing, apologies, symbolic offers and repairing the concrete damage are typical gestures preschoolers use to make up (Sackin & Thelen 1984; A. Schmitt unpublished results, the following is based on 65 reconciliations). On average, children spontaneously repair about 30% of their conflicts. This rate increases to over 80% with increasing conflict intensity. Conciliatory gestures are very efficient since in 91% of all cases, they are accepted by the addressee and former opponents resume play. Playful togetherness and relief from conflict distress appear to be the main resources at stake.

The comparison of crying and conciliatory gestures illustrates well that tactics of very different degrees of cognitive and behavioural complexity may have similar immediate success and elicit similar counter-measures when it is discovered that they are used deceptively. Actually, the large majority of conciliatory gestures are honest, as suggested by three obser-

Effectiveness of crying is also frequency dependent in peer groups. In most kindergarteners, crying is very efficient since it elicits helping and comforting in about 95% of cases (Sawin, 1970 in Radke-Yarrow et al., 1983; Grammer, 1988). However, counter-measures develop against children who cry too often. They are branded as 'cry-babies' and ignored. Most kindergarteners, crying is very efficient since it elicits helping and comforting in about 95% of cases (Sawin, 1970 in Radke-Yarrow et al., 1983; Grammer, 1988). However, counter-measures develop against children who cry too often. They are branded as 'cry-babies' and ignored.

This label may stick on them for weeks. Once their rate of crying has been low for some time, the effectiveness of their cries increases again. A similar social dynamic applies to sneakers who 'tell the teacher' to resolve conflicts, to discovered liars and to cheaters feigning conciliatory intentions. Note that crying and telling-the-teacher are tactics that are quite easy to learn, to perform and to understand for an observer, as compared with pretending conciliation and lying. Despite this, they elicit similar social dynamics when overused.

Resuming play and relieving stress: Conciliatory gestures Co-operative propositions, object offering, stroking, kissing, apologies, symbolic offers and repairing the concrete damage are typical gestures preschoolers use to make up (Sackin & Thelen 1984; A. Schmitt unpublished results, the following is based on 65 reconciliations). On average, children spontaneously repair about 30% of their conflicts. This rate increases to over 80% with increasing conflict intensity. Conciliatory gestures are very efficient since in 91% of all cases, they are accepted by the addressee and former opponents resume play. Playful togetherness and relief from conflict distress appear to be the main resources at stake.

The comparison of crying and conciliatory gestures illustrates well that tactics of very different degrees of cognitive and behavioural complexity may have similar immediate success and elicit similar counter-measures when it is discovered that they are used deceptively. Actually, the large majority of conciliatory gestures are honest, as suggested by three obser-

Effectiveness of crying is also frequency dependent in peer groups. In most kindergarteners, crying is very efficient since it elicits helping and comforting in about 95% of cases (Sawin, 1970 in Radke-Yarrow et al., 1983; Grammer, 1988). However, counter-measures develop against children who cry too often. They are branded as 'cry-babies' and ignored. Most kindergarteners, crying is very efficient since it elicits helping and comforting in about 95% of cases (Sawin, 1970 in Radke-Yarrow et al., 1983; Grammer, 1988). However, counter-measures develop against children who cry too often. They are branded as 'cry-babies' and ignored.

This label may stick on them for weeks. Once their rate of crying has been low for some time, the effectiveness of their cries increases again. A similar social dynamic applies to sneakers who 'tell the teacher' to resolve conflicts, to discovered liars and to cheaters feigning conciliatory intentions. Note that crying and telling-the-teacher are tactics that are quite easy to learn, to perform and to understand for an observer, as compared with pretending conciliation and lying. Despite this, they elicit similar social dynamics when overused.

Resuming play and relieving stress: Conciliatory gestures Co-operative propositions, object offering, stroking, kissing, apologies, symbolic offers and repairing the concrete damage are typical gestures preschoolers use to make up (Sackin & Thelen 1984; A. Schmitt unpublished results, the following is based on 65 reconciliations). On average, children spontaneously repair about 30% of their conflicts. This rate increases to over 80% with increasing conflict intensity. Conciliatory gestures are very efficient since in 91% of all cases, they are accepted by the addressee and former opponents resume play. Playful togetherness and relief from conflict distress appear to be the main resources at stake.

The comparison of crying and conciliatory gestures illustrates well that tactics of very different degrees of cognitive and behavioural complexity may have similar immediate success and elicit similar counter-measures when it is discovered that they are used deceptively. Actually, the large majority of conciliatory gestures are honest, as suggested by three obser-

Effectiveness of crying is also frequency dependent in peer groups. In most kindergarteners, crying is very efficient since it elicits helping and comforting in about 95% of cases (Sawin, 1970 in Radke-Yarrow et al., 1983; Grammer, 1988). However, counter-measures develop against children who cry too often. They are branded as 'cry-babies' and ignored. Most kindergarteners, crying is very efficient since it elicits helping and comforting in about 95% of cases (Sawin, 1970 in Radke-Yarrow et al., 1983; Grammer, 1988). However, counter-measures develop against children who cry too often. They are branded as 'cry-babies' and ignored.
the most wanted short- and long-term resources in children’s lives. However, there is a high potential of rejection (54% among well acquainted 3–4 year olds, Corsaro, 1981; even 26% in popular children, Putallaz & Gottman, 1981). Actually, the entry situation has been identified both by teachers and clinicians as posing serious problems to children, and as being a key element in long-term peer acceptance and a quick diagnostic of social competence.

The most successful tactic (>95%) to enter a familiar peer play group is to wait, circle around the area and observe, to greet and make an empathic statement on the group’s activity and then to request access and engage in a behaviour similar to that underway. This tactic seems to be a demonstration of sharing the group’s frame of reference. However, 3–4 year olds most often (>70%) use non-verbal tactics (physical contact, watching and circling, entering and smiling) or disruptive verbal tactics (making a claim on the area or on play objects, presenting self), that are quite ineffective (about 20%). Moreover, most of the ineffective tactics used are only one step in length, consisting of waiting and watching, or in non-verbal entry. The successful tactics however are those consisting of many steps, i.e. persistent tactics of a high escalative potential. Overall, Corsaro (1979) identified 15 entry tactics, the least successful being used the most often. The most parsimonious explanation for this seems to be that the learning process underway is trial-and-error. Its low effectiveness is easy to understand since 15 tactics, many alternatives at each step and the necessity to use indirect multi-step procedures leads to the previously mentioned combinatorial explosion. Moreover, children instruct each other very incompletely and the meta-rules have thus to be inferred by observation or by lonesome experience. Thus, at 3–4 years, social intelligence seems to be inadequate to definitely solve the entry problem, although many tactics are tried.

Sometimes, while apparently trying to enter a group, children present themselves (‘I have a larger car’), derogate group members (‘your drawing is awful’), force inclusion, either by citing a rule mandating it or by threatening or otherwise asserting power. This is an inefficient tactic. However, these children may not be interested in joining the group, but they may want to confirm or improve their social standing vis-à-vis the group or individual group members. This actually works (Hold-Cavell & Borsutzky, 1986). Thus, children may have very different motives in approaching others.

**Long-term resource acquisition (months to years)**

Long-term resources are objects (that are valued by themselves and as a means to facilitate interaction; for a brief review, see Schropp, 1986), access and affiliation to a peer group, relationships with group members (friendship, dominance) and social status (prestige, reputation, popularity). One principle pervades all analysis of social intelligence, and particularly of relationships and group structure: linear cause–effect relations do not hold, or, put positively, each of the above descriptors may be a cause as well as an effect of social organisation; for example popularity facilitates access to a play-clique. Since playing together is fundamental for children’s friendships (Youniss, 1986), participation increases popularity, which in turn improves the chances of making friends and entering other play groups, and so on. The same self-reinforcing dynamics hold for rejection (Hymel et al., 1990) and supporting others in conflict (see below). To complicate things, high status, friendship and dominance, and particularly being a member of a group of high-ranking friends results in high levels of access to and utilisation of limited material resources (Charlesworth & LaFreniere, 1983). Possession of desired objects increases prestige, etc. Consequently, it is very difficult to determine if a behaviour is a resource in itself or a means to another end. In fact, both immediate and long-term, and both material and socio-emotional resources may simultaneously be at stake. These may conflict and produce ambivalence, and thus complicate the social judgement of those involved and observing, including scientists.

**Entering a peer group: Newcomers**

Newcomers need 1–2 months to accommodate to an existing group. In newly forming groups, about 5–10% of the children are never accepted, even after months (our informed guess; we are not aware of data). They have no friends, are disliked and spend most of their time alone. In the first week, newcomers are ‘the antithesis of aggressive: arms kept down and close to trunk, face and eyes averted, movements slow, silent’ (McGrew, 1972). They observe continuously and then start to engage in behaviours practiced by in-groups. Again, as in the case of entering familiar groups, this demonstration of sharing the group’s frame of reference efficaciously triggers acceptance. Premature attempts to influence group members are ignored or rejected. ‘... as the newcomer observes his peers interacting, he comes to recognize the
behavioural contingencies of inclusion, approval, and acceptance. By relying on the actions of more knowledgable hosts and the observable consequences of their behaviour, new children may learn to act appropriately without having to discover what is positively or negatively sanctioned from direct experience (Feldbaum et al., 1980).

The above points to the difficulties associated with contacting familiar play-cliques and a new group. While the former is essential in determining social standing within a group, the latter may have been among the most challenging and life-threatening of social situations encountered throughout the history of our species. Indeed, xenophobia and ethnocentrism are universals and a primate legacy (Goodall, 1986; Brown, 1991; Eibl-Eibesfeldt, 1995).

Obtaining high regard and leadership: Self-presentation, threat, being helpful and ‘nice’ Verbally attracting attention is the most frequent and efficient tactic to obtain high regard. The performer becomes the centre of attention in 21% of all cases and in the long run increases status (over a year; Hold-Cavell & Borsutzky, 1986). There are some other behaviours that are only slightly less frequent and efficacious: ostentatious movements (climbing on a table), gently touching others, and threatening displays. Thus, single acts of self-presentation or threat are not very efficacious, but they add up over long time periods. Moreover, self-presentation items not directed to a specific person, and directed aggressive moves, have additive effects.

Children visually monitor individuals who are frightening and worthy of imitation. The amount of attention paid to an individual has proved to be a valid observational index of social status or group structure. It is related to dominance and popularity, and partially predicts leadership, i.e. initiating and organising games, being imitated, arbitrating, protecting (for a review, see Hold-Cavell, 1992). The fact that threat displays increase rank in attention structure and thus leadership allows prediction of a more frequent and direct involvement of leaders in conflicts, as compared to non-leaders. Actually, Montagner et al. (1988) showed that leaders participate much in conflicts, impose themselves, but use gentle forms of aggression, e.g. threat displays. However, they are also very cooperative or ‘nice’, e.g. they accept objects offered by others or give solicited objects in about 80% of all cases.

Acquisition of social status appears to be an extremely complicated task. In recent years, a number of studies have tried to determine the role of social cognitions associated with this task, particularly with failures to master it. Some conclusions of this research are particularly relevant in the present context (after Dodge & Feldman’s, 1990 review). Firstly, there are consistent differences in social intelligence between high and low status children, the latter being less sophisticated. Secondly, children’s socio-cognitive intelligence is not a single construct, but a series of distinct social information processing devices. Thirdly, in low-ranking children, the degree of deficiency of their cognitions and behaviour varies across situations and with time. That is, they have no general intellectual deficits; rather, they misinterpret and misbehave in particular situations.

Status gain through conflict management: Reciprocity, hawks, mice, bullies, retaliators and supporting others Reciprocal co-operation is associated with gain in social status over the school year (Atzwanger, 1991; sequences of two moves were analyzed; status was measured by position in attention structure). In contrast, reciprocal aggression (an eye for an eye) does not result in status changes (Grammer & Atzwanger, 1992). On the level of three-move sequences, a child, B, may immediately counter-attack a charge by A and then initiate another attack on A (the hawk tactic; terminology loosely follows Maynard Smith & Price, 1973). B may also persistently take to flight (mouse) or first react with a threat and then withdraw when confronted with a new attack (bully). Finally, B may first show flight and then initiate an attack on A (retaliator). Only retaliation resulted in long-term status gain (Atzwanger, 1991). The long-term efficiency of the tit-for-tat, another simple tactic derived from reciprocity, has been shown theoretically in simulation tournaments (Axelrod, 1984).

We want to add an example of status loss through conflict management. Barner-Barry (1986) has described a group of children’s tacit, non-concerted use of ostracism to control the aggressive and disruptive behaviour of a formerly accepted peer (ROB). The behaviour of all individual group members was as simple and efficient as it could be: they avoided ROB and excluded him from common activity for weeks, until his aggressions almost disappeared (see Chapter 13).

The above interaction and conflict management tactics appear to be cognitively very straightforward and driven by elementary emotions such as the universal anger-retaliation scheme (Russell, 1991) or avoidance of aversive stimuli. This contrasts with supporting others in conflicts, i.e. intervening from an observer position and thus being emotionally less absorbed. Nevertheless, the correlation of long-term status gain with
retaliation and supporting are similar (moderately high, around 0.5: Atzwanger, 1991; Grammer, 1992). The following description of the three main supporting tactics illustrates the cognitive demands (Grammer, 1992). Note that in general, both the supporter and the supported gain status. During ganging-up-on, a child C backs the high-ranking winner A in a quarrel between A and B. This is a low-cost tactic by which C seems to direct A’s attention to itself and to lower B’s status. Despots are high-ranking and intervene in conflicts between low-ranking B and C. Despots distribute their support among many different children since a repeatedly aided individual may climb the social ladder and become a rival. Despotism thus seems to cement the status quo of the group. Reciprocal supporting among friends enables both allies to rise in rank. In sum, aid-giving in conflicts may be both a demonstration of a power position and a means to reach it. This conclusion is corroborated by three observations adding to the above. Firstly, most of the time, supporting has no obvious immediate goal. It seems to be ‘explorative’. Secondly, high-ranking individuals support and are supported more often than low rankers. Thirdly, friends are helped more often than non-friends.

**Very-long-term resource acquisition (life span and beyond)**

The ultimate ends of meta-learning It is unclear how the social knowledge children acquire is exactly related to the mastering of adult life. We have already mentioned the influence of early attachment and trust on the later ability to resolve conflicts in the peer group (Suess et al., 1992) and in marriage (Boon & Holmes, 1991). Also, entering a group or making contact with an unknown individual are often needed in adult life. In a general way, many of the behavioural elements and the social dynamics described above are familiar to adults. More specifically, experience with dominance behaviour and tactics used to obtain and maintain high regard, status and power, and the ability to mindread or understand the frame of reference of another may be very useful in mate choice. From a biological viewpoint, mate choice, parental care and altruism towards kin are the most important social tasks adults have to master. Sexual selection theory predicts that all reproductive efforts are fraught with ambivalence and interest conflicts (e.g. since females are the limiting factor in reproduction, males have to compete for females, which in turn choose among males and incite their rivalry; Borgerhoff Mulder, 1991). Men’s socio-economic status is an important mate choice criterion of women, who use social position, prestige and wealth as indicators (Buss & Schmitt, 1993). Thus during flirting and courtship, deception attempts are expected to be numerous, e.g. men exaggerate their status and women feign interest in order to discover a man’s ‘real’ attributes. Actually, dates do not often lead to partnership. Success is far below 10% among clients of dating services (Grammer, 1993).

*From conditioning to simulating*

Some of children’s solutions to social problems may be equivalent in terms of success, although they vary much in cognitive and behavioural complexity. Complexity may be used to classify the different arts of social block management. The most simple elements of social ‘intelligence’ are probably innate (e.g. the maintenance of eye-contact of newborns). Easy to perform behaviours (crying) and reactively mirroring the other’s actions (chains of blows during quarrelling, retaliation) need only little more insight. Some understanding of the other is suggested by step-by-step and reactively adapting one’s own behaviour to that of the other (obvious when children solicit objects). No more understanding underlies attention-seeking, which is conditioned by glances and looks of others. A broader understanding of the situation and of the available action alternatives, accompanied by some planning, is exemplified in conciliation. Mindreading and simulation may play an important role in supporting others in conflict and in entering groups. This is suggested by the fact that they are often preceded by long observation and by the variability of the behaviours actually performed. Most mindreading and behavioural flexibility is clearly needed in the acquisition of long-term resources such as leadership. In the long run, the ‘fittest’ tactics may not only survive through mental selection processes (simulation), but also through ‘natural’ selection (social pressure, success). Heuristics, meta-rules, mindreading and simulation capabilities thus may not only emerge through insightful thinking, but also through conditioning.

A classification like the above, which admittedly is only a first attempt, is one prerequisite (among others such as a similar typology of social problems), to quantitatively test hypotheses derived from Machiavellian intelligence theory. For example, our preliminary analysis does not corroborate the following hypotheses $H_1$ and $H_2$ (the reader is asked to imagine how it is related to $H_3$ and $H_4$).
H1: Successful solutions to any social problem are cognitively and behaviourally complex.
H2: Complex problems are better solved by complex solutions.
H3: The more complex a problem, the more potential solutions (intelligence) are required.
H4: Complexity prevails in the social world, as compared to the non-social world.

An old hat as conclusion: More data and theories needed
We have tried to make clear that social success, and ultimately reproductive success, is mainly determined by the consequences of a behaviour, and less by the cognitive complexity ('intelligence') underlying it. 'Simple' and 'complex' behaviour may be equally adaptive or non-adaptive. What is most needed is a measure for the complexity of problems and solutions. Our description of children's social intelligence showed the diversity of their behavioural repertoire and the successes and failures of their 'social engineering'. We demanded more data, to be collected through naturalistic observation, and an integrative functional theory. The Adapted Mind theory (Barkow et al., 1991) is promising, but since it postulates that our brains are made of separately evolved 'modular' entities, its integrative power may not suffice. Indeed, it has no criterion to delimit modules from brains are made of separatedly evolved 'modular' entities, its integrative success, is mainly determined by the consequences of a behaviour, and less by the cognitive complexity ('intelligence') underlying it. 'Simple' and 'complex' behaviour may be equally adaptive or non-adaptive. What is most needed is a measure for the complexity of problems and solutions. Our description of children's social intelligence showed the diversity of their behavioural repertoire and the successes and failures of their 'social engineering'. We demanded more data, to be collected through naturalistic observation, and an integrative functional theory. The Adapted Mind theory (Barkow et al., 1991) is promising, but since it postulates that our brains are made of separately evolved 'modular' entities, its integrative power may not suffice. Indeed, it has no criterion to delimit modules from each other and would postulate distinct modules for each of the resource acquisition strategies identified in children's lives: one for entering groups, for status acquisition, peacemaking etc. In view of the pervasive need for theories, we close with a definitely old epistemological hat, quoting some weavers and champions of it.

- What I believe was strictly true is that innumerable facts were stored in the minds of naturalists ready to take their proper places as soon as any theory which would receive them was sufficiently explained. CHARLES DARWIN
- Theory determines observation. ALBERT EINSTEIN
- Nothing is more practical than a good theory. WINSTON CHURCHILL
- The above is absolutely true since I have completely imagined it. BORIS VIAN

Acknowledgements
The authors were supported by the Austrian Science Foundation (FWF, p.9723).

References
Corsaro, W. A. (1979). "We are friends, right?": Children's use of access rituals in a nursery school. Language in Society, 8, 315–36.


