# Moral decision-making and moral development: Toward an integrative framework

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## ABSTRACT

How moral decision-making occurs, matures over time and relates to behaviour is complex. To develop a full picture of moral decision-making, moral development and moral behaviour it is necessary to understand: (a) how real-time moral decisions are made (including relevant social and contextual factors), (b) what processes are required to develop to enable mature moral decisions, (c) how these processes develop over time, and (d) how moral decisions relate to behaviour. In this paper, psychological and social neuroscience theories of moral decision-making and development are briefly reviewed, as is the development of relevant component processes. Various component processes and factors are seen as required for moral decision-making and development, yet there is no comprehensive framework incorporating these components into one explanation of how real-time moral decisions are made and mature. In this paper, we integrated these components into a new framework based on social information processing (SIP) theory. Situational factors, and how both cognitive and affective processes guide moral decisions was incorporated into the Social Information Processing-Moral Decision-Making (SIP-MDM) framework, drawing upon theories and findings from developmental psychology and social neuroscience. How this framework goes beyond previous SIP models was outlined, followed by a discussion of how it can explain both real-time moral decisions and moral development. We concluded with how the SIP-MDM framework could be used to guide future research and theory development in this area.

## Introduction

Differences in research approaches to moral decision-making and moral development, informed by various theories and perspectives have led to a discrepancy in the definitions and usage of moral terms, which can cause confusion. The terms 'moral judgement', 'moral reasoning', and 'moral cognition' are often used interchangeably, and with differing definitions. The broader term moral decision-making will be used in this paper, to refer to any decision, including judgements, evaluations, and response choices, made within the 'moral domain' (Smetana, 2006; Turiel, 1983), i.e. decisions regarding moral issues or principles such as justice, harm, fairness and care. A moral decision can be a response decision about how to behave in a real or hypothetical moral dilemma (a situation with moral rules or principles attached, where a response choice is required), or it can be a judgement or evaluation about

the moral acceptability of the actions, or moral character of others, including judgements of individuals, groups or institutions.

"Judgments and decisions of any sort – including those that involve matters of morality – are not a matter of magic but result from processing of information" (Fiedler & Glöckner, 2015, p. 139). Moral decision-making, similarly to other types of decision-making, is a complex process. When deciding how to act in a situation within the moral domain an individual must firstly recognise the situation as having moral rules attached, retrieve relevant moral schemas from memory, encode and interpret relevant features of the situation and generate and evaluate possible moral response options. As many processes are involved when making moral decisions, particularly moral response decisions, it follows that in order for moral decision-making to mature, many processes, and relationships between processes, are required to develop. For example, to encode the relevant features of a moral situation, attention must be allocated to these features. Increases in attentional abilities will lead to more features of a situation being encoded, and therefore enhance the capacity for making more mature moral decisions. However, many other processes are also involved in moral decision-making and each is necessary but not sufficient for mature moral decision-making. Moral development is the maturation of moral decision-making, including the development of moral reasoning and related processes that increase the capacity for making mature moral decisions. Moral reasoning differs from other forms of reasoning because it is guided by morally relevant rules, knowledge and understanding, stored in memory as moral schemas. Moral reasoning is one process that can guide moral decisions, but other processes and factors are also involved, and the extent of their involvement can differ depending on the type of decision being made.

The moral domain covers the fairly universal principles of harm, justice, fairness and care, though how these principles are set out as rules or laws can differ between societies, cultures and religions, and may change over time. It does not necessarily follow that mature moral decisions based on a deep understanding and appreciation of moral principles will lead to behaviour that conforms to a law of society. For example, an individual with a mature understanding of the moral principle of fairness may feel they cannot obey laws that violate the human rights of a certain group. Furthermore, whether a moral response decision leads to enactment of a chosen behaviour may depend on other contextual and situational factors. Behaviour which conforms to or follows moral principles (though not necessarily laws) of society can be referred to as moral or prosocial behaviour, and behaviour which violates a moral principle of society can be referred to as immoral or antisocial behaviour. Moral decision-making and how it develops will be the focus of this paper, rather than moral behaviour, but we do offer some suggestions for how future research could enhance our understanding of the relationship between moral decisions and behaviour.

As outlined, moral decision-making, moral development and relationships between moral decision-making and behaviour is complex. Previous theories have failed to comprehensively explain how real-time moral decisions are made, how they mature over time and how they relate to behaviour. Moral theories within developmental psychology have focused on the maturity of moral reasoning, as a process that guides moral decision-making. Such theories explain how moral reasoning develops and matures, for example through increased role-taking opportunities leading to improvements in perspective taking and a move away from ego-centrism (Piaget, 1932). However, these developmental theories have often neglected factors that affect real-time moral decision-making, such as relevant situational factors, and moral reasoning "levels" do not always correlate with behaviour (Blasi, 1983). Some moral psychology theories have focused on real-time moral decision-making, such as the social intuitionist theory (Haidt, 2001) which proposed that moral decisions are driven by automatic intuitions, yet these theories do not suggest how moral decision-making matures or changes over time.

In recent years there has been an increased interest in moral decision-making amongst social neuroscientists (Beauchamp, Dooley, & Anderson, 2013; Dooley, Beauchamp, & Anderson, 2010; Greene, Sommerville, Nystrom, Darley, & Cohen, 2001; Mendez, Anderson, & Shapira, 2005). The most prominent moral theory in social neuroscience is the dual-process theory, which makes inferences about the cognitive and affective processes involved in moral decision-making based on the extent to which different brain regions are activated when making such decisions (Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008; Greene, Nystrom, Engell, Darley, & Cohen, 2004; Greene et al., 2001). Some social neuroscience perspectives are more developmental in focus, suggesting how brain development facilitates moral development through its effect on the emergence of relevant cognitive and affective processes, but such theories do not always reference the rich tradition of developmental psychology theory in this area (Baird, 2008; Kagan, 2008). Taken together, moral theories from developmental psychology and social neuroscience have the potential to provide a fuller picture of moral decision-making and moral development.

Moral theorists have proposed many different component processes and factors required for moral decision-making and moral development, such as perspective taking, intuitions and empathy. These components have not yet been integrated into one comprehensive theory which explains how real-time moral decisions are made and how they mature over time. In a review of the neuroscience of moral cognition, Van Bavel, FeldmanHall, and Mende-Siedlecki (2015) advocated a shift from dual-process theories to a dynamic systems model of moral cognition. For a dynamic explanation of moral decision-making and moral development it is necessary to understand (a) how real-time moral decisions are made (including relevant social and contextual factors), (b) what processes are required to develop to enable mature moral decisions, and (c) how these processes develop over time. To also explain moral behaviour, it is necessary to understand how moral decisions relate to behaviour. Further research and theory development is needed to answer these questions and provide a predictive model of moral decision-making and eventually moral behaviour. An integrative framework incorporating aspects from developmental psychology and social neuroscience could be a first step towards such a model, in order to guide future research and theory development in this area. Social information processing theory (SIP) has previously been integrated with moral domain theory (Arsenio & Lemerise, 2004) but this integration could be expanded on to include components from other moral theories while increasingly focusing on development.

In this paper, the main moral theories and perspectives will be briefly reviewed, followed by a summary of their respective strengths and weaknesses. We will explain why an integrated theory is needed and introduce SIP theory as an approach that can be useful for such a framework. The component processes and factors suggested as being relevant for moral decision-making and

development will be outlined, and selected research into how the main component processes develop will be discussed. These components will then be incorporated into an integrative framework based on SIP theory. How this framework differs from previous SIP models and how it can explain moral decision-making and moral development will then be outlined, followed by suggestions for how the framework could be used to guide future research and theory development in this area.

## A brief review of moral theories and perspectives

### Cognitive-developmental and affective development theories

Historically, moral psychology has been dominated by the rationalist, cognitive-developmental theoretical perspective, employing stage theories to explain development. Piaget's (1932) theory, often considered to be the first cognitive-developmental theory of moral development, outlined four stages of logical reasoning and two stages of moral development: heteronomy and autonomy. Children in the heteronomous stage feel an obligation to abide by the external rules set by adults and when they reach the autonomous stage they realise that rules are worthy of respect and are based on mutual consent (Piaget, 1932). Piaget (1932) proposed that logical reasoning develops alongside related cognitive processes such as abstract reasoning, and this paves the way for moral development. At stage four, logical reasoning is defined by the ability to use complex, abstract cognitive skills to solve problems, in turn facilitating more mature moral decisions. Piaget (1932) hypothesised that moral development occurs as a child moves away from egocentrism, which requires the cognitive capacity to differentiate between the ego and social environment, and is facilitated by the maturation of language and imagination. From the age of about six or seven, a child's opportunities for peer co-operation facilitates the development of mutual respect, and so the child moves away from egocentric thought (Duska & Whelan, 1977). Piaget (1932) proposed that children construct their social and moral intelligence through managing their social interactions, and he emphasised peer over parent interactions.

Kohlberg (1976, 1981, 1984a) expanded Piaget's theory beyond childhood, to encompass adolescence and adulthood, and argued that, "since moral reasoning clearly is reasoning, advanced moral reasoning depends upon advanced logical reasoning. There is a parallel between an individual's logical stage and his or her moral stage" (Kohlberg, 1984b, p. 171). Kohlberg (1976, 1981) proposed six stages of moral judgement, grouped into three levels: pre-conventional, conventional and post-conventional. The pre-conventional level is the level of most children under nine, while most adolescents and adults are at the conventional stage, and the post-conventional level is reached by a minority of adults. Similarly to Piaget (1932), Kohlberg (1976, 1981) emphasised the importance of role-taking (taking another's perspective) in moral development and proposed that a child's social environment provides role-taking opportunities and such participation in role-taking spurs on moral development. Kohlberg saw his six stages as sequential, one must pass through each in turn. Development to the next stage occurs when cognitive disequilibrium is created, or when a person's perspective is not sufficient to deal with a moral dilemma. This disequilibrium causes a person to think about the inadequacies of their reasoning and to search for more adequate reasons (Duska & Whelan, 1977). There have been some notable criticisms of Kohlberg's theory; some have commented that his theory is masculine in perspective (Gilligan, 1982), and there is evidence to doubt whether the higher developmental stages are culturally universal (Snarey, 1985).

Rest, Bebeau, and Thoma's (1999) componential model of moral development is often referred to as a neo-Kohlbergian approach, moving the field away from stage theory, and instead of seeing development as occurring one stage at a time, development was considered gradual, leading to more mature forms of thinking. Rest (1984), proposed that the four components underlying moral action are moral sensitivity, moral judgement, moral motivation and moral character. Moral sensitivity involved interpreting the situation and an awareness of the relevant moral factors and implications, including how actions would affect others, which requires perspective taking. The moral judgement component involved deliberation over possible courses of action and deciding which would be most morally justifiable. The moral motivation component involved prioritising moral values over other competing values, and moral character referred to skills and strategies that support the moral choice, such as self-control (Rest, 1984; Walker, 2002). This model integrated both cognitive and affective processes and also highlighted that moral action (behaviour), not just moral judgements, required explanation. Rest et al. (1999) also recognised the usefulness of schema theory to moral development, which was further developed by Gibbs (2013).

Cognitive-developmental theorists proposed that cognition, and particularly reasoning, is the main driver of moral decisions. Hoffman's theory (2000), on the other hand, is one of affective primacy, and focused on affective empathy as the main driver of moral decisions, rather than cognition, though he did highlight the role of cognition for development and for achieving a "self-other" distinction. He proposed that empathy is congruent with the moral principles of caring and justice, playing an important role in moral decision-making and reasoning. Hoffman's (2000) developmental framework of empathy involved three primitive modes: mimicry, conditioning and direct association, and two mature modes: verbally mediated association and social perspective taking, with language and cognitive development facilitating the development of the mature modes. He proposed that affective empathy, construed as affect rather than cognition, becomes bonded with moral principles, giving the principles motive force, while empathy could act as a powerful retrieval cue, triggering moral schemas stored in memory. Hoffman (2000) also linked cognition with emotion, as he hypothesised that the attributions people make about the cause of events can affect the level of empathy experienced; empathic distress may be neutralised if a victim is viewed as being responsible for their own plight. He hypothesised that a person's moral structure, made up of empathic affects, cognitive representations and motives is internalised when they accept and abide by its principles without regard to external reward or punishment.

Gibbs (2013) offered an alternative to affective or cognitive primacy theories, and argued that the most plausible position within developmental theory is that moral motivation occurs as a consequence of affective and cognitive *co*primacy; that is, both affect and

cognition act as motives for moral action. While Kohlberg proposed six stages, Gibbs, Basinger, and Fuller (1992) and Gibbs (2013) proposed four stages, grouped into immature and mature levels, and added more transitional stages. Gibbs (2013) argued that the standard stages of moral development reflect gains in working memory, and hypothesised that attentional abilities are required to develop for the maturation of moral decisions. Increasing attentional abilities allow individuals to attend to more than one feature of a situation, moving away from an egocentric bias, and gains in working memory capacity allow for more than one source of information to be held in mind when making decisions (Gibbs, 2013).

Gibbs (2013) also hypothesised other factors relevant to explaining moral behaviour; he proposed that antisocial behaviour can be explained as a function of a developmental delay in moral judgement, self-serving cognitive distortions (e.g. self-centred, blaming others and minimising biases) and deficiencies in social skills. Gibbs (2013) proposed that the mature stages of moral development are constructed through social perspective taking. He developed Rest et al.'s (1999) proposition that moral stages should be conceptualised as schemas, proposing that adaptive refinement and reorganisation of schemas enables moral development to take place. Schemas are "general knowledge structures that reside in long-term memory and facilitate information processing" (Walker, 2002, p. 361), with moral schemas being knowledge structures regarding moral events. However, moral decisions do not just mature because they are based on an increased quality and quantity of empirical knowledge; schemas are frameworks, and moral maturity, or "growing beyond the superficial" requires a deeper understanding of fairness and moral reciprocity (Gibbs, 2013).

While Rest et al. (1999) and Gibbs (2013) revised Kohlberg's theory (Kohlberg, 1976, 1981, 1984a, 1984b), retaining the cognitive-developmental perspective, others have criticised Kohlberg's theory and called for a new approach, due to the lack of correlation between moral maturity and behaviour (Krebs & Denton, 2005). It has been argued that the study of morality has been dominated by investigating moral decisions as an end product, whereas in real life, behaviour is the end product (Krebs and Denton, 2005), and moral reasoning does not fully explain behaviour (Blasi, 1983). Rest (1984), Rest et al. (1999) and Gibbs (2013) has been crucial for advancing the moral development field towards a co-primacy approach and in conceptualising moral stages as schemas. Both theories focus on moral action as the end point, and go some way to explaining moral motivations and the moral decision-making processes that occur when weighing up different courses of action. These theories could be expanded by also taking into account other, non-moral factors, such as situational factors, that might affect the process from moral decisions to behaviour. Rather than rejecting cognitive-developmental perspectives, an integrative approach incorporating aspects from cognitive-developmental theories with additional aspects from other relevant theories may lead to a theory which predicts moral behaviour more robustly.

*Social intuitionist theory and the somatic marker hypothesis*

Through their focus on the development of logical reasoning development, early moral development theorists proposed that moral decisions are *driven* by reasoning, within the cognitive domain. On the other hand, within social intuitionist theory, Haidt (2001) proposed that moral decisions are driven by emotionally-based intuitions, and that moral reasoning is constructed *after* a decision, to explain a decision that had been made intuitively. Haidt and Bjorklund (2008) argued that moral beliefs and motivations come from a small set of intuitions that have evolved. Support for the theory comes from studies which show 'moral dumbfounding'; people give quick answers to moral dilemmas but then struggle to explain their answers (Haidt & Hersh, 2001). The real difference between rationalist and intuitionist theories is one of emphasis; while rationalists believe that the real action is reasoning, intuitionists believe that the real action is "gut feeling", moral emotions and quick intuition (Haidt & Bjorklund, 2008).

The social intuitionist view of intuitions driving moral decisions is not entirely dissimilar to Damasio's (1994) somatic marker hypothesis, although there are differences with reference to the role of reasoning. Somatic markers are another intuitive, automatic process which may guide some moral decisions. The somatic marker hypothesis (Bechara & Damasio, 2005; Damasio, 1994) recognised the role of emotions in decision-making and proposed that when we think of a bad outcome connected with a given response option that comes to mind, we experience an unpleasant gut feeling, which is a 'somatic marker'. This somatic marker then forces our attention onto the negative outcome and may lead to rejection of this option. Somatic markers can be stored in memory as affect-event links, which further aid future decision-making (Damasio, 1994) as they can guide decision-making by anticipating future events, even when not consciously recognised (Bechara & Damasio, 2005). While somatic markers can operate without coming to consciousness, when they are conscious they can help to narrow down the number of response options and this process occurs before reasoning, increasing the accuracy and efficiency of the decision process (Damasio, 1994). This is in contrast to the social intuitionist view that reasoning is not involved in the decision-making process but is only carried out to explain a decision already made.

Haidt (2001) argued that the important distinction between intuition and reasoning is that intuition occurs quickly, effortlessly and automatically, while reasoning is slow and requires more effort, including attentional resources. Kahneman (2011) uses the metaphors of System 1 and System 2 to describe fast and slow thinking. System 1 is responsible for intuitive, automatic thinking and operates with little or no effort, while System 2 is responsible for more deliberate thought and reasoning and requires effortful mental activities. Kahneman (2011) argued that System 1 is responsible for more of the decisions we make than System 2, and his view seems to mirror that of the social intuitionists: "If System 1 is involved the conclusion comes first and the arguments follow" (p 45). However, System 2 is needed to monitor and control thoughts and actions suggested by System 1, so deliberate thought and reasoning are needed to confirm, reject or reformulate the automatic suggestions, or intuitions of System 1.

*Domain theory*

Domain theory, referred to as social-cognitive domain theory or moral domain theory, views morality as one of several strands of the developing social knowledge of children (Smetana, 2006; Turiel, 1983). This theory makes the important distinction between the

personal, moral, and social domains and it is proposed that these domains follow different developmental trajectories, with knowledge being constructed through reciprocal social interactions. The majority of research based on domain theory has focused on establishing whether children of different ages can distinguish between moral and social conventional acts (Killen & Smetana, 1999; Smetana, 1985; Song, Smetana & Kim, 1987; Tisak & Turiel, 1988). Hypothetical situations used in studies are either in the personal, moral or social domain, yet real-life situations often involve more than one domain. Nucci (2001) argued that in mixed-domain situations there are individual differences in whether the situation is interpreted as being in the social or moral domain.

While domain research has been helpful in highlighting the distinction between domains, the predictions made about how moral decisions develop and mature with age require greater theoretical elaboration. In summarising domain-related research, Smetana (2006) argued that studies with children of different ages confirm understanding within the moral domain develops from a focus on concrete harm in early childhood to an understanding of fairness in later childhood. This is similar to how cognitive-developmental theorists propose that moral reasoning maturity occurs, with the development of an appreciation of fairness and equality, but domain theory does not elaborate on the cognitive or affective processes that allow for this development to occur. A review of domain theory concluded that it should be seen as a complementary rather than alternative to existing accounts of moral development because of its conceptual and methodological flaws (Lourenço, 2014).

*Social neuroscience theories and perspectives*

There has been an increased interest in moral decision-making amongst social neuroscientists. Some social neuroscience theories of moral decision-making and development have been proposed, but these do not always reference the rich tradition within developmental psychology. The dominant theory within social neuroscience has been the dual-process theory (Greene et al., 2008, 2004, 2001). In this theory it is proposed that people make moral decisions based either on negative emotional responses elicited by a dilemma, or by engaging in utilitarian moral reasoning. Initial emotional responses can be overridden by moral reasoning but this requires increased cognitive control. Support for this theory comes from studies showing increased activity in the medial prefrontal cortex (emotional responses), dorsolateral prefrontal cortex (cognitive reasoning) and the anterior cingulate cortex (signals the need for cognitive control) when choosing responses to hypothetical moral dilemmas (Greene, 2009). This theoretical perspective focuses only on explaining utilitarian moral decision-making (i.e. approving harmful actions that maximise good consequences) and while this theory can help in understanding how utilitarian moral decisions are made, it tells us little about how moral maturity occurs.

Other social-neuroscience perspectives have been proposed which are more developmental in focus than the dual-process account. Kagan (2008) presented a developmental theory of morality, drawing on both cognitive-developmental stages and neuroscience, with the inclusion of affective components such as guilt and empathy. He proposed that children follow a universal sequence of stages and each stage involves the emergence of a new cognitive achievement, due to corresponding changes in brain circuitry. Kagan's fifth stage, occurring between ages 5 and 10 years is an understanding of abstract constructs such as fairness and ideals, which is facilitated by profound maturational changes in the brain between ages 5 and 7 years. Similar to Kagan (2008), Baird (2008) linked moral development to brain development within her theory, although she particularly focused on brain development in adolescence and argued that the maturation of the prefrontal cortex (PFC) produces significant improvements in behavioural and emotional control, decision-making and abstract reasoning. Baird (2008) also focused on the integration of emotion and cognition in adolescence, and argued that we have an innate capacity to develop a moral sense. She incorporated ideas from the somatic marker hypothesis (Damasio, 1994) to explain how emotional states can guide future decisions, by proposing that developmental improvements in cognition lead to the development of self-conscious emotions.

Taber-Thomas and Tranel (2012) presented a cognitive neuroscience perspective of social and moral functioning, and argued that there is a functional hierarchy underlying socio-moral functioning, from basic functions such as processing emotion from faces, to higher cognitive processes such as moral cognition. They concluded that social and moral functioning critically depend on a core fronto-limbic network centred on the ventromedial PFC (vmPFC), but acknowledged that this network does not function in isolation and relies on other social functions. As with Baird's theory (2008), their perspective incorporated aspects of the somatic marker hypothesis (Damasio, 1994) and they asserted that the vmPFC is crucial for the anticipation of emotional consequences of behaviour.

There are other social neuroscience theories, which while not specifically moral theories, are of relevance here, as they incorporated moral reasoning and some of the relevant component processes and factors. Anderson and Beauchamp (2012) presented the Socio-Cognitive Integration of Abilities Model (SOCIAL), a theoretical framework of social function, which defined social function/skills as social competence, social interaction and social adjustment. Within the SOCIAL framework it is posited that the emergence of social function is shaped by internal factors (e.g. temperament and personality), external factors (e.g. family environment, socioeconomic status (SES) and culture) and brain development and integrity. Brain development and integrity has not yet been explicitly included in any models of moral development. The SOCIAL framework also included higher-order cognitive processes critical for social functioning: attention, executive skills (including attentional control, cognitive flexibility and goal setting), communication and social cognition (including emotion perception, attribution, Theory of Mind (ToM) and moral reasoning) (Anderson & Beauchamp, 2012). While this framework included moral reasoning as a sub-skill of social cognition, this relationship could be reframed to explain how social cognition may impact upon moral reasoning maturity.

Yeates et al. (2012) suggested an integrative model of social competence in children with brain disorders, including three main components: SIP, social interaction and social adjustment. The authors defined SIP as a series of problem-solving steps, and they referenced the importance of executive functions and ToM to SIP. The three components of the model can impact upon and interact with each other, and factors that can affect the development of these components are parenting style, family function and SES, as well as brain injury related factors such as type and severity of insult and regional brain abnormalities (Yeates et al., 2012). While this is a theory of social competence rather than moral development, social competence can influence interactions with peers, which can in

turn impact upon the development of perspective taking, which is proposed to be crucial for moral development (Gibbs, 2013; Hoffman, 2000; Kohlberg, 1976; Piaget, 1932). Components from these social perspectives could be incorporated into a framework of moral development in an attempt to explain how social functioning may affect social interactions, moral decisions and moral behaviour.

*Summary of moral theories and perspectives*

The theories and perspectives outlined above differ in their focus. Moral theories within developmental psychology focus on the maturity of moral reasoning, as a process that guides moral decision-making. These theories explain how moral reasoning develops and matures, through processes such as increased role-taking opportunities leading to improvements in perspective taking and a move away from egocentrism. Cognitive-developmental theories focus on the role of reasoning maturity in moral decision-making while Hoffman (2000) focused on the role of affective empathy development (Hoffman, 2000) and Gibbs (2013) suggested a co-primacy approach. Social intuitionist theory (Haidt, 2001) focused on automatic intuitions as a driver for moral decisions but does not propose how moral decision-making matures over time. Similarly, dual-process theory (Greene et al., 2008, 2004, 2001) focused on real-time moral decision-making rather than development of moral maturity, and inferences about which cognitive and affective processes are involved are made based on the extent to which different brain regions are activated. Other social neuroscience approaches are more developmental in focus (Baird, 2008; Kagan, 2008) and focused on how brain development correlates with moral development, through its effect on the emergence of relevant cognitive and affective processes, such as abstract reasoning and emotion recognition.

Differences in focus within these moral theories have led to different research priorities. Within developmental psychology, there is a tradition of trying to measure developmental stages of moral reasoning, with a lack of focus on other factors, such as situational factors, which may influence moral decisions and behaviour. Social neuroscience research tends to use either neuroimaging methods while individuals are making moral-decisions, as a measure of which brain regions and related processes are involved, or, measures moral decision-making in individuals with brain injuries. Social neuroscience research typically focuses on the real-time moral decision-making process, without focusing on development, while developmental psychology research focuses on moral maturity rather than other processes involved in decision-making, with neither research discipline focusing on moral behaviour as the end product.

There are strengths and weaknesses of the various theories discussed in this paper. Piaget's (1932) theory was the first cognitive-developmental theory and highlighted the role of logical reasoning for moral development. While Piaget proposed how moral development can occur (though social interactions), his theory focused only on development in children. Kohlberg (1976, 1981, 1984a) extended this theory beyond childhood, and also proposed how moral development occurs (through role-taking opportunities). However, Kohlberg's theory has been criticised as being masculine in focus and the stages may not be culturally universal. A further weakness of Kohlberg's theory is his proposition that stages are sequential and that higher stages of reasoning replace immature stages; individuals are not consistent in their stage of reasoning in response to different hypothetical dilemmas, suggesting that immature stages can co-exist alongside mature stages (Krebs & Denton, 2005). In contrast to Kohlberg's proposition that stages are sequential, Rest et al. (1999) and Gibbs (2013) proposed that development is gradual and can be conceptualised as schemas. Moral schemas, and the extent to which they are activated, may develop over time and be dependent upon situational factors. A further strength of the work of Rest and Gibbs is in their focus on moral behaviour rather than just moral decisions, and they go some way to explaining links between moral decisions and behaviour, though this could be expanded upon. Furthermore, Gibbs's theory is one of co-primacy, which brings together competing viewpoints in the field by proposing that both cognition and affect can act as motives for moral action.

While social intuitionist theory (Haidt, 2001) can help to explain why some moral decisions appear automatic, the theory does not focus on individual differences in the proposed set of evolved moral beliefs or motivations, or how they develop and lead to moral maturity. Domain theory (Smetana, 2006; Turiel, 1983) has been helpful in highlighting the distinction between domains but does not make strong predictions about how moral development occurs. One limitation of moral psychology theories is that they have not explicitly included brain development, and how this can impact on moral development. Social neuroscience theories and perspectives have attempted to link stages of development to corresponding brain circuitry, helping to explain how brain development relates to moral development (Baird, 2008; Kagan, 2008). However, social neuroscience perspectives do not always reference the rich tradition of developmental psychology theory in this area, such as Anderson and Beauchamp (2012) who cite Kohlberg (1984a) in explaining the moral reasoning component of SOCIAL, without reference to criticisms of his theory, or more recent formulations, such as Gibbs (2013).

**Why is an integrative framework needed?**

Taken together, moral theories from developmental psychology and social neuroscience provide a fuller picture of the processes and factors relevant for moral decision-making, and how these might develop to enable moral maturity. The different components proposed to be required for moral decision-making and development have not yet been integrated into one comprehensive theory. An integrative framework could include both affective and cognitive processes and also show how both intuitions and reasoning can guide moral decisions. Developmental psychology theories have outlined that the cognitive and affective processes required for mature moral decision-making develop with age, but have not explicitly explained how this occurs as a consequence of brain development. More recent neuroscience perspectives have emphasised the importance of brain development for the maturation of
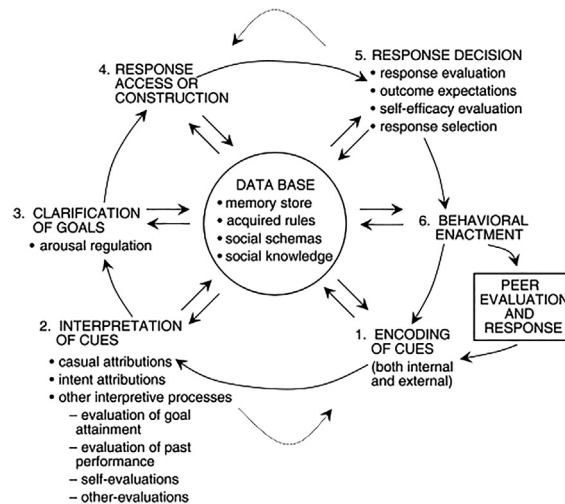
**Fig. 1.** Crick and Dodge's (1994) Social information processing model. Caption: From Crick, N.R., & Dodge, K.A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. Psychological bulletin, 115(1), 74. Fig. 2. "A reformulated social information-processing model of children's social adjustment", p.76. Copyright 1994 by the American Psychological Association. Reprinted with permission.

moral reasoning and related processes, but often neglect the moral developmental psychology literature. The field of moral development would benefit from clearer integration of the developmental psychology literature with insights from social neuroscience research.

In a review of the neuroscience of moral cognition, Van Bavel et al. (2015) argued that hypothetical scenarios used in neuroscience research usually ignore the influence of social and contextual factors, and they advocated a shift from dual-process theories to a dynamic systems model of moral cognition. Most moral theories and the research focus on moral decisions (judgements, evaluations or response decisions) as the end point, rather than seeking to explain how these moral decisions relate to behaviour. Some theories have sought to explain moral action, including the interpretation of a situation (Rest, 1984), cognitive distortions and social skills (Gibbs, 2013) within theory, but additional factors may also be relevant. Further theory development is needed in order to explore the influences on real-time moral decisions, how these decisions mature over time and how they relate to behaviour. An integrative framework incorporating aspects from developmental psychology and social neuroscience could be a first step, to guide future research and theory development in this area.

### Social information processing theory

SIP theory (Crick & Dodge, 1994) was proposed as an explanation of how decisions are made in relation to aggression. Aggression is a behaviour which harms, or is intended to harm another (Anderson & Bushman, 2002). The original SIP model therefore relates to the moral principle of harm, and has the potential to be expanded to explain the processing involved in other decisions and behaviours within the moral domain (i.e. justice, fairness and care). SIP theory has previously been integrated with moral domain theory (Arsenio & Lemerise, 2004) but such an integration can be greatly expanded upon, incorporating aspects from other moral theories.

According to SIP theory (Fig 1. Crick & Dodge, 1994), children's behavioural responses are a function of the processing of information in a situation. The model consists of six steps: (1) encoding of cues, (2) interpretation of cues, (3) clarification of goals, (4) response access or construction, (5) response decision, and (6) behavioural enactment. The six steps represent a logical order but do not necessarily occur in this order, and can co-occur. Children come to a social situation with a set of biologically determined capabilities and a database of memories of past experiences, which can affect how information is processed (Crick & Dodge, 1994). Memories of past events are stored in the database as acquired rules, social schemas and social knowledge. SIP abilities are theorised to develop with age due to a growth in experience with social interactions, developmental shifts in attentional ability, mental capacity or speed of processing, and the organisation and interpretation of social information (Crick & Dodge, 1994). This is similar to how moral development is proposed to occur, according to the various moral development theories, suggesting that moral development could be explained using a SIP framework.

Emotional processes were incorporated into the SIP model by Lemerise and Arsenio (2000), suggesting that a SIP approach can be used to address the cognition vs. affect divide within moral psychology. They added emotional processes at certain steps of the SIP model, such as emotion recognition at Step 1 and empathic responsiveness at Step 5. Lemerise and Arsenio (2000) also added affect-event links to the database in the centre of the model, and theorised that memories of past events include affective as well as cognitive components. This is similar to Hoffman's (2000) proposal that affective empathy can act as a powerful retrieval cue, triggering moral schemas stored in memory, and also similar to Damasio's (1994) proposal that somatic markers can be stored in memory as affect-event links, aiding future decision-making. In addition, Lemerise and Arsenio (2000) added emotional processes to the centre of the

SIP model and hypothesised that individual differences in emotionality and emotion regulation can influence each step of SIP. They proposed that children enter a social situation with a level of physiological arousal or mood and differ in their ability to regulate this, partly due to biological predispositions of their emotionality or temperament.

Following their integration of emotional processes into the SIP model, Arsenio and Lemerise (2004) incorporated SIP with moral domain theory, proposing that moral domain theory can be used to expand on the latent mental structures, or the database of the model. They hypothesised that social experiences lead to the generation of latent mental structures that are stored in memory, or the database. Domain knowledge stored in memory must be activated and used in the processing of a situation in order to influence behaviour. If domain knowledge is retrieved early in the process, it can influence other steps of SIP, such as goal clarification (Arsenio & Lemerise, 2004). Social schemas are in the centre of the SIP model, as a component that can influence all steps of processing. Calvete and Orue (2012) found that adolescents who scored higher on a justification for violence schema were more likely to choose an aggressive behaviour in response to a hypothetical ambiguous situation, and a narcissism schema predicted anger and access to aggressive responses. This study also found that aggressive response access predicted aggression, and so response access may play a mediating role between schemas and behaviour (Calvete & Orue, 2012). Moral schemas will be relevant for moral decision-making, but how they relate to moral behaviour, including any potential mediating factors or processes, remains to be explored. The integration of domain theory with SIP theory added moral domain knowledge to the centre of the model, as a component that can affect all steps of processing. However, moral decision-making does not mature based solely on an increase of moral knowledge; it also involves other processes, such as the development of perspective taking and a move away from egocentricity (Gibbs, 2013; Kohlberg, 1976, 1984a, 1984b; Piaget, 1932).

Aspects from other moral theories could be integrated into a SIP framework. Rest's (1984) moral sensitivity component involves interpretation of the situation, which is similar to Step 2 of the SIP model, and his proposed moral judgement component which involves deliberation could be formulated as Step 5 of a SIP model. Palmer (2003) proposed a model of offending behaviour which incorporated both moral reasoning development and SIP skills, and she theorised that SIP mediates the link between parenting and offending (Palmer, 2000). Palmer (2003) proposed that developmental levels of moral reasoning can affect SIP steps. At Steps 1 and 2, perspective taking and degree of egocentricity, both associated with moral reasoning level, are likely to influence an individual's ability to make accurate attributions about intent and causality (Palmer, 2003). She proposed that immature levels of moral reasoning will be associated with biases in processing, such as a hostile attribution bias. At Step 3, Palmer (2003) theorised that the types of goals chosen are likely to be associated with level of perspective taking and egocentricity, and increasing maturity of moral reasoning will be associated with goals that take the feelings and needs of other people and wider society into account. At Steps 4 and 5, moral reasoning maturity will impact on response generation; different responses will be justifiable depending on moral reasoning maturity, with individuals reasoning at a higher level less likely to perceive physical aggression as justifiable, based on moral concerns for the feelings of others (Palmer, 2003). Components from various moral theories could be added to a SIP framework to show how moral maturity can affect each step of processing and how engaging in SIP can affect moral maturity.

**The components of moral decision-making and development: what develops and how?**

*What develops?*

"Central to any discussion of developmental issues is the consideration of 'what develops'" (Crick & Dodge, 1994, p. 80). Table 1 displays the main component processes and factors suggested by various theories and perspectives to be involved in real-time moral decision-making or necessary for moral development. These components are grouped into broad categories of cognitive, affective, social and other. Some of the affective components listed could be viewed as either cognitive or affective (e.g. emotion regulation) but within this paper we have considered they are by and large affective. Some components such as perspective taking and empathy are proximal factors of moral development, while other components are more distal factors. For example, social skills, while distal factors, still affect the development of components such as moral schemas and perspective taking by facilitating opportunities for social perspective taking, which in turn facilitates moral development. There are many bi-directional relationships between components; for example, peer interaction influences the development of perspective taking abilities, which in turn can affect peer interactions. Some research has found developmental and predictive relationships between components, (e.g. Vera-Estay, Seni, Champagne, & Beauchamp, 2016), suggesting that the various components could be integrated into one framework of moral development.

*Development of moral decision-making and related components*

We have highlighted the component processes and factors that have been suggested as important for real-time moral decision-making and moral development. In order for these components to be integrated into a framework which describes how moral decision-making occurs and matures over time, it is necessary to understand how these components develop, and how their developmental trajectories may impact on real-time moral decision-making. We will now review selected research into how the main components develop, before integrating the components into a developmental framework.

*Moral decision-making*

Most research into moral decision-making has focused on moral evaluations or response choices in adults, but there is some research into the development of moral preferences in children and adolescents. Evidence of an understanding of moral rules, as well

**Table 1**
The components of moral decision-making and development.

| Component type | Component | Theories/perspectives to have proposed this component is involved in moral decision-making or development |
|---|---|---|
| Cognitive | Working memory | Gibbs (2013) |
| | Perspective taking | Baird (2008), Piaget (1932), Gibbs (2013), Kohlberg (1976, 1984a, b), Rest (1984, 1999) |
| | Attention | Gibbs (2013), Crick and Dodge (1994) |
| | Abstract thought/reasoning | Baird (2008), Piaget (1932) |
| | Logical reasoning | Piaget (1932), Kohlberg (1984a, b) |
| | Schemas/scripts | Gibbs (2013), Hoffman (2000), Rest et al. (1999), Crick and Dodge (1994), Arsenio and Lemerise (2004), Lemerise and Arsenio (2000) |
| | Attributions | Hoffman (2000), Gibbs (2013), Crick and Dodge (1994), Arsenio and Lemerise (2004), Lemerise and Arsenio (2000) |
| | Self-control | Rest (1984, 1999) |
| Affective | Affective empathy | Hoffman (2000), Kohlberg (1984a, b), Gibbs (2013) |
| | Emotion regulation | Lemerise and Arsenio (2000) |
| | Emotion recognition | Anderson and Beauchamp (2012), Taber-Thomas and Tranel (2012) |
| | Somatic markers | Baird (2008), Taber-Thomas and Tranel (2012) |
| | Intuition | Haidt (2001) |
| Social | Social functioning/competence/skills | Anderson and Beauchamp (2012), Gibbs (2013), Yeates et al (2012) |
| | Peer interaction/socialisation | Piaget (1932), Gibbs (2013), Hoffman (2000), Haidt (2001), Turiel (1983), Smetana (2006), Yeates et al (2012), Lemerise and Arsenio (2000) |
| | Socio-economic status | Anderson and Beauchamp (2012), Yeates et al (2012) |
| | Culture | Haidt (2001), Anderson and Beauchamp (2012) |
| | Parenting/family function | Piaget (1932), Hoffman (2000) Palmer (2003), Anderson and Beauchamp (2012), Yeates et al (2012) |
| Other | Brain development and integrity | Baird (2008), Kagan (2008), Taber-Thomas and Tranel (2012), Anderson and Beauchamp (2012), Yeates et al (2012) |
| | Temperament/personality | Haidt (2001), Kagan (2008), Lemerise and Arsenio (2000) |
| | Social information processing | Arsenio and Lemerise (2004), Palmer (2000) |

as showing moral preferences and expectations have been found to be present in children as young as three months, shown by their preference to attend to a prosocial character (Kiley Hamlin, Wynn, & Bloom, 2010). When asked to judge the actions of others, young children weigh up the costs and benefits of harm, as older children and adults do, but children aged 6 years old judge decisions involving harm negatively, regardless of whether it leads to a greater benefit (Powell, Derbyshire, & Guttentag, 2012), suggesting that young children are influenced by outcome when making moral evaluations. Cognitive-developmental theorists proposed that taking situational circumstances, including an actor's intentions into account when reasoning about moral issues only occurs at the mature level, transition stage 3/4 according to Gibbs et al. (1992). In contrast to this proposal, research has found that even young children are able to take intentions into account when making moral judgements. Although influenced by outcome, young children, similarly to adults, are also influenced by an actor's intentions when making moral evaluations; the reliance on intent when making moral decisions, and the ability to distinguish more clearly between ill and well-intentioned actions both develop with age (Cushman, Sheketoff, Wharton, & Carey, 2013; Nobes, Panagiotaki, & Bartholomew, 2016; Nobes, Panagiotaki, & Pawson, 2009). It may be the case that young children are able to take intent into account when their attention is oriented towards this feature of an event, as in the studies mentioned above (e.g. "What did X want to do?" or ""Did [the character] want [the relevant outcome to occur]?''), but they do not independently focus on intent until later ages, or at least do not articulate intent when explaining their reasoning. Moral reasoning is often measured as an indicator of an individual's highest capacity for reasoning across different questions or moral dilemmas and research has found that moral reasoning develops with age (Chiasson, Vera-Estay, Lalonde, Dooley, & Beauchamp, 2017; Colby et al., 1983; Gibbs et al., 1992; Humphries, Parker, & Jagers, 2000; Vera-Estay et al., 2016).

Social neuroscience studies can reveal which brain regions are more active during moral decision-making, or how damage to certain brain regions affects moral decision-making. Neuroimaging studies using moral decision-making tasks have found that the brain region most commonly activated is the vmPFC (Fumagalli & Priori, 2012). The vmPFC is involved in emotional processing (Etkin, Egner, & Kalisch, 2011) so its recruitment during moral decision-making offers some support for the view that moral decisions are driven by emotions. Neuroimaging studies into moral decision-making typically employ tasks which involve judging the actions of others rather than making your own response decisions about how to act; the vmPFC has not been found to show increased activation during moral response decision tasks, but further research employing such tasks is needed (Garrigan, Adlam, and Langdon, 2016a; Garrigan, Adlam, and Langdon, 2016).

The large majority of neuroimaging studies of moral decision-making involve adults and there is limited research into how the maturation of relevant brain regions may correlate with mature moral decision-making. Harenski, Harenski, Shane, and Kiehl (2012) did include 15 adolescents (aged 13–18 years) in their functional magnetic resonance imaging (fMRI) study alongside an adult sample (aged 19–53 years) and found a positive correlation between age and hemodynamic activity in the temporoparietal junction (TPJ) when participants rated the severity of moral transgressions. This region is known to contribute to mentalising during moral decision-making in adults, so the authors concluded that adolescents use mentalising less than adults when rating moral transgressions. There

were no significant age differences for ratings of transgressions, indicating that adults and adolescents were similarly able to identify violations and rate their severity. It may, therefore, be the case that adolescents use mentalising as much as adults when rating transgressions, but that mentalising in adolescence activates other regions in the network; neuroimaging research of cognition has found that children and adolescents activate networks more extensively, while adults show activation in more specific regions (Scherf, Sweeney, & Luna, 2006; Tamm, Menon, & Reiss, 2002).

*Perspective taking*

The component cited by most theories as being crucial for moral development is perspective taking. Perspective taking in this context is considered to be the cognitive component of empathy and refers to the ability to infer another's mental states and attributions; also referred to as mentalisation ability or ToM. Perspective taking is important for moral development as it allows for the thoughts and feelings of others to be taken into account when making moral decisions, as attributions of intent can affect how moral decisions are processed, and whether empathy is triggered. While perspective taking is the component most frequently proposed to be involved in moral development, there is little research linking the development of perspective taking to moral decision-making. Research has found that visual perspective taking (taking into account what others can see) develops between 12 and 14 months (Sodian, Thoermer, & Metz, 2007) and that by four years old children can pass false belief tasks (Wellman, Cross, & Watson, 2001), showing an understanding that a person can have a belief that contradicts reality. There is limited research into the development of perspective taking in adolescence but it has been found that more complex perspective taking, such as the ability to take into account another person's perspective to direct appropriate behaviour, and the ability to understand another's emotional states are still developing into late adolescence (Dumontheil, Apperly, & Blakemore, 2010; Vetter, Altgassen, Phillips, Mahy, & Kliegel, 2013). Studies have found that males only show increases in perspective taking from 15 years onwards, suggesting gender differences in developmental trajectories (Van der Graaff et al., 2014).

Perspective taking is hypothesised to develop through social interaction and pretend play (Kohlberg, 1976, 1981; Piaget, 1932; Selman, 1976). The importance of peer interaction for perspective taking development in adolescence has been emphasised over parent interaction (Baird, 2008) and research has found that children's competence in peer interaction is significantly related to ToM understanding (Peterson, Slaughter, Moore, & Wellman, 2016). As perspective taking develops through an interaction with the social environment, social factors (e.g. SES) can influence its development, which in turn affects moral development. A framework of moral development, therefore, needs to include perspective taking, along with the processes affected by perspective taking (e.g. affective empathy), and factors which influence the development of perspective taking (e.g. peer interaction).

"The brain regions that undergo the most significant development during adolescence overlap with those that have been linked to the ability to take other people's perspectives and infer mental states." (Choudhury, Blakemore, & Charman, 2006, p. 168). A study into the development of the neural network associated with perspective taking found that in adults (aged 25–32 years), activity increased in the left inferior parietal cortex and precuneus when processing third person, compared to first person judgments, and children (aged 8–10 years) additionally showed increased activity in the dorsolateral PFC and the right inferior parietal cortex (Dosch, Loenneker, Bucher, Martin, & Klaver, 2010). There was also a decrease in reaction time differences between third and first person perspective judgements with age, suggesting that adults are more efficient at processing third person perspectives (Dosch et al., 2010). Sebastian et al. (2012) found an increased neural response in the vmPFC for adolescents compared to adults during an affective ToM task, but no significant difference during a cognitive ToM task, and an increased amount of errors in the adolescent group for the affective but not the cognitive ToM condition. These findings suggest that the development of affective ToM, understanding the emotional states of others, is more complex and continues beyond that that of cognitive ToM.

*Attention and working memory*

The cognitive processes of attention and working memory are proposed to be required for moral development (Gibbs, 2013). Development of working memory can refer to both an increase in capacity, i.e. the amount of information that can be temporarily stored while processing information, and to an increased ability to direct attention to relevant information while ignoring irrelevant information (Baddeley & Hitch, 1974; Engle, Tuholski, Laughlin, & Conway, 1999). A linear increase in performance from age 4–15 years has been found for working memory measures associated with the phonological loop (phonological short-term store where rehearsal takes place), the visuospatial sketchpad (stores visual and spatial material) and the central executive (responsible for regulatory functions including attention and problem solving) (Gathercole, Pickering, Ambridge, & Wearing, 2004). de Wilde, Koot, and van Lier (2016) found that lower working memory scores were related to increases in teacher-child conflict one year later, and that teacher-child conflict was negatively associated with the development of working memory, suggesting that working memory can affect social development, and vice-versa. Decision-making is more difficult in situations with high working memory load, i.e. when there is a lot of information from different sources. Increased working memory load can lead to more impulsive decisions (Hinson, Jameson, & Whitney, 2003) and prevent somatic markers from being produced (Hinson, Jameson, & Whitney, 2002), suggesting that individuals with low working memory capacity are likely to have more difficulty making moral decisions when working memory demands are high.

Attention works as a filtering process to determine what information from the environment is selected for subsequent perception (Amso & Scerif, 2015) and development of attentional processes may allow individuals to focus on more details within a situation, or filter out irrelevant information. Three main visuospatial attention functions have been proposed: alerting (a state of arousal elicited by an unexpected external cue), orienting (shifting attention to select information in the environment) and executive attention (resolving conflict between competing inputs) (Fan, McCandliss, Sommer, Raz, & Posner, 2002). It has been found that visual attention develops rapidly during the first 5–10 months (Ross-Sheehy, Schneegans, & Spencer, 2015) and staying alert to cues shows

significant developmental improvement after age 7 years in terms of speed of processing (Pozuelos, Paz-Alonso, Castillo, Fuentes, & Rueda, 2014). Executive attention develops strongly between ages 4 and 6 years (Rueda, Rothbart, McCandliss, Saccomanno, & Posner, 2005) showing further improvements in late childhood (Pozuelos et al., 2014). A study of 400 3–12 year olds found a staging in the development of attention and executive functions from age 6 years, starting with the maturing of inhibitory functions, followed by maturation of auditory and visual attention at age 10 years and the development of fluency in adolescence (Klenberg, Korkman, & Lahti-Nuuttila, 2001).

A longitudinal study into the neural networks of working memory in a sample of 6–25 year olds revealed that working memory capacity correlated with activity in frontal and parietal regions, cortical thickness in the parietal cortex, and white matter structure of fronto-parietal and fronto-striatal tracts, while fractional anisotropy in white matter tracts and caudate activity predicted future working memory capacity (Darki & Klingberg, 2015). It has been found that adults show similar patterns of neural activation as children and adolescents during working memory tasks, but adults have more refined, localised activation of regions (Scherf et al., 2006). A magnetic resonance imaging (MRI) study of children (aged 7–12 years) and adults (aged 18–31 years) found that children showed greater functional connectivity of regions in the dorsal attention network compared to adults, whereas adults showed greater functional connectivity between regions within the ventral attention network than children (Farrant & Uddin, 2015). This pattern of development of attention networks may be a neural signature of the developmental shift from bottom-up attention mechanisms to top-down attentional capacities (Farrant & Uddin, 2015).

### Abstract reasoning

Abstract reasoning has also been proposed to be important for moral development (Baird, 2008; Piaget, 1932) and refers to the ability to base reasoning on relationships between representations rather than just simple features of a stimulus (Dumontheil, 2014). Abstract reasoning may be important for moral development if it enables moral concepts to be understood and applied across different settings, even those not previously experienced. The Wisconsin Card Sorting Task is used as a measure of abstract reasoning, attention regulation and working memory in research studies, and performance on the task has been found to increase with age (Bujoreanu & Willis, 2008; Somsen, 2007). A shift from using concrete to abstract strategies to solve algebra problems has been found by age 15–16 years (Susac, Bubic, Vrbanc, & Planinic, 2014) and abstract reasoning has been found to be impaired in children and adolescents with autism spectrum disorders (Solomon, Buaminger, & Rogers, 2011). A neurodevelopmental study of relational reasoning (abstract reasoning) found that similar to adults, children recruited the rostrolateral PFC when processing relations but failed to use this region when integrating across two relations (Crone et al., 2009). Despite the proposal of the importance of abstract reasoning to moral reasoning development, there is a lack of research linking these components.

### Affective empathy, emotion regulation and emotion recognition

Perspective taking, the ability to know and understand the mental states of other people, is the cognitive component of empathy, while affective empathy allows individuals to experience the feelings of others. Affective empathy (hereafter referred to as empathy) is the main affective process proposed to be important for moral decision-making and moral development. It is proposed that empathy can act as a motivator for moral behaviour and also a powerful retrieval cue (Hoffman, 2000). Similarly to moral terms, there are issues with how empathy is defined in the literature (Decety & Cowell, 2014) and it is often unclear what aspect of empathy is being measured in studies.

Concern for others has been measured in infants aged 8–16 months, based on their responses to a caregiver and a peer in distress, finding that levels of affective and cognitive empathy were evident before 12 months and increased gradually to 16 months (Roth-Hanania, Davidov, & Zahn-Waxler, 2011). It was also found that empathy at 10 months predicted prosocial behaviour assessed 2–4 months later (Roth-Hanania et al., 2011). Children as young as 18 months old have been found to help adults in instrumental, empathic and altruistic contexts, although empathic helping required greater communication input from the adults (Svetlova, Nichols, & Brownell, 2010).

A critical review of affective empathy did not find a consistent relationship between empathy and aggression in children but did find evidence of a negative relationship between empathy and aggression in adolescence (Lovett & Sheffield, 2007). Research has found that self-reported empathy develops during adolescence (Carlo, Mestre, Samper, Tur, & Armenta, 2011) but there is some evidence that empathic concern does not develop between ages 10–14 years (Garaigordobil, 2009), 13–18 years (Van der Graaff et al., 2014) or during adulthood (Grühn, Rebucal, Diehl, Lumley, & Labouvie-Vief, 2008). Neuroimaging research has found evidence of separate neural systems for cognitive and affective empathy, with the affective network consisting of the inferior frontal gyrus, the inferior parietal lobe, the anterior cingulate and the anterior insula (See Shamay-Tsoory, 2011 for a review). Patients with traumatic brain injuries (TBIs) and lesions in the PFC have been found to have impaired cognitive and affective empathy (de Sousa et al., 2010, 2011; Shamay-Tsoory, Tomer, Goldsher, Berger, & Aharon-Peretz, 2004).

The role of empathy in moral decision-making and moral development may be linked to other processes; for empathy to motivate moral behaviour, individuals must to be able to correctly recognise the emotions of other people, regulate their own emotions, and retrieve relevant empathy-cognition bonds from memory. Emotion regulation is the control of emotional experience and expression (Campos, Campos, & Barrett, 1989) and consists of extrinsic and intrinsic processes responsible for monitoring, evaluating and modifying emotional reactions (Thompson, 1994). It has been suggested that there are multiple dimensions of emotion regulation, including difficulties controlling impulses and engaging in goal-directed behaviours when experiencing negative emotions and difficulties (Gratz & Roemer, 2004). Eisenberg et al. (2000) found that emotion regulation predicted externalising behaviour for children prone to negative emotionality and Lockwood, Seara-Cardoso and Viding (2014) found that emotion regulation moderated the relationship between empathy and self-reported prosocial behaviour in typically developing (TD) adults. A review of emotion

regulation concluded that it develops through observational learning and modelling, and its development can be affected by parenting style and the family environment (Morris, Silk, Steinberg, Myers, & Robinson, 2007). The brain regions involved in emotion regulation, including the limbic region and PFC, undergo structural and functional development during adolescence (See Ahmed, Bittencourt-Hewitt, & Sebastian, 2015 for a review) and damage to the PFC has been found to be related to deficits in emotion regulation (Anderson, Barrash, Bechara, & Tranel, 2006; Salas et al., 2016).

The ability to correctly identify emotions has been proposed to be indirectly involved in moral development; emotion recognition facilitates social interactions which lead to increases in perspective taking abilities (Anderson & Beauchamp, 2012; Taber-Thomas & Tranel, 2012). Children as young as 4–6 months old are able to distinguish between different emotions, and recognise emotions from faces (Serrano, Iglesias, & Loeches, 1992), but these abilities continue developing into adulthood (Thomas, De Bellis, Graham, & LaBar, 2007). Various brain regions have been found to be involved in emotion recognition from facial expressions and from speech, including the amygdala, orbitofrontal cortex and the fusiform gyrus (See Adolphs, 2002 for a review), while different emotions appear to activate different brain regions, suggesting separate neural systems for different emotions (Sprengelmeyer, Rausch, Eysel, & Przuntek, 1998) and the ability to correctly recognise emotions from faces has been found to be compromised following brain injuries (Croker & McDonald, 2005; Ryan et al., 2014; Tonks, Williams, Frampton, Yates, & Slater, 2007).

## Moral decision-making and development: toward an integrative framework

Moral decision-making differs from other types of decision-making because the situation has moral rules or principles attached, which may invoke moral reasoning and the activation of morally relevant schemas from memory. However, moral decision-making also shares similarities with other types of decision-making as it involves the processing of information and making judgements, evaluations, and response decisions, which may lead to behavioural action. Like other types of decision-making, moral decision-making is subject to influences such as situational factors, personality factors and biases. SIP theory can provide a useful framework for explaining how decisions are made, and can be adapted to include components relevant to moral decision-making and moral development.

Moral principles are necessary but not sufficient for moral behaviour, (Kohlberg, 1984a); other components and factors which affect decision-making and behaviour enactment need to be considered. The original SIP model was proposed as an explanation of aggressive behaviour in children (Crick & Dodge, 1994) and it has been found that aggressive children display atypical SIP skills, and SIP problems are predictive of aggressive behaviour (Dodge, Laird, Lochman, & Zelli, 2002; Lansford, et al., 2006; Oostermeijer, Nieuwenhuijzen, van de Ven, Popma, & Jansen, 2016; Ziv & Sorongon, 2011). Such research suggests that the SIP model provides a sound basis for explaining behaviour, which has not been the focus of previous moral theories. What is known about the development of moral maturity and related components needs to be linked with what is known about decision-making, to gain a better understanding of how moral decisions are made, how they mature over time, and in turn, have a better understanding of moral behaviour. Although many social, biological and psychological factors are involved in the development of behaviour, the actual behavioural act is preceded by a decision-making process, whether cognitive, affective or both, which serves as the proximal control mechanism (Burks, Laird, Dodge, Pettit, & Bates, 1999). Moral response decisions can be conceptualised as the response decision step (Step 5) in a SIP framework, as the proximal decision before a behavioural response, although a behavioural response may only follow if it is perceived that one is necessary, and the intended behaviour is able to be carried out.

### The Social Information Processing-Moral Decision-Making framework

A conceptual, illustrative framework of moral decision-making and development will now be introduced, showing how the components of moral decision-making and development suggested by various theories can be integrated into one dynamic explanation of how moral decisions are made and mature over time. We have termed this the Social Information Processing–Moral Decision-Making (SIP-MDM) framework (Fig. 2). The format owes much to the original (Crick & Dodge, 1994) and more recent models (Arsenio & Lemerise, 2004; Lemerise & Arsenio, 2000) but components have been added to each step and the centre of the model has been reconceptualised, incorporating ideas from developmental psychology and social neuroscience.

### How this framework differs from previous SIP models

Arsenio and Lemerise (2004) incorporated some aspects of moral theory by integrating SIP with domain theory, but the SIP-MDM framework takes integration further by adding components from other moral theories and attempting to add a developmental aspect. Components marked with a '+' bullet point have been added to previous models (Fig. 2). Italics have been used to show where a component is not completely new but has been amended slightly, e.g. 'moral' added to social schemas. Relevant components have been added at each step, the centre has been reformulated and Step 5 has been conceptualised as *moral* response decision. A horizontal arrow has been added to represent maturation over time and each component is hypothesised to develop over time, increasing the capacity for more mature moral decisions.

Conceptualising Step 5 as moral response decision allows for the framework to explain response decisions made within a moral dilemma, i.e. a situation within the moral domain where a response decision is required. The SIP-MDM framework could also be used to explain decision-making in other domains, but if a situation is in the moral domain, and recognised by the individual as having moral rules or principles attached, then components relevant to moral decision-making, such as moral reasoning, will be activated. The six steps of the SIP-MDM framework specifically indicate the processing that is occurring when making a decision about how to
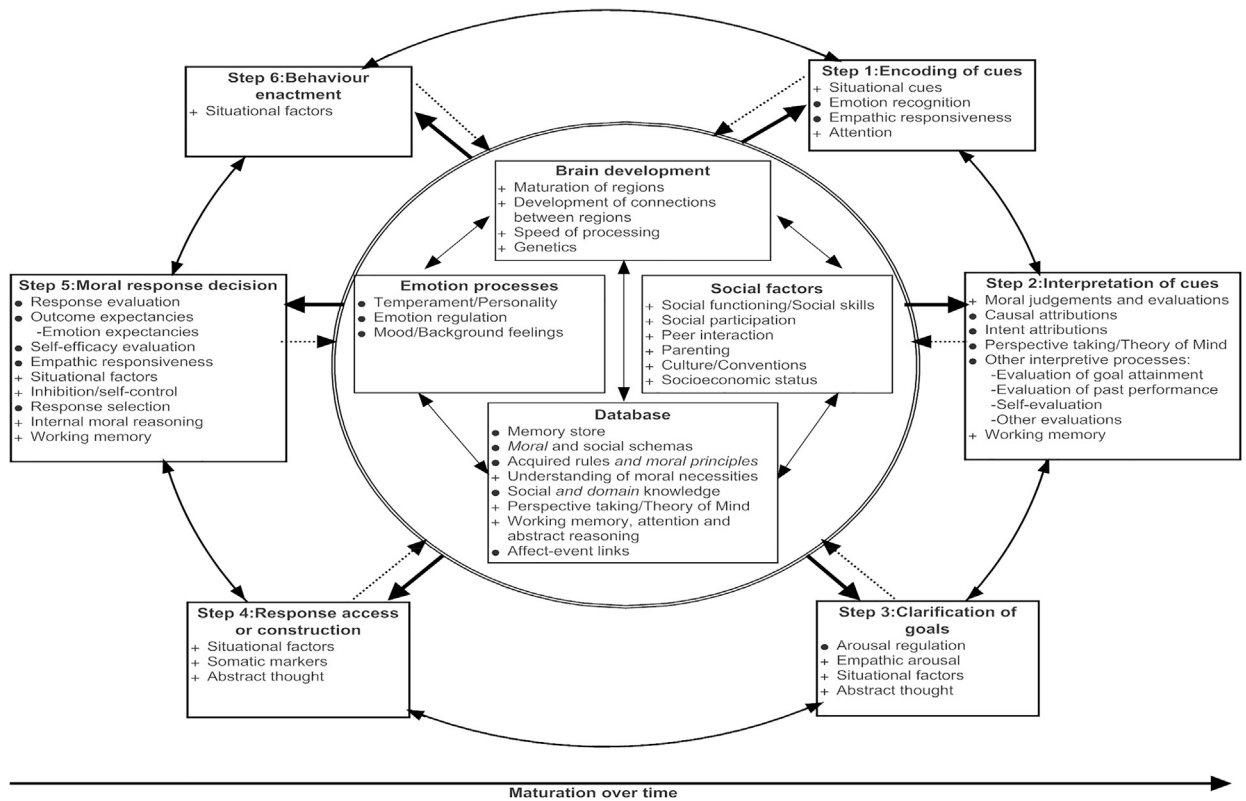
**Fig. 2.** The Social Information Processing-Moral Decision-Making Framework (SIP-MDM).

behave in a moral dilemma. Although the steps of the framework are not strictly sequential, a moral response decision is the proximal step made before behaviour enactment. Moral decisions which are not response decisions, such as judging or evaluating the actions of others have been added at Step 2. Such moral judgements and evaluations made when interpreting a situation can influence whether a situation itself is viewed as moral or not and can have an effect on subsequent processing, including the response decision that is chosen at Step 5.

Reformulation of the centre of the SIP-MDM framework expands the database component of previous models by adding aspects relevant to moral decision-making and development such as moral schemas and perspective taking. The database can be viewed as a 'store' of resources that can be drawn upon when processing information. Social factors and brain development have also been added to the centre alongside the database (Crick & Dodge, 1994) and emotion processes (Lemerise & Arsenio, 2000). Social factors can influence the development of other components. For example, peer interaction can influence the development of perspective taking through role-taking with peers (Gibbs, 2013; Piaget, 1932), and the relationships between parenting practice and behaviour may be mediated by SIP (Palmer, 2000). Brain development can influence moral decision-making directly, as brain regions relevant to real-time decision-making mature, and also indirectly, via its influence on the development of component processes such as working memory and empathy. Connections between brain regions can also lead to increases in processing efficiency. Decreases in reaction times for adults compared to adolescents when making moral decisions indicates that adults become more efficient at processing such information (Dosch et al., 2010). Adding these components to the centre of the framework shows how they can be used in making real-time decisions, but also that their development over time can lead to more efficient processing and mature moral decision-making.

All the relationships in this framework are multi-directional: the components in the centre of the framework can influence each step of information processing, and engaging in processing can influence the development of components within the centre of the framework (e.g. moral schemas), in turn influencing future moral decision-making. The thick arrows from the centre to each step indicate the components in the centre influencing real-time decisions, and the dashed arrows indicate information processing influencing development of components in the centre. The arrows are separate as this relationship is not entirely cyclical; although engaging in SIP can influence development of factors in the centre, development occurs over time and so cannot be used in the same situation.

This SIP-MDM framework suggests how moral decisions can be driven by both automatic processes and by reasoning. Somatic markers have been added (Step 4), as a component which can affect decision-making, narrowing down possible responses in a situation. It has been found that typical immoral events require shorter judgement decision times than atypical events (Fransson & Ask, 2010), suggesting that more common moral decisions may require less reasoning. Moral reasoning has been added at Step 5, as a

component involved in making a moral response decision. Moral reasoning is just one of the processes which guides moral decisions, although it draws upon and is dependent upon other components such as emotion expectancies, attention, encoding, working memory, and perspective taking. Even though initial decisions may be driven by some somatic markers or automatic activation of a moral schema at Step 4, reasoning is required to confirm, reject or reformulate this into a moral decision (Kahneman, 2011). Moral reasoning in a given situation depends on the processing at other steps of the framework, and to what extent the situation activates moral schemas.

Cognitive and affective components suggested by various moral theories have been added at relevant SIP steps. Crick and Dodge (1994) hypothesised that SIP abilities develop with age partly due to developmental shifts in attentional ability, and Gibbs (2013) proposed that attention is important for moral development, but it has not been explicitly included in previous SIP models. Here, attention has been added to Step 1. It is proposed that at Step 1, where cues are encoded, attentional abilities (e.g. shifting attention and executive attention) and attentional bias will influence what information is encoded, which then impacts upon what information is available for subsequent processing. Attention has also been added to the database as a process that can develop over time and lead to increased efficiency of SIP and the capacity for more mature moral-decisions. Working memory has been added to Steps 2 and 5, and to the database of the SIP-MDM framework. It is hypothesised that increases in working memory capacity, and the ability to direct attention to relevant information while ignoring irrelevant information will aid the interpretation of cues and the moral decision-making step. Inhibition/self-control has been added at Step 5, as a process that can guide response decisions (Rest, 1984; Rest et al., 1999), as certain possible responses may need to be inhibited.

Perspective taking/ToM has been added at Step 2 and the database. Making appropriate attributions at Step 2 relies on the ability to accurately infer the beliefs and intentions of other people, and as perspective taking develops over time, it can influence all SIP steps by making processing less egocentric. Emotional processes were added to the SIP model by Lemerise and Arsenio (2000) but the SIP-MDM framework also includes empathic arousal at Step 3 and it is proposed that individuals with greater empathic arousal will select more prosocial goals. Abstract thought/reasoning has been added at Steps 3 and 4 and to the database. At Step 3, abstract thought will allow individuals to think of a goal not previously experienced, and at Step 4 it will allow for responses not previously enacted to be constructed. Development of abstract reasoning skills can impact on other steps of processing through its effect on moral development; it allows for moral concepts to be understood and applied across different settings, including those not previously encountered. 'Situational factors' have been added at Steps 1, 3, 4, 5 and 6. Level of moral reasoning varies according to context or situation (Krebs, Vermeulen, Carpendale, & Denton, 2014), and can be influenced by factors such as alcohol intake (Denton & Krebs, 1990). Situational factors may be of most importance at Step 6 following the moral response decision at Step 5 and may account for differences between moral decisions and moral behaviour. While the SIP-MDM framework acknowledges that situational factors need to be taken into account when explaining moral decision-making and behaviour, further research is needed into the relevant situational factors.

*Moral decision-making within the SIP-MDM framework*

Although the six steps are not necessarily how processing occurs in every situation, the order of the six steps will now be used to illustrate how a moral response decision may be made in an everyday moral dilemma (a situation with moral rules or principles attached where a response decision is required), using the example of deciding whether to cheat during a game of Monopoly with friends (an example scenario used in the So-Moral, Dooley et al., 2010). How an individual may decide to cheat in this situation, based on the suggested framework will be discussed, but how an alternative behavioural action (not cheating) may occur will also be outlined.

At Step 1 the individual will encode the cues such as looking at how much money each player has, encoding the other players' emotions, including their own emotions, and encoding situational cues such as the opportunity to cheat (e.g. other players are distracted or have left the room). Encoding these cues will require attention abilities and emotion recognition, and which cues are encoded will affect subsequent processing. Encoded cues are then interpreted at Step 2; this is an important step and is where a situation is recognised as having moral rules attached or not, through moral judgements and evaluations. For cheating at the game to occur, an individual may either not recognise that this situation has moral rules attached, e.g. they may think that because it is a game with friends, "moral rules" governing cheating may not apply, or they do recognise the moral rules attached, but still decide to cheat for various reasons, e.g. they are losing and want to win, which is an attribution and evaluative process. In interpreting cues, the individual may engage in perspective taking; thinking how their friends might feel if they cheated, or thinking how they would feel if their friends cheated, which could influence the goals they set in the situation. In interpreting cues, the individual may also engage in various evaluations such as evaluating theirs and their friends' past performances of playing Monopoly, which will require working memory in order to keep various sources of information in mind.

At Step 3, goals for the situation are set, and these can be influenced by whether or not empathic arousal occurs, and also influenced by situational factors (e.g. does the opportunity to cheat still exist). This step is where an individual decides what they want from the situation, such as to cheat at the game by possibly gaining more money to play with, and increasing their chances of winning. Possible responses are accessed or constructed at Step 4. In this example, an individual may think of various ways in which they can cheat, such as taking some extra money from the bank or hiding some of the other players' money. Responses thought about at this step can be influenced by somatic markers and situational factors, and may require abstract thought. A Step 5, the moral response decision is made, i.e. to cheat and how to cheat, or to not cheat and continue to play by the rules. Deliberation occurs at this step, which may include engaging in moral reasoning and evaluating the expected outcome. A self-efficacy evaluation may also occur at this step, where the individual evaluates their ability to carry out their intended behavioural action, e.g. evaluating if they would

be able to take extra money without being caught by the other players. Deliberation at this step could lead to a change in the selected goal, or a change to the chosen response option. The response decided upon at Step 5, to cheat or not to cheat at the game, will be enacted at Step 6 unless situational factors change (e.g. the opportunity to cheat no longer exists, or increases), or the individual over estimated their ability to carry out their chosen course of action. As stated, the steps do not necessarily occur in this order, and processing can be rapid.

In terms of choosing a moral or prosocial course of action, in the Monopoly example, an individual may not cheat either because they do not consider cheating as a possible action, or they may consider it but decide against it for various reasons. If an opportunity to cheat was either not encoded (not noticed), or was not interpreted as such, then there is no moral dilemma and no response decision to be made. An individual may recognise the opportunity to cheat but not consider it a possible action, which may be due to knowledge of moral rules related to the specific situation (knowledge that cheating is bad), or due to a deeper understanding and moral necessities (an appreciation of fairness). As individuals develop moral maturity, more decisions will be made based on a deeper understanding of moral necessities, rather than on situation specific moral rules. At each step, certain components can influence an individual's decision-making, leading them to decide not to cheat. For example, engaging in perspective taking at Step 2 may lead an individual to decide that the other players would be distressed and less likely to trust them if they cheated, or thinking about the ways to cheat at this step might trigger a somatic marker, or affective empathy, which feels unpleasant and rules out cheating as a viable option. As previously stated, the 6 steps are not sequential and can impact on each other, for example, which cues are encoded Step 1 can be affected by existing goals or motivation, which can bias encoding of cues through selective attention.

*Moral development within the SIP-MDM framework*

In terms of the *development* of moral decision-making in such a framework, the development of each of the components of the framework leads to an increased efficiency of decision-making. For example, increases in the ability to recognise emotions (Step 1) will enable such cues to be encoded and used in processing a situation, and increases in working memory, including attentional control (Step 2) will allow for more relevant features of a situation to be taken into account when making a decision. However, to fully achieve the capacity for mature moral decision-making, the components in the database also need to develop. Each of the components of the framework are necessary but not sufficient for moral development; the capacity to make mature moral decisions requires the development of many component processes, including the database, and whether mature real-time moral decisions are actually made depends on the processing that occurs, which can be influenced by situational factors. Based on this framework, to be able to make a mature moral decision in a moral dilemma (i.e. a decision based on an appreciation of moral necessities), an individual needs to have both a developed database and sufficiently developed component processes to be able to process information in a situation.

One important difference to this framework compared to previous SIP models is the extension of the database to add components thought to be crucial for moral development, such as perspective taking, an understanding of moral necessities, working memory, attention and abstract reasoning. Moral development is not just achieved through an increase in moral knowledge and improvements in information processing efficiency, but also involves the development of perspective taking and an appreciation of moral necessities for "growth beyond the superficial" (Gibbs, 2013). Immature moral reasoning is proposed by cognitive-developmental theorists to be rule orientated and young children have been found to show an understanding of moral rules (Kiley Hamlin et al., 2010). In a moral dilemma with strong or obvious moral rules attached (e.g. it is wrong to steal from a shop), young children are likely to make prosocial moral decisions, but when the moral rules of the situation are more ambiguous they may struggle to recognise the relevant moral principles, due to immature abstract reasoning skills and a lack of appreciation of moral necessities. Additionally, young children may also struggle when making moral decisions in situations where the working memory load is high or they are unable to correctly identify the emotions of others.

While a capacity for making mature moral decisions develops with age and experience, factors will affect whether or not a mature moral decision is made. An individual may have the capacity for making mature moral decisions but the processing that occurs in a situation, which can be influenced by biases and situational factors, can affect whether or not the situation is recognised as being in the moral domain. Components such as working memory and abstract reasoning develop during adolescence which may increase the efficiency of information processing but competing reward and control systems in the developing adolescent brain can affect decision-making, leading to increased risk-taking (Steinberg, 2007), and potentially antisocial moral decisions. There are also different situational factors which are of relevance at different ages, for example peer influences are particularly important during adolescence; the presence of peers can affect adolescents' decision-making (Gardner & Steinberg, 2005).

Our suggested framework is dynamic and is in line with the argument made by Rest et al. (1999) that development is gradual rather than one step at a time. Each of the components of the model develops with age and experience, either due directly or indirectly to the maturation of the brain, which occurs with growth and socialisation. Damage to the brain may alter the developmental trajectories of these components, resulting in less efficient social information processing and delayed moral development, having a subsequent effect upon behaviour. The horizontal arrow at the bottom of the framework is to illustrate that the whole process develops over time, but this developmental aspect could be greatly expanded upon by research into developmental relationships between components. Mature moral decisions may result in prosocial behaviour but other factors also influence behaviour, and such factors and their effects (e.g. peer influence) can change over time. Behaviour enactment, at Step 6 of this framework is a result of processing that occurs in a situation, the integrity of the component processes at each step and in the centre of the framework, and also situational factors.

*Promise and limitations of an integrated developmental framework of moral decision making*

Developmental psychology and social neuroscience approaches to moral decision-making and development have developed separately, with different research methods and informed by separate theories. Theories and research have tended to focus on moral decisions rather than behaviour as the end point. There have also been divides within theories from these disciplines, such as whether moral decisions are driven by intuitions or reasoning. Furthermore, although many components have been proposed to be important for moral decision-making and development, these have not previously been integrated into one comprehensive theory, and research does not tend to measure multiple components to assess relationships between them.

Looking to the future of moral theory development, our suggested SIP-MDM framework offers promise that concepts from developmental psychology and social neuroscience can be incorporated into one integrative framework. This framework goes beyond previous integrations with SIP theory as it incorporates ideas from various moral theories rather than just moral domain theory. It is also a step towards a dynamic model of moral decision-making, which was suggested by Van Bavel et al. (2015) and shows how moral decisions are not just driven by automatic intuitive processes and/or slower reasoning processes, but that many other components and factors are involved. This framework includes brain development but also references the rich tradition of developmental psychology. Using the term 'moral decision-making' places moral decisions alongside other types of decision-making, which can help in thinking about the general influences and processes that guide such decisions (e.g. situational factors), along with the morally specific processes, creating richer explanations of decisions and behaviour. While not a working model, this framework can offer predictions to be tested by future research studies, leading to further clarification of the framework, hopefully increasing insight into developmental relationships between components, in turn leading to better predictions of behaviour, and hopefully more creative ways of helping those who have difficulties within components described within our framework.

As antisocial behaviour involves breaking moral rules of a culture or society, bearing in mind that many of these rules are socially constructed, it could be explained using a moral SIP framework. In our suggested framework, antisocial behaviour could be explained as behaviour based on immature moral decision making, which could either be the result of (a) developmental delay or deficiencies in one or more of the component processes such as perspective taking or working memory, or (b) due to an underdeveloped database (a lack of adaptive moral schemas or an understanding of moral necessities), or (c) it could be the result of poor information processing, such as failing to attend to all the salient feature of a situation, a misinterpretation of cues, or failing to recognise a situation as having moral rules attached. This fits with the Situational Action Theory of crime (Wikström, 2005; Wikström, Oberwittler, Treiber, & Hardie, 2012) which proposes that crimes are moral actions, that crime involves an interaction of personal and environmental factors, and that whether an individual views crime as a possible action in a situation is determined by their moral evaluation of action alternatives.

Screening some of the component skills of our suggested framework in atypically developing individuals, or those at risk of engaging in antisocial behaviours could allow for targeted interventions which may prove more useful than general interventions. For example, people with brain injuries and also offender populations have been found to have deficits in facial emotion recognition (Croker & McDonald, 2005; Robinson et al., 2012). If an individual has deficits in emotion recognition, our framework would suggest that they will have problems encoding this information, which may potentially bias subsequent processing and moral decisions and behaviour. Teaching generic social problem solving skills may be of limited utility in such a case, as in a real life situation the individual will still struggle to use information from others' facial expressions in their moral decision-making, so emotion recognition training may be more beneficial. It has been found that modification training, to encourage the perception of happiness over anger in ambiguous facial expressions, results in a decrease in self-reported anger and aggression in TD adults and adolescents at risk of engaging in offending behaviour (Penton-Voak et al., 2013). It is also possible to increase moral behaviour and reduce antisocial behaviour by training individuals in some of the component processes; a study which trained perspective taking abilities in preschool children found that training increased visual, cognitive and affective perspective taking, and that these increases were related to increased prosocial behaviour and decreases in aggressiveness (Cigala, Mori, & Fangareggi, 2015). Further increases in prosocial behaviour and decreases in aggression may potentially be achieved by training individuals in some additional components, such as moral reasoning, moral rules and attention and working memory. Further investigation of how components relate to behaviour can help to determine which components it would be most useful to target for intervention.

While there is promise of what a fully integrative working model of moral decision-making and development could offer, developing such a model that predicts moral decision-making, moral development and moral behaviour is an ambitious task. In incorporating all of the components thought to be involved, there is a risk of creating a theory of everything, which is too broad and non-specific, or overly complicated. There are also challenges in reconciling differing theories and philosophical viewpoints, and also incorporating social neuroscience research which has largely developed separately from developmental psychology research. Bearing in mind these limitations, we will now discuss some suggestions for future research, which we see as the next step to creating an integrative model.

*Using the SIP-MDM to guide research*

It was beyond the scope of the current paper to systematically review all research into the development of all of the components of moral decision-making and moral development but we have summarised selected research, which suggests that all the component processes mature with age. Studies typically just measure one component of moral decision-making or moral development, but some studies have found developmental and predictive relationships between components (Carlo, Mestre, Samper, Tur, & Armenta, 2010; de Wilde et al., 2016; Eisenberg, Carlo, Murphy, & van Court, 1995; Peterson et al., 2016) and that training some of the components

can lead to improvements in prosocial behaviour (Cigala et al., 2015). Further developmental research which measures moral decision-making alongside some of the other component processes (e.g. perspective taking and emotion recognition), SIP skills and behaviour can help to provide a clearer picture of the relationships between all of these components, including predictive relationships.

The framework presented here attempts to consider how moral decision-making may occur and how development of the components can increase the capacity for mature moral decision-making. Research is needed to either confirm or reject the predictions of this framework, for example, does developmental progression in emotion recognition abilities affect what is encoded in a moral dilemma, and does this in turn have any effect on moral decision-making and behaviour? Our suggested framework can be used to generate such hypotheses about moral decision-making and moral development, to guide research and theory development. Testing some of these hypotheses in TD samples can provide information about the typical developmental relationships between components. Testing hypotheses of the SIP-MDM framework in atypically developing samples can provide information about how difficulties in certain components can impact the moral decision-making process and moral development.

Conceptualising moral response decisions within a SIP framework allows for such decisions to be measured with a SIP instrument, using vignettes which depict violations of moral rules or principles. Measuring moral decisions this way could allow for an investigation of how more real-life moral response decisions are made, based on a response constructed by the individual rather than forced-choices in hypothetical dilemmas. For example, the social information processing test (van Nieuwenhuijzen, Vriens, Scheepmaker, Smit, & Porton, 2011) includes a vignette of a boy in a wheelchair being bullied, which relates to the moral principles of justice and harm, and decisions about this dilemma are more 'real-life' than choosing to kill one person or to kill five people (Greene et al, 2001). Future studies could use a SIP measure alongside measures of moral reasoning and other component processes, to provide a better understanding of relationships between the components.

Further research into which brain areas are recruited when making different types of moral decisions is needed in order to expand on the brain development component of the SIP-MDM framework. Developmental neuroimaging studies could provide insight into how the brain networks for moral decisions change with age. Evidence from neuroscience suggests that the vmPFC is the brain region most commonly recruited for moral decision-making, but neuroscience studies tend to use utilitarian hypothetical dilemmas involving life or death choices (Greene et al., 2001), which do not to reflect the everyday moral decision-making of most people. Furthermore, the vmPFC has been found to be recruited during other types of decision-making, such as decisions relating to food choice (Hare, Malmaud, & Rangel, 2011), so it is not a uniquely moral brain region. Many components, such as empathy, perspective taking and working memory are proposed to be important for moral decision-making maturity, so a wide range of brain regions and networks may underpin moral decision-making and development. Research which measures brain development from infancy to adulthood, alongside measuring moral reasoning and related components such as perspective taking, would provide a fuller picture of the brain networks required for moral decision-making. Such research would allow the 'brain development' of our framework to be greatly expanded upon, pinpointing which brain regions are most important for the maturation of moral decision-making, and highlighting developmental windows of importance which can be useful in training to enhance moral decision-making.

Measuring some of the components of the SIP-MDM framework in individuals, such as their moral reasoning level and SIP skills, may allow for a prediction of how they are likely to act in moral situations, but without further exploration of all relevant situational factors, behavioural prediction would not be possible. Further research into the situational factors that may affect moral decision-making will help to better predict moral behaviour. Situational factors have been incorporated into some steps of the SIP-MDM framework but this is an area that needs further research and clarification in order to improve the predictive power of such a framework in different situations. Research from criminological literature can add to our knowledge of relevant contextual and situational factors for offending behaviour, and how these interact with other factors and change over time. For example, peer influence is particularly important during adolescence and adolescents are more likely to offend when unsupervised with peers (Wikström, Ceccato, Hardie, & Treiber, 2010).

## Conclusion

Moral decision-making and development are complex processes involving many components. In this paper we have highlighted 'what develops', i.e. the component processes and factors outlined by the various theories and perspectives, and discussed research into how these components develop. The SIP-MDM framework is the first attempt to incorporate all of the suggested relevant components into one descriptive framework of moral decision-making, moral development and behaviour. This framework expands the definition of moral development to incorporate the maturation of relevant component processes, as well as the maturation of moral decision-making, including moral reasoning. Development of the components, including the database, can lead to an increase in the capacity for making more mature moral decisions, but whether a mature moral response decision is made, and results in a moral behaviour will depend on situational factors and the processing that occurs in that situation. Our framework can explain how real-time moral decisions are made, and can help in describing the components that need to develop in order for mature moral decisions to be able to occur. Further research in this area can provide either support for this framework, or arguments for reformulation. For a fully working model which explains both moral decision-making and behaviour alongside moral development, specific situational factors need to be further explored and developmental processes, including brain development, expanded upon.

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