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A dual-process approach to cognitive development: The case of children's understanding of sunk cost decisions

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Only in recent years have developmental psychologists begun advocating and exploring dual-process theories and their applicability to cognitive development. In this paper, a dual-process model of developments in two processing systems—an "analytic" and an "experiential" system—is discussed. We emphasise the importance of "metacognitive intercession" and developments in this ability to override experiential processing. In each of two studies of sunk cost decisions, age-related developments in normative decisions were observed, as were declines in the use of a "waste not" heuristic. In the second study, children and adolescents were presented with arguments for normative and non-normative sunk cost decisions. Following argument evaluation, participants were re-presented the original problems and a set of novel, transfer problems. Results indicated that post-argument improvements were most apparent during adolescence. Age-related improvements were most noticeable on the transfer problems. In general, the findings suggest that the ability to metacognitively intercede (i.e., reflect on arguments; inhibit experientially produced responses) emerges towards middle adolescence. However, even by the end of adolescence, in the absence of significant contextual cues and motivation, this ability is infrequently utilised.

For decades, cognitive developmental psychology flourished under the guidance of Piaget's (1972; Inhelder & Piaget, 1958) general theory of intellectual development. Because Piaget's theory covered a wide range of intellectual domains—from simple sensorimotor skills to higher-order reasoning—and offered an equally impressive range of testable hypotheses, the theory opened innumerable avenues for empirical examination. Hundreds of empirical investigations dotted the developmental landscape, with many investigators claiming support for various Piagetian hypotheses

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and others claiming to have refuted aspects of Piaget's theory. As research proceeded from the 1970s and into the 1980s, and as the sheer quantity of anti-Piagetian evidence mounted, evidence taken as support of the theory was extensively criticised. Although many of these criticisms were unjustified and based on misinterpretations of basic Piagetian claims, by the mid-1980s it was clear that most cognitive developmentalists had serious misgivings about the adequacy of Piaget's approach.

As Piaget's theory fell from grace, information processing theories gained ground. However, although information processing theories remain in vogue, they have been criticised on several grounds. For instance, with few exceptions (e.g., Case, 1985, 1998; Markovits & Barrouillet, 2002), information processing theories have not provided adequate accounts of the mechanisms that guide developmental change. Obviously, this shortcoming is critical for any adequate account of development. In addition, like other recent approaches to cognitive development (e.g., the "theory-theory" approach; see Wellman & Gelman, 1992), information processing theories either focused entirely on explicit information processing or ignored the implicit/explicit processing distinction.

In addition to these ongoing paradigm shifts, a disturbing trend in cognitive developmental research has been on determining the earliest ages at which particular abilities (e.g., "theory of mind") are in evidence. The general framework guiding much of this work has been, either implicitly or explicitly, nativist. Thus, rather than studying age-related change, some theorists (e.g., Gopnik & Wellman, 1994) have argued that very young children (e.g., 3- to 4-year-olds) possess abilities that are highly similar to the abilities of adults and that competencies once believed to emerge only during adolescence are, in fact, present in preschoolers (e.g., Ruffman, Perner, Olson, & Doherty, 1993).

As developmentalists' preoccupation with early development has continued, a number of interesting shifts have occurred in theories of adult cognition. In particular, adult theorists (e.g., Bargh & Chartland, 1999; Evans & Over, 1996; Stanovich, 1999) have recognised that reasoning and decision making are achieved largely through interactions between two processing systems. One system, here labelled the "analytic" system (see Evans, 1989), is concerned with conscious, explicit cognition. The second system, here referred to as the "experiential" system (see Epstein, 1994), operates at a minimally conscious level. With the exception of research on implicit and explicit memory (e.g., Lie & Newcombe, 1999; Schneider, & Bjorklund, 1998), cognitive developmentalists have assumed that a simple shift from predominantly intuitive processing to analytic processing is a principal characteristic of development and have focused their empirical efforts on developments in the analytic system. Thus, experiential processes have largely been ignored (Klaczynski, 2001a, in press-b).

In this paper, we first discuss the distinction between analytic and experiential processing. In doing so, we borrow heavily from the theories of Evans (1989; Evans & Over, 1996), Stanovich (1999; Stanovich & West, 2000), and Epstein (1994; Epstein & Pacini, 1999). This outline includes a discussion of the implications of dual-process theories for research on cognitive development. As an illustration of how dual-process theories can be applied to developmental phenomena, we then describe our research on the development of decisions based on sunk costs. Our conclusions focus on the role of analytic processing in overriding experiential processing and, specifically, on how developments in metacognitive abilities allow for age-related changes in the evaluation of preconsciously activated heuristics.

DUAL-PROCESS THEORIES OF REASONING AND DECISION MAKING

In contrast to traditional theories of development, a basic assumption of dual-process theories is that age-related change occurs in two separate operating systems. Rather than assuming that development proceeds from simple intuitive cognition to more computationally complex, deliberative cognition within a single operating system, dual-process theories assume that both deliberate, explicit processes and implicit, intuitive processes operate simultaneously at most, if not all ages (disentangling implicit from explicit cognition during infancy is likely to prove exceedingly difficult).

In the adult literature, dual-process theories arose because basic information processing theories and decision theories could not adequately account for the surprising finding that adults frequently perform poorly on a wide range of apparently simple judgement and reasoning tasks (e.g., conjunction problems, Wason's 1966 selection task). Although "bounded rationality" arguments provide one means of dealing with these findings—that is, by asserting that problem complexity often overwhelms human information processing capacities, thus forcing people to "do the best they can with what they have"—such arguments cannot explain developmental findings that children often perform well on the same tasks that seem to perplex adults (see Davidson, 1995; Jacobs & Potenza, 1991; Klaczynski & Narasimham, 1998; Markovits & Dumas, 1999; Reyna & Ellis, 1994). However, even if rationality (on simple problems) is bounded by information processing constraints, bounded rationality theories do not, in and of themselves, explain the precise means by which "satisficing" occurs.

Like competence/performance theories in developmental psychology (see Overton, 1985), dual-process theorists approach this problem by assuming that, even among individuals who possess the analytic competencies to solve complex tasks, these competencies are not always activated in situations that apparently call for their use. Instead, people typically rely on memory-based strategies that are activated by experiential system predominance. Task characteristics and individual differences in intellectual motivation (see Epstein & Pacini, 1999; Stanovich & West, 1997, 1998, 2000) determine which information processing system is predominant on that task. Because it is the more cognitively economical system, which emerged earlier in human evolution and often produces satisfactory (and sometimes optimal) responses, most theorists believe that the default processing system is experiential (Brainerd & Reyna, 2001; Evans & Over, 1996; Klaczynski, 2001b; Stanovich, 1999).

The experiential system involves the preconscious activation of procedural and episodic memories that can be used to guide judgements and decisions. Rather than relying on logical processing, when this system is predominant, people generally base their judgements on strongly activated memories. In general, experiential processing is fast, operates at a minimally conscious level, and places little, if any, demand on working memory. This system facilitates information mapping onto and assimilation into existing knowledge categories, operates to convert conscious strategies and tactics into automatic procedures, and aids the activation of decision-making heuristics and other memories (e.g., stereotypes, beliefs, vivid episodic memories) that bias judgements and interfere with attempts to reason "objectively".

Thus, experiential processing often depends on the activation of heuristic short-cuts, most of which are acquired through experience. Developmentally, this means that individuals' repertoire of heuristics should become increasingly diverse and more easily activated with age. The implication of this conclusion is *not* that adults will necessarily use heuristics more than children, but instead that—when experiential processing is predominant—adults' judgements and decisions will reflect more variability in the types of heuristics they use. If children have not yet acquired the heuristics that adults typically use on a task, the (possibly mistaken) conclusion that adults rely on experiential processing more than children may be drawn. However, simply because adults have more heuristics available than children does *not* mean that they will use heuristics more often. The high probability that an increasingly diverse array of heuristics is acquired from childhood through adulthood explains neither the frequency with which heuristics are applied to judgement and decision situations nor occasions on which heuristics, although activated, are not exercised. As discussed subsequently, because a situation activates a particular heuristic does not mean that this heuristic will be used. The experiential processing system, functioning with little or no conscious awareness, continuously assimilates information and matches internal and external cues to memory procedures; this matching process, in turn, activates and makes available specific heuristics for utilisation.

The experiential system co-develops with the analytic system. The analytic processing system comprises consciously controlled, effortful thinking, and the numerous competencies that have traditionally been considered essential to cognitive development and normative decision making (Evans & Over, 1996; Stanovich, 1999). Unlike experiential processing, analytic processing is directed towards breaking down problems into their component elements, examining these elements, and, from this analysis, deriving solutions, judgements, decisions, and arguments. In further contrast to experiential processing, analytic processing operates on "decontextualised" representations. The process of decontextualisation is essential if analytic competencies are to be engaged consistently and used effectively (Stanovich, 1999; Stanovich & West, 1997). Decontextualised task representations—wherein the underlying structure (e.g., logical components) of a problem is decoupled from superficial contents (e.g., counterfactual information)—provide a working memory structure on which logico-computational processing can operate (Stanovich & West, 1997; see also Donaldson, 1978). However, the ability to decontextualise task structure from potentially misleading contents, and from logically irrelevant memories activated by these contents, depends largely on the development of metacognitive and executive function abilities (e.g., impulse control, ability to inhibit memory-based interference). In Table 1 (adapted from Epstein, 1994; Evans, 2002; Stanovich, 1999), a brief list of the attributes of the two processing systems is presented.

As noted previously, development is in part characterised by the acquisition of judgement and decision heuristics. Although heuristics may

TABLE 1
Characteristics of the experiential and analytic processing systems

Experiential processing	*Analytic processing*
Evolved early	Evolved late
Fast	Deliberate
Automatic	Controlled and effortful
Minimally conscious	Conscious
Operates on contextualised representations	Operates on and constructs decontextualised representations
Involves activation of memories (e.g., beliefs, heuristics, stereotypes)	Involves activation of higher-order reasoning and decision-making abilities
Relies on cursory situational analyses	Relies on precision and breaking down situations into specific elements
Frees attentional resources for analytic processing	Heavy load on working memory
Operates independently from general intelligence	Operates in cooperation with general intelligence and metacognitive abilities

be learned explicitly, by and large they are acquired through implicit cognitive processes (see Reber, 1992). Once acquired, heuristics are activated automatically by situational cues. Many people also employ these heuristics automatically not only because they are "fast and frugal" (Gigerenzer, 1996), but also because they often lead to outcomes beneficial, or at least not harmful, to the decision-maker. Also, because people have only a fleeting awareness that they have been activated, and because their activation elicits intuitions or "gut" feelings that they are "right" for the immediate situation (Epstein, 1994), decision heuristics are often used in situations for which their relevance is doubtful. Yet, although heuristic activation is effortless and automatic, once activated, it is likely that some (but perhaps not all) heuristics are momentarily available in working memory (Klaczynski, 2001a, 2004, in press). This availability affords reasoners the opportunity to consciously reflect on the value of the heuristic and actively decide whether to use the heuristic or not. As the adult literature indicates, either most people do not engage in this type of conscious reflection or, if they do, most people decide that the heuristic is in fact worth using.

The first point of this discussion is that experiential processing tends to predominate people's thinking. Second, experiential processing predominance can be overridden by analytic processing (Stanovich, 1999). The process of overriding experiential processing is conscious, likely requires advanced metacognitive abilities, and therefore is likely to be achieved more effectively by adolescents and adults than by children. However, the third point of the foregoing discussion is that most adolescents (and most adults) are not predisposed to override the experiential system functioning; nonetheless, there are wide individual differences in the tendency to inhibit the utilisation of automatically activated heuristics, engage in logical analysis, and construct decontextualised task representations (Klaczynski, 2000; Stanovich & West, 2000).

We therefore argue that the acquisition of metacognitive abilities—and dispositional tendencies to *use* these abilities (see Stanovich, 1999)—is critical to managing the interface between analytic and experiential processing in working memory. Metacognitive competence comprises the abilities to reflect on the process of knowing, the structure and quality of evidence and strategies, and the accuracy of personal knowledge (Kuhn, 2000, 2001). Further, metacognitive abilities include the abilities to monitor reasoning for consistency and quality, inhibit memory-based interference in attempts to reason analytically, and evaluate the appropriateness of preconsciously activated heuristics (when these are available in working memory).

Developmental evidence thus points to two key distinctions between adult and child cognition. First, along with the obvious fact that adults possess more analytic competencies than children, adolescents and adults also have access to more heuristics. Because these heuristics have a longer history of use in adults than in children, it is very possible that heuristics become increasingly easy to activate with age (Klaczynski, 2004). Second, recent research indicates that perhaps the key difference between child and adolescent cognition concerns the greater likelihood that older individuals have acquired the various metacognitive abilities listed previously (see Moshman, 1990, 1999; Kuhn, 2000, 2001; Kuhn, Amsel, & O'Loughlin, 1988). However, as Kuhn's research illustrates, few adolescents and adults have fully acquired these abilities and, as the adult decision literature suggests, even fewer are disposed to using those metacognitive abilities they do possess.

APPLICATION TO DECISION MAKING: DEVELOPMENTAL TRENDS IN SUNK COST DECISIONS

Research on the development of decision making is still in its infancy. Although numerous investigations have examined adolescent decision making (e.g., Steinberg & Cauffman, 1996; see Jacobs & Ganzel, 1993), these investigations have typically focused more on specific issues (e.g., abortion) than on the actual processes that guide decision making (for exceptions, see Byrnes, 1998; Klaczynski, 2001a, 2001b; Kokis, Macpherson, Toplak, West, & Stanovich, 2002; Reyna & Ellis, 1994). The developmental literature on heuristics and biases is particularly sparse. Extant research has found that, at least under some conditions, and despite possessing the analytic competencies needed for normative solutions, adolescents and adults rely on certain heuristics (e.g., representativeness) more than children (see Davidson, 1995; Jacobs & Potenza, 1991; Klaczynski, 2000; Reyna & Ellis, 1994). However, as Kokis et al. (2002) and Klaczynski (in press) point out, these findings cannot be taken to mean that adolescents and adults *in general* rely more on experiential processing than children.

In two studies, we examined age-related changes in a particular heuristic—the "waste not" heuristic (see Arkes & Ayton, 1999; Baron, Granato, Spranca, & Teubal, 1993)—that adults frequently use when making decisions about "sunk costs". In Study 1, age trends in problems that did and did not involve sunk costs were explored. In Study 2, we employed the Stanovich and West (1999) methodology for studying the "understanding/acceptance" principle to examine age differences in the ability to reflect on arguments that were either against or in support of the "waste not" heuristic, the ability of different age groups to understand these arguments, and whether children applied their understanding of the arguments to subsequent sunk cost decisions.

Most theories of normative decision making maintain that anticipated future consequences, rather than investments in prior decisions, should be the primary determinants of current decisions (Arkes & Ayton, 1999). When sunk costs are "honoured" or the "sunk cost (SC) fallacy" is committed, decisions are dictated by inconsequential expenditures in prior actions (i.e., irretrievable time, money, effort, etc. "sunk" into a decision). Thus, after investing in a goal and subsequently discovering that the goal is no longer worthwhile, attainable, or as desirable as alternative goals, people continue "throwing good money [or effort] after bad" (Heath, 1995; Staw, 1976). For example, the more entrepreneurs invest in new businesses, the more likely they are to expand those businesses when they are failing (McCarthy, Schoorman, & Cooper, 1993).

Although considerable evidence indicates that adults commit the SC fallacy frequently, age differences in the propensity to honour sunk costs have been little studied. In their investigations of 7–15-year-olds (Study 1) and 5–12-year-olds (Study 2), Baron et al. (1993) found no relationship between age and SC decisions. By contrast, Klaczynski (2001b) reported that the SC fallacy decreased from early adolescence to adulthood, although normative decisions were infrequent across ages. A third pattern of findings is reviewed by Arkes and Ayton (1999). Specifically, Arkes and Ayton argue that two studies (Krouse, 1986; Webley & Plaiser, 1998) indicate that younger children commit the SC fallacy less frequently than older children.

Making sense of these conflicting findings is difficult because criticisms can be levied against each investigation. For instance, Arkes and Ayton (1999) questioned the null findings of Baron et al. (1993) because sample sizes were small (e.g., in Baron et al., Study 2, *n*s per age group ranged from 7 to 17). The problems used by Krouse (1986) and Webley and Plaiser (1998) were not, strictly speaking, SC problems (rather, they were problems of "mental accounting"; see Webley & Plaiser, 1998). Because Klaczynski (2001b) did not include children in his sample, the age trends he reported are limited to adolescence. Thus, an interpretable montage of age trends in SC decisions cannot be created from prior research.[1]

On the basis of the Krouse (1986) and Webley and Plaiser (1998) findings, and from other developmental findings indicating age-related increases in heuristic use, Arkes and Ayton (1999) hypothesised that children are likely less to commit the SC fallacy than adults. In part, the logic underlying this hypothesis is that, because they have had fewer experiences with precautions against waste (e.g., from parents, "eat all your food so it doesn't get

[1]The mean age of children in Study 1 of Baron et al. (1993) was 12.1 years. The standard reported deviation (1.6 yrs.) indicates that most children were between 10.5 and 13.7 years. Hence, small sample size could have interacted with a restricted age range to mask developmental differences.

wasted''), children have not fully internalised the ''waste not'' heuristic. As such, in contrast to adolescents and adults, the heuristic is less likely to be activated automatically and inappropriately applied in sunk cost situations. That is, although they may have knowledge of the heuristic, children may restrict their use of it to those specific situations in which it is, in fact, appropriate (e.g., buying more food than one can eat). Adults, by contrast, are more likely to apply the heuristic ''thoughtlessly'' in situations for which its usefulness is of doubtful value.

An alternative proposition is based on the previously outlined theory of the role of metacognition in mediating interactions between analytic and heuristic processing. In this view, even young children have had ample opportunities to convert the ''waste not'' heuristic from a conscious strategy to an automatically activated heuristic stored as a procedural memory. Evidence from children's experiences with food (e.g., Birch, Fisher, & Grimm-Thomas, 1999) provides some support for the argument that even preschoolers are frequently reinforced for not ''wasting'' food. Mothers commonly extort their children to ''clean up their plates'' even though they are sated and even though the nutritional effects of eating more than their bodies require are generally negative. If the ''waste not'' heuristic is automatically activated in sunk cost situations for both children and adults, then one possibility is that no age differences in committing the fallacy should be expected.

However, if activated heuristics are momentarily available for evaluation in working memory, then the superior metacognitive abilities of adolescents and adults should allow them to intercede in experiential processing before the heuristic is actually used. Although the evidence is clear that most adults do not take advantage of this opportunity for evaluation, the proportion of adolescents and adults who actively inhibit the ''waste not'' heuristic should be greater than the same proportion of children. The aim of Study 1 was to test these three competing hypotheses regarding the development of sunk cost decisions and, more generally, to illustrate the utility of adopting a dual-process approach to cognitive developmental phenomena.

STUDY 1

Method

Participants. As part of a larger study of decision making and its development, 30 7–8-year-old (13 boys, 17 girls; $M = 8.08$ yrs, $SD = 1.09$ yrs), 34 10–11-year-old (15 boys, 19 girls; $M = 10.84$ yrs, $SD = 0.63$ yrs), and 30 13–14-year-old (15 boys; 15 girls; $M = 13.80$ yrs, $SD = 0.93$ yrs) children participated. Participants were volunteers from private elementary and middle schools in central Pennsylvania. Experimental sessions were conducted with individual participants in rooms at their schools and lasted between 30 and 40 minutes.

Materials and procedure. Children made decisions on six sunk cost problems, which were intermixed with several other types of decision-making problems. Prior to each problem, participants were told that a story character needed help making a decision, that there was no right or wrong decision, and that it was important to recommend the decision that "you really think will be most helpful". To help the younger children understand the alternatives and to retain their attention, simple pictures accompanied the written descriptions of the alternatives. Presentation order of the decision options (i.e., the SC option and the "normative" non-SC option) within problems was counterbalanced across participants. The problems were presented in one of four randomly determined orders.

Of the six SC problems, two involved monetary investments, two involved time/effort investments, and two involved investments in projects with a peer. Each problem presented a decision that a hypothetical child had made, and the amount and type of investment that she or he had "sunk" into that decision. This decision was described as not likely to produce the effect for which it was intended. An alternative that was more likely to achieve the decision maker's goal was then presented.[2]

For each SC problem, a same-content, "no sunk cost" (N-SC) problem was created. N-SC problems described courses of action analogous to those in the SC problems, except that no decision to invest in these plans had been made. Pursuit of these plans would require the same amount and type of investment as in the analogous SC problems. An alternative plan that was more likely to achieve the decision maker's goal, and that had the same cost in the analogous SC problem, was also presented. The N-SC problems served as controls to ensure that, when children honoured sunk costs on the SC problems, they did so because of the investments that had been made and not because they misconstrued the decision maker's goals. Normative decisions (scored "1") in both the SC and N-SC problems were the options that were more likely to achieve the decision makers' goals.

Children made decisions on one SC problem and one N-SC problem from each domain (i.e., monetary, time/effort, peer). Thus, there were two

[2]From the normative perspective, the amount of time, effort, or money invested in a project should have no bearing on decisions to abandon or continue a decision. Psychologically, however, "amount" has a significant impact on the SC decisions of adults (McCarthy et al., 1993). Because the present research was largely exploratory, "amount" was not manipulated. Instead, the SC problems were piloted with adults to ensure that investments were sufficiently large to activate the sense that "a lot" would be "lost" if a decision were abandoned. Additional research is needed to determine whether, for example, children and adolescents have different thresholds for the level of investment required before they commit the SC fallacy.

problem sets, each containing three SC and three N-SC problems. The SC problems in one set were the N-SC problems in the other set and vice versa; approximately half of the children received one problem set and half received the other problem set. Problem set was a between-subjects variable; problem type (SC versus N-SC) and domain (monetary, time/effort, peer) were within-subjects variables. Because no effects of problem set were significant (smallest $p = .12$), this variable is not discussed further. Examples of SC and N-SC problems are presented in Appendix A.

Results

Mean scores are presented in Table 2. A 3 (age) × 3 (domain: monetary, effort, peer) × 2 (problem type: SC, N-SC) analysis of variance revealed an age-related increase in normative decisions across domains and problem types, $F(2, 104) = 6.02$, $p = .003$. In addition, the domain × problem type interaction was significant, $F(2, 208) = 8.73$, $p < .001$. Although SC scores did not differ on the monetary, time/effort, and peer problems ($p = .28$), N-SC scores were higher than SC scores on the monetary and time/effort problems (ps $< .001$), but not on the peer problems ($p = .06$). Thus, the SC fallacy was committed with significant frequency on the monetary and time/effort problems.

The results thus show age increases on both the SC and N-SC problems and, therefore, do not support the Arkes and Ayton (1999) hypothesis. However, despite significant age-related increases in normative decisions, scores on the SC problems were significantly below chance at each age (smallest $p = .038$). By contrast, N-SC scores were above chance for the 11- and 14-year-olds (ps $< .001$), but not the 8-year-olds (note, however, that

TABLE 2
Study 1: Age trends in sunk cost decisions in the monetary, effort, and friendship domains

Domain	*8-year-olds*	*11-year-olds*	*14-year-olds*
Money			
Costs sunk	.16 (.37)	.28 (.46)	.43 (.50)
No costs sunk	.61 (.50)	.74 (.44)	.84 (.37)
Time/Effort			
Costs sunk	.19 (.40)	.33 (.48)	.38 (.49)
No costs sunk	.52 (.51)	.77 (.43)	.81 (.40)
Friendship			
Sunk costs	.45 (.51)	.36 (.49)	.38 (.49)
No sunk costs	.42 (.50)	.51 (.51)	.57 (.50)

Scores could range from 0 to 1. Chance responding was .50.

the difference between N-SC scores and SC scores was significant, *p*s $< .001$, at all ages). Consistent with research on adults, most adolescents and children committed the SC fallacy in situations that involved investments in prior actions. This was particularly clear when those situations involved investments of effort and money. Figure 1 shows age trends in SC and N-SC decisions, collapsed across the monetary and time/effort domains. As the figure shows, age-related improvements in decision making occurred to very similar extents on the SC and N-SC problems. Also clear from the figure is that the SC fallacy was committed frequently across ages, but was especially common in the youngest age group (on approximately 82% of the problems, the 8-year-olds committed the fallacy).

Discussion

The findings support the notions that (a) analytic decision-making competencies improve from childhood to adolescence, at least in the domain of sunk cost decisions, but that (b) despite these improvements, most adolescents commit the sunk cost fallacy. Presumably, the fallacy is committed because—regardless of age—most children and adolescents apply an automatically activated heuristic against waste without evaluating

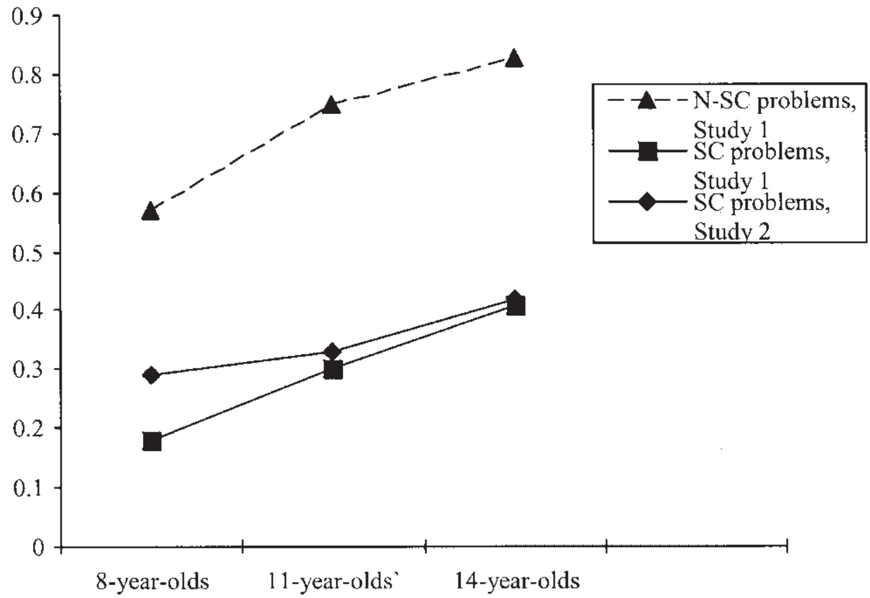

Figure 1. Age trends in SC and N-SC decisions across the monetary and effort domains.

its appropriateness to specific situations. The heuristic, in others words, operates as an all-purpose rule guarding against waste that is typically both activated and applied automatically. However, the developmental effect we observed could be at least partially attributed to improved abilities to inhibit experientially activated ("prepotent") heuristics. Thus, our suggestion is that the key difference between children and adolescents, at least on sunk cost decisions, is *not* their access to or the automaticity of the "waste not" heuristic"; rather, the difference is primarily in the ability to "metacognitively intercede" prior to applying the products of experiential processing (Klaczynski, 2004).

Alternatively, children may perform worse than adolescents because they simply do not understand the principle that decisions should be based on anticipated future consequences rather than prior investments. Because they do not possess the analytic competencies to make normative decisions, children rely on what they do know: the "waste not" heuristic. Opposed to this explanation, however, are the findings from the N-SC problems. On these problems, even the youngest participants performed significantly better than chance. Children thus do appear to understand that decisions should be based on those future actions most likely to achieve their goals.

Nonetheless, Study 2 was intended to test the possibility that children (and adolescents) do not fully understand the normative principle underlying sunk cost decisions. Specifically, we adopted the research approach of Stanovich and West (1999) in their discussion of the "understanding/acceptance principle". According to this principle, the greater the understanding of a decision-making principle, the more likely that normative arguments will be accepted and subsequent decisions will be based on those arguments (see Stanovich & West, 1999, pp. 351 – 352). Alternatively, the less a principle is understood, the more likely that non-normative arguments will be accepted and that subsequent decisions will be based on non-normative heuristics.

Using a variant of the Stanovich and West (1999) methodology, we presented children with arguments for either the normative decision or the non-normative "waste not" (i.e., sunk cost) decision. If children understand the normative principle, but the situational cues that pull for the "waste not" heuristic overwhelm attempts to process information analytically, then arguments for the normative decision should activate this competence (i.e., normative arguments should activate the metacognitive abilities required to override experiential processing). If children understand these arguments and apply them to subsequent decisions, then the case could be made that children do have the requisite competence, but do not apply this competence because they over-rely on heuristics (see Stanovich & West, 1999). Similarly, if children possess the requisite competencies, then they should not be swayed by arguments for the non-normative decision. That is, among those children whose initial decisions are normative, an understanding of the normative principle would be implied if they were not swayed in the non-normative direction by arguments that the "waste not" heuristic is worthwhile.

STUDY 2

Method

Participants. As part of a larger study of children's decision making, 331 9-year-old, (M = 9.4 yrs; SD = .58; n = 107; 50 boys, 57 girls), 12-year-old (M = 12.3 yrs; SD = .44; n = 110; 56 boys, 54 girls), and 15-year-old (M = 15.6 yrs; SD = .61; n = 110; 52 boys, 58 girls) children participated. The 9- and 12-year-olds were drawn from the fourth and seventh grades of two elementary schools that served predominantly mid-SES families. The 15-year-olds were recruited from the tenth grades of the two high schools into which the elementary schools fed. Data from three 9-year-olds were discarded because their teachers reported that these children had serious reading difficulties.

Materials and procedure. For the 9-year-olds, sessions were conducted with groups of no more than four students; modal group size was three. For the 12- and 15 year-olds, groups ranged from three to eight students; at both ages, modal size was four. Sessions lasted between 45 and 60 minutes and were conducted in rooms at participants' schools. Participants were randomly assigned to the conditions described subsequently.

All problems and arguments were presented on separate pages of a 29-page booklet. Although few children had difficulty reading the materials, an undergraduate assistant or teacher was present with each group to answer questions. The instructions, a practice problem (involving the decision to play or read a book, but not involving sunk costs), and a practice argument (again, not involving sunk costs) were read to all participants. Proper use of the rating scales used for the arguments was demonstrated with a large (24 × 12 inch) replica of the scale that appeared in the booklets.

Each session began with a baseline assessment of sunk cost decisions (as well as other types of decisions not discussed here) and, immediately subsequent to this assessment, exposure to normative or non-normative arguments. Two baseline problems were presented. After a brief introduction, children made decisions on both problems. During the second phase, the first problem of the pair was presented again, but children were not asked to make a decision. Instead, an argument that endorsed the normative decision or the non-normative decision for this problem was presented immediately below the problem, and children rated argument strength. The second sunk cost problem was then re-presented with a normative or non-normative argument and rating scale.

In the normative argument (NA) condition, the arguments for both problems were for the normative decision. In the non-normative argument (NN) condition, the two arguments were for the sunk cost decision. In the normative plus non-normative (N + NN) condition, two arguments (one normative, one non-normative) were presented after each problem. In the N + NN condition, the order of the two arguments presented for each problem was counterbalanced. A control condition was included to be identical to the NA and NN conditions, except that descriptions of the characteristics (e.g., tall, outgoing) of the hypothetical decision makers in the problems replaced the arguments.

During the third phase (the "understanding/acceptance" or U/A phase), the problems—but not the arguments—were presented a third time. After being assured that they could make the same or a different decision than they had originally, children again made decisions on each problem. Next, a 5-minute filler task (a simple maze on one page, a hidden picture task on the next page) was given. In the final phase, transfer was assessed on two SC problems the children had not previously seen.

Results

Argument ratings. As an initial step in our analyses, we explored whether ratings of normative and non-normative arguments differed by age and condition. Mean ratings in the three experimental conditions are presented in Table 3. In a first analysis, ratings in the NA condition were compared to ratings in the NN condition. A 3 (age) × 2 (condition) analysis of variance showed that, although ratings were higher in the NA condition than in the NN condition, $F(1, 163) = 18.22$, $p < .001$, this main effect was qualified by an age × condition interaction, $F(2, 163) = 3.74$, $p = .026$. Somewhat surprisingly, follow-up analyses showed both the 9-year-olds ($p < .001$) and the 12-year-olds ($p = .047$) rated normative arguments as superior to non-normative arguments; the 15-year-olds, at least in this between-condition comparison, did not rate normative arguments higher than non-normative arguments. In a second, within-condition analysis, normative argument ratings in the N + NN condition were compared to non-normative argument ratings in the same condition. A 3 (age) × 2 (rating type: normative or non-normative) ANOVA indicated that participants across ages overwhelmingly believed that the normative arguments were superior to the non-normative arguments, $F(1, 76) = 45.26$, $p < .001$. Thus, participants generally rated normative arguments as superior to non-normative arguments. Although the

TABLE 3
Study 2: Mean argument ratings (and SDs) in the experimental conditions

	Condition		
Argument type	*NA*	*NN*	*N + NN*
Normative			
9-year-olds	3.38 (.65)		3.16 (.72)
12-year-olds	3.21 (.74)		3.52 (.66)
15-year-olds	3.04 (.66)		3.29 (.53)
Non-normative			
9-year-olds		2.41 (.81)	2.66 (.75)
12-year-olds		2.76 (.96)	2.30 (.74)
15-year-olds		2.83 (.85)	2.33 (.79)

Ratings could range from 1 to 4.

TABLE 4
Study 2: Mean proportions (and SDs) of normative decisions on the baseline, U/A, and transfer problems

	Argument condition			
Age	*Control*	*Norm.*	*Non-norm.*	*N + NN*
9 years				
Baseline	.32 (.32)	.25 (.34)	.27 (.36)	.34 (.35)
U/A	.28 (.33)	.38 (.39)	.19 (.29)	.25 (.33)
Transfer	.28 (.38)	.25 (.34)	.23 (.33)	.34 (.31)
12 years				
Baseline	.35 (.33)	.35 (.37)	.34 (.40)	.28 (.35)
U/A	.30 (.32)	.61 (.44)	.19 (.34)	.32 (.44)
Transfer	.35 (.37)	.56 (.31)	.28 (.34)	.35 (.39)
15 years				
Baseline	.44 (.46)	.45 (.40)	.40 (.35)	.43 (.42)
U/A	.38 (.39)	.77 (.31)	.42 (.37)	.67 (.36)
Transfer	.42 (.40)	.82 (.31)	.38 (.41)	.66 (.30)

between-condition analysis indicated that 15-year-olds did not favour one argument type over the other, the within-subjects comparisons showed that, at each age level, normative arguments were considered better than non-normative arguments.

Baseline and understanding/acceptance decisions. Mean proportions of normative responses on the baseline problems are presented in Figure 1 and Table 4. Table 4 also contains means for each condition when the problems were first presented (baseline) and when the same problems were re-presented. An analysis of variance, with age and condition as between-subjects variables and time (baseline, U/A) as a within-subjects variable, revealed significant main effects of age ($p < .001$), and condition ($p = .005$) and significant interactions between age and time, $F(3, 316) = 4.01$, $p = .019$, and condition and time, $F(6, 316) = 11.71$, $p < .001$.

Analyses of the age × time interaction indicated that the effect of time was significant only for the 15-year-olds. The interaction generally arose because age differences were smaller on the baseline problems than on the U/A problems. More importantly, examination of the condition by time interaction indicated that the differences between baseline and U/A scores were not significant in the control and N + NN conditions, scores increased significantly in the NA condition ($p < .001$), and there was a nonsignificant trend for scores to decline in the NN condition ($p = .083$).

However these tests are somewhat misleading because the effects of condition do appear to differ somewhat by age (see Table 4). Thus, to test the hypothesis that even 9-year-olds understand and accept normative arguments, a planned comparison between baseline and U/A scores was conducted separately for each age group. These tests showed that each age group improved from baseline to U/A and, specifically, that the 13% increase in the 9-year-olds' scores was significant, $F(1, 29) = 4.46$, $p = .043$. By contrast, the apparent baseline-to-U/A declines in the NN condition were not significant at any age (smallest $p = .071$, for the 12-year-olds). Finally, in the N + NN condition, the scores of the 15-year-olds, but neither of the younger age groups, improved from baseline to U/A, $F(1, 28) = 7.30$, $p = .012$.

Normative arguments—when presented by themselves—were understood, accepted, and applied to subsequent decisions at each age. However, only at 15 years was the persuasive appeal of normative arguments sufficient to overpower that of simultaneously presented non-normative arguments. Although each age rated normative arguments as superior to non-normative arguments, only the 15-year-olds were able to apply their acceptance to subsequent decisions when these competing arguments were presented simultaneously. In general, the results support our suggestion that age differences in sunk cost decisions cannot be entirely explained by failure of children to understand the normative principle.

Sunk cost transfer. Mean transfer scores are presented in Table 4. An age × time (baseline vs transfer) × (condition) analysis of variance yielded significant main effects of age ($p < .001$) and condition ($p = .002$), and significant condition × time, $F(3, 316) = 5.86$, $p = .001$, and age × condition, $F(2, 316) = 2.69$, $p = .015$, interactions. However, although the condition × time interaction gives the appearance that transfer occurred across age groups in the NA condition, in reality this affect arose primarily because of the baseline-to-transfer increases among 12- and 15-year-olds. Indeed, inspection of the 9-year-olds' transfer scores in the NA condition (see Table 4) shows no evidence of transfer whatsoever—that is, scores returned to baseline levels. By contrast, positive transfer was evidenced by the 12- and 15-year-olds in the NA condition, $F(1, 30) = 4.88$, $p = .035$, $F(1, 29) = 18.09$, $p < .001$, respectively, and by the 15-year-olds in the N + NN condition, $F(1, 28) = 4.05$, $p = .054$.

Correlations among scores and ratings. Partial correlational analyses (controlling for age) indicated, in the experimental conditions, that normative responses at baseline were correlated to normative responses at U/A ($r = .33$, $p < .001$). However, whereas baseline and transfer scores were unrelated ($r = -.02$), U/A scores were positively related to transfer ($r = .27$, $p < .001$). Thus, only those participants who accepted and understood the arguments were likely to improve on the transfer problems. Further bolstering this argument are the partial correlations between baseline and transfer scores in the NA and N + NN conditions. Somewhat surprisingly, there was only a modest relationship between normative baseline responses and normative ratings ($r = .15$, $p = .057$). However, normative ratings were linked to normative decisions both on U/A problems ($r = .38$, $p < .001$) and on the transfer problems ($r = .23$, $p = .003$). These correlations were largely unaffected in an additional analysis controlling for normative responses on the baseline problems. Concerning non-normative ratings (in the NN and N + NN conditions), these were negatively, but modestly, linked to baseline ($r = -.15$, $p = .058$) and U/A ($r = -.16$, $p = .03$) scores. Non-normative ratings were unrelated to transfer scores, however ($r = .05$). Together, these findings suggest that it was generally only participants who accepted and understood normative arguments and applied these arguments to the U/A problems who evidenced transfer.

Discussion

Study 2 showed, as in Study 1, that despite age-related improvements in sunk cost decisions (on the baseline problems), the responses of most participants were non-normative. Thus, in contrast to the Arkes and Ayton (1999) hypothesis, the tendency to commit the sunk cost fallacy diminishes somewhat with age. In addition, analyses of children's ratings of normative and non-normative arguments indicated that the former were generally treated as superior to the latter. The exception to this finding was that, in the between-condition analysis (but not in the within-subject analysis) contrasting ratings in the NA and NN conditions, the 15-year-olds did not rate the arguments differently. This is surprising because the 15-year-olds' decisions improved considerably in the NA and N + NN conditions and did not decline in the NN condition. Thus, it is perhaps more important to consider the effects of arguments in the N + NN conditions. Across ages in this condition, normative arguments were clearly rated as superior to non-normative arguments.

These findings dovetail nicely with the findings on the U/A problems. When only normative arguments were presented (the NA condition), normative decisions increased for each age group. By contrast, when presented only non-normative arguments (the NN condition), the tendency for normative decisions to decline was not significant. When participants were presented both normative and non-normative arguments, only the U/A decisions of the 15-year-olds were affected. Apparently, the ability to evaluate normative arguments effectively when these arguments compete against intuitively appealing non-normative arguments—and actually *apply* the understanding that emerges from this evaluation—develops only by middle adolescence.

The correlational analyses showed that acceptance of normative arguments improved understanding and application of the normative decision principle (i.e., base decisions on anticipated future consequence rather than on prior investments). Independently of baseline performance and age, children who rated normative arguments highly generally made normative decisions on the U/A problems. By contrast, although a modest tendency was found for children who rated non-normative arguments highly to commit the SC fallacy on the U/A problems, the effect of non-normative arguments was considerably smaller than that of the normative arguments.

Examination of transfer decisions revealed positive transfer in the NA and N + NN conditions. However, these effects were clearly related to age. Only the two adolescent groups evidenced positive transfer in the NA condition and only the 15-year-olds evidenced transfer in the N + NN condition. The latter finding again indicates that only by mid-adolescence does the capacity to simultaneously evaluate and decide between the competing "pulls" of normative and non-normative arguments emerge—at least in the domain of sunk cost decisions (see Klaczynski, in press). Analyses of correlations with baseline scores showed that transfer was unrelated to baseline performance, but was positively associated with normative ratings and normative decisions on the U/A problems. Evidently, transfer was more a function of participants' ability to understand and accept normative arguments than a function of normative decisions made on the baseline problems.

GENERAL DISCUSSION

The results from this work illustrate the general usefulness of applying dual-process theoretic frameworks to developmental phenomena. Specifically, our findings suggest that children, like adults, respond to sunk cost decision situations by initially relying on experientially activated heuristics. Without cues to engage in analytic processing, the particular heuristic we examined—the "waste not" heuristic—is not only automatically activated, but also applied with little or no critical reflection on the appropriateness of the heuristic to particular situations. In general, however, adolescents are somewhat less prone to unreflectively applying the heuristic than children. Our hypothesis is that the increased tendency of adolescents to make normative decisions results from their greater willingness to engage to "metacognitive intercession" (Klaczynski, 2004). Thus, although the "waste not" heuristic is activated automatically for both children and adolescents, it is also momentarily available in working memory for critical scrutiny. However, because they are more likely to have acquired the ability to inhibit such "prepotent" responses, and because they have a better understanding that simply because a decision strategy is activated it does not need to be applied, adolescents are more disposed to evaluating heuristics before actually implementing them.

Results from Study 2 provide further support for this argument. Specifically, the greater difficulties children have with sunk cost decisions do not appear to arise because they lack the analytic competence to understand the normative principle. Across ages, normative arguments were rated as superior to non-normative arguments; across ages, decisions improved from baseline performance when the problems were re-presented after normative arguments had been evaluated. Thus, at least some minimal level of decision competence was available even at 9 years of age. The critical differences between children and adolescents were found on the transfer problems. Here, only adolescents applied the general understanding of the normative principle they had gleaned from the arguments to problems for which the arguments were not directly intended.

Again, this age difference can be attributed to metacognitive differences between children and adolescents. Children were apparently limited in their argument evaluation capacities such that they could apply their understanding of the arguments only to the original problems. Because of an increased capacity to abstract domain-general decision rules from the normative arguments and determine the appropriateness of these rules to novel problems, adolescents performed better than children on the transfer problems.

When children were presented both normative and non-normative arguments after making baseline decisions (i.e., the N + NN condition), a second "level" of age-related difference was found. That is, despite the fact the children at each age (in the within-subjects analyses) rated the normative arguments as superior, only the 15-year-olds were able to apply their understanding of the arguments to the U/A and transfer problems. This suggests that the interference created by logically irrelevant arguments prevents children and early adolescents from applying their understanding of normative arguments to subsequent decisions. Developments in the capacity to inhibit such interference (see Reyna & Brainerd, 1995) continue after the onset of adolescence and perhaps into adulthood. Prior to mid-adolescence, children seem capable of pulling apart and distinguishing between simultaneously presented normative and non-normative arguments. However, children seem to be incapable of proceeding to the next step—applying what they gleaned from these arguments to subsequent decisions. Additional work on developmental trends in the capacity to inhibit interference, particularly during adolescence, is required to flush this possibility out more completely. Nonetheless, our data provide suggestive evidence that the metacognitive abilities to evaluate both types of argument, and perhaps the working memory capacity that affords the ability to evaluate competing strategies for subsequent decisions, emerges relatively late in development.

Conclusions

In contrast to cognitive and social psychology, dual-process theories have had relatively short lives in developmental psychology. Because a considerable amount of developmental research has been devoted to age-related changes in analytic processing, particularly important for future research are more precise investigations of the relationships among age, inhibition abilities, and experiential processing. Little is currently known of the ‘‘ifs’’ and ‘‘hows’’ of experiential processing changes with age. Similarly, age-related changes in the mechanisms regulating interactions between experiential and analytic processing have not been thoroughly explored. Regarding these interactions, we suggest that experientially activated heuristics are—for children, adolescents, and adults—at least momentarily available in working memory before they are applied. While in working memory, heuristics may be evaluated for their appropriateness to particular situations.

In situations in which people have few or no personal investments (e.g., the outcome of a decision is, at least subjectively, unlikely to negatively impact important personal goals) or in which there is little time for reflective contemplation, heuristics are likely to be employed automatically. However, given adequate time and motivation to evaluate heuristics, the potential for pre-application evaluation exists for children, adolescents, and adults. With development, such metacognitive and executive function skills as the abilities to evaluate and justify strategies (see Moshman, 1998) and to inhibit prepotent responses emerge. Even by adulthood, however, these skills are far from completely developed (Kuhn, 2000, 2001; Kuhn et al., 1988; Moshman, 1998).

A dual-process approach to development complements and extends "competence/performance" theories of development (e.g., Overton, 1985). Specifically, competence/performance views attempt to distinguish between underlying analytic competencies and situational factors that interfere with the ability to apply these competencies. However, such theories have not focused explicitly on the mechanisms and outcomes of processing when logically relevant competencies are not activated. That is, reasoning and decisions are "written off" to such performance factors as impulsivity and unfamiliarity (and, at times, to familiarity) without sufficient attention to precisely how these factors affect performance. A dual-process view focuses on three aspects of processing not typically accounted for in competence/performance theories.

First, dual-process theories call attention to the role of "metacognitive intercession," and failures to engage in such intercession effectively. This theorising is consistent with cognitive theorists' (e.g., Evans & Over, 1996; Stanovich, 1999) claims that, although experiential processing is the default processing system, this processing can be overridden by analytic processing. The process of overriding experiential processing predominance, however, would seem to require advanced metacognitive and executive function abilities, as well as the types of thinking dispositions discussed by Baron (1985, 1988), Perkins, Jay, and Tishman (1993), and Stanovich and West (1998, 2000; Stanovich, 1999; see also Kokis et al., 2002).

Second, dual-process accounts provide explicit descriptions of the mechanisms that guide performance when the analytic system is not predominant. Thus, for example, when analytic competencies are not predominant, performance appears to depend largely on memory-based strategies and heuristics that are automatically activated and applied. Third, and relatedly, dual-process accounts do not operate on the assumption that experientially guided performance is necessarily irrational. Instead, under most conditions, the outcomes of experiential processing are beneficial or, at least, not harmful. Without the speed with which a wide array of information is processed experientially, real-world functioning would be impossible. Similarly, if not for the rapidity and automaticity afforded by experiential processing, information processing would be over-taxed; again, it would not be possible for explicit learning and reasoning to occur.

Although dual-process theories have emerged to explain age-related developments in implicit and explicit memory (see Brainerd & Reyna, 2001; Schneider & Bjorklund, 1998), similar developmental accounts of reasoning and decision making have been slower to take hold. Developmental memory researchers (e.g., Guttentag & Dunn, 2003) have increasingly recognised that implicit memory interacts with conscious strategy use to determine performance. Likewise, developmental research on reasoning would profit from further theoretical and empirical distinctions between implicit and explicit processing and additional attention to developments in both processing systems.

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APPENDIX A

Monetary SC decision

Tom had $20 to buy a ticket to see a clown at the carnival. There are two clowns who have shows, Howlin' Hank and Laughin' Larry. Because the two shows are at the same time, Tom could only buy a ticket to see one clown. Tom has always wanted to see Howlin' Hank because everybody says he's so funny. So, he spent all of his money and bought a ticket for Howlin' Hank.

Then, Tom found out that he had bought the *wrong ticket*! His ticket was really for Laughin' Larry. All of Tom's friends have said that Laughin' Larry isn't nearly as funny as Howlin' Hank. But the people who sold Tom the ticket said that he could not have his money back. Tom was very upset that he wouldn't be able to see Howlin' Hank.

Then, Tom checked his pocket. To his surprise, Tom found that he had more money. If fact, he still had $20—if he wanted to, he could buy the right ticket and still see the show with Howlin' Hank.

What should Tom do?

Spend another $20 and buy a ticket to see Howlin' Hank

Use the ticket he already bought to see Laughin' Larry

Time/effort SC decision

On parents' day at Julie's school, there will be a contest where all the students' paintings will be shown. Julie has spent the last 14 days working really hard on a drawing. She wants to win a prize pretty badly and thinks her drawing has a chance to win. Now, at long last, the drawing is almost finished.

Then, just four days before the contest, Julie had an idea for a totally different drawing. She is positive that she could draw the new picture in four days, just in time for the contest. Not only that, but Julie thinks that the new drawing would be a lot better than the one she's been working on. The problem is that Julie has only one drawing board. That means that if she wants to draw the new picture, she will have to completely erase the picture she's been working on.

What should Julie do?

Erase the old picture and draw the new one

Keep the drawing she's been working on

Monetary N-SC decision

Tom has $20 to buy a ticket to see a clown at the carnival. There are two clowns who have shows, Howlin' Hank and Laughin' Larry. Because the two shows are at the same time, Tom can only buy a ticket to see one clown. Tom has always wanted to see Howlin' Hank because everybody says he's so funny. Then, he found out that a ticket for Howlin' Hank cost $40—and Tom only had $20. Tom was very upset that he wouldn't be able to see Howlin' Hank.

All of Tom's friends have said that Laughin' Larry isn't as nearly funny as Howlin' Hank. However, Tom could see Laughin' Larry because tickets for Laughin' only cost $20.

Then, when he was standing in line to buy a ticket for Laughin' Larry, Tom checked his pocket. To his surprise, Tom found that he more money than he thought—he actually had $40! If he wanted to, he could buy a ticket for the show with Howlin' Hank.

What should Tom do?

Spent $40 for a ticket to see Howlin' Hank

Spend $20 for a ticket to see Laughin' Larry

Time/effort N-SC decision

On parents' day, there will be a contest at Julie's school where all the students' drawings will be shown. When Julie came up with an idea for a drawing, she thought that it could be really good if she worked really hard on it for the next two weeks. Julie wants to win a prize pretty badly and thinks her idea for a drawing would have a chance to win.

Before she started working on the drawing, Julie had an idea for a totally different drawing that would take her about 18 days to finish if she worked really hard. Julie thinks this picture will be even better than the one she would create with her first idea. The problem is that Julie has only one drawing board. That means that she will be able to draw only the first picture or only the second picture.

What should Julie do?

Work on the second idea she had for a drawing

Work on the first idea she had for a drawing

APPENDIX B

Sunk cost arguments

Remember, Julie spent 3 weeks working on a very good drawing for the contest. But then, just 2 days before the contest, she came up with another idea for a drawing. She thinks that the new drawing will be better than the one she worked on for 3 weeks. The problem is that, in order to draw the new picture, she will have to throw out the old picture.

So, she asked Amy (or Tara) for her advice.

Normative. Amy thinks that Julie should erase the old picture and draw the new one because:

> All the time that Julie put into the old picture doesn't make any difference. She wants to win, so she should use the new picture. She shouldn't worry about what she's already done. The work she put into the old one is in the past—she can't let that affect her now. Because she really wants to win, she's got to go with the best picture, even if she has to throw out a picture she worked hard on.

Non-normative. Tara thinks that Julie should keep working on the picture that she's spent three weeks on because:

> Julie's worked on this picture for 3 weeks. Even if the new picture would be better, all of her imagination and effort were in the old picture. She should show a picture that really means something to her. She worked really hard on that picture. If she doesn't use the one she worked so hard on, all of that time and effort will be wasted. If she doesn't use the old picture, she'll just be throwing away three weeks of work.