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A social-cognitive framework for understanding serious lies: Activation-decision-construction-action theory



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A B S T R A C T

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Little is known about the cognition of deception (Gombos, 2006). We propose a cognitive account of *serious lying* (i.e., deception involving high stakes) in response to a solicitation of a truth: *Activation-Decision-Construction-Action Theory* (ADCAT). Built on the Activation-Decision-Construction Model of answering questions deceptively (Walczyk, Roper, Seeman, & Humphrey, 2003), the theory elaborates on the roles of executive processes, theory of mind, emotions, motivation, specifies cognitive processing thoroughly, and considers the rehearsal of lies. ADCAT's four processing components are (a) activation of the truth, the (b) decision whether and how to alter deceptively the information shared, (c) construction of a deception, and (d) action [acting sincere while delivering a lie]. Core constructs are "theory of mind" and "cognitive resources". Specifically, throughout serious deception, individuals are inferring the current or potential mental states of targets and taking steps to minimize the allocation of cognitive resources during delivery to appear honest and lie well.

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1. The need for a cognitive theory of serious deception

Deception is intentionally leading another to believe something that the sender believes is untrue. It comes in many forms, including falsification (lies), equivocation (evasion, ambiguity), omission (withholding important information), exaggeration, and understatement (Masip, Garrido, & Herrero, 2004). The cognition of deception is poorly understood (DePaulo et al., 2003). We present a cognitive theoretical framework for understanding serious deceptions, including those that

are fundamentally perceived as threats, transgressions and betrayals that result specifically in relationship

problems; that endanger people's reputations and that are forbidden by organized religion and indictable by law (DePaulo, Ansfield, Kirkendol, & Boden, 2004, p. 148).

We define *serious deception*, a term hereafter used interchangeably with *high-stakes deception*, as an instance of deceit embedded in a social context in which sharing the truth might prove very costly to individuals in not meeting their goals. For less serious deception, the potential cost of truth telling is small. A much more precise definition is offered later in Section 3.4.1 of this article.

Beyond explaining an interesting aspect of social life, a cognitive account can advance lie detection. Scientists studying lying have often postulated that it is more cognitively demanding than truth telling (e.g., Sporer & Schwandt, 2006; Vrij, Fisher, Mann, & Leal, 2008; Zuckerman, DePaulo, & Rosenthal, 1981), an intuitively appealing notion that is not always so (DePaulo et al., 2003). A theory can illuminate when lying draws more on

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attention and working memory (Vrij, Granhag, & Porter, 2010). In particular, Walczyk, Igou, Dixon, and Tcholakian (2013) noted that one of the major criticisms of the Control Question Technique (CQT) of the polygraph as a lie detector is its lack of a valid theoretical foundation. A well-specified cognitive theory of deception can advance cognitive-based lie detection efforts that overcome this limitation. A glossary of important terms used hereafter appears in Table 1. A boldfaced, lowercase letter (e.g., **{a}**) following each in text shows its table entry.

2. Perspectives with relevant insights on the cognition of deception

Six perspectives offer important insights on the cognition of deception. For instance, Zuckerman et al. (1981) proposed the impactful Four-Factor Theory of deception. Deception involves (a) generalized arousal, (b) guilt and other emotions, (c) cognitive aspects, and (d) liars' attempts to control verbal and non-verbal cues to appear honest. Although these authors speculate that lying imposes greater "cognitive load" **{i}** than truth telling, which can result in longer response times and in other signs of load, the theory does not elaborate on the cognition of lying. It highlights the complex, multifaceted nature of deceit, a notion embraced by the theory we propose.

The cognitive load of lies of omission is central to Lane and Wegner's (1995) Preoccupation Model of Secrecy. It postulates that when individuals keep secrets, for example, withholding from a romantic partner the truth of having served time in prison, (a) the strategy most often used is *thought suppression*. ("I will stop thinking about my

criminal past to avoid accidentally blurring it.") (b) Over time, this ongoing suppression can cause the secret to intrude in the thoughts of the individual. ("I can't stop thinking about what I did.") (c) Intrusive thoughts renew attempts at thought suppression. ("I will try harder to block these memories.") (d) This cycle can advance such that the individual obsesses over the memories even long after a secret has been shared. This model acknowledges the difficulty often involved in hiding guilty knowledge and underscores memory processes in deception, as does our theory of high-stakes deception.

Vrij, Granhag et al. (2010) identified six ways in which the cognitive load of dishonesty can exceed that of honesty. (a) Formulating a "lie" **{f}** may be cognitively demanding by requiring a novel response. Not taking their credibility for granted, liars (b) tend to monitor and control their demeanor to appear honest, and (c) monitor targets' reactions to see whether their deceit is believed. (d) Liars may need to remind themselves to role-play and (e) suppress the truth as they fabricate. (f) While activation of the truth often happens automatically, activation of the lie can be more deliberate. These are useful hypotheses we accept of when lying may impose more cognitive load but do not specify underlying mechanisms. Thus, they do not comprise a theory.

A fourth perspective is Information Manipulation Theory 2 (IMT2; McCornack, 1992; McCornack, Morrison, Paik, Wisner, & Zhu, *in press*), which explicates how the information of a communication can be altered deceptively. At its foundation is Grice's (1989) Cooperative Principle of the implicit expectations between two parties conversing. IMT2 characterizes deception as a covert violation of one or

Table 1

Glossary of important constructs of ADCAT.

-
- {a} Central executive:** the "supervisor" of working memory (i.e., executive function) that coordinates the slave systems (b–d below), it selects strategies and sets goals, contends with novelty and complexity, anticipates outcomes, allocates and shifts attention between tasks and strategies, and inhibits responses inconsistent with goals. It is also responsible for awareness of others' states of mind (ToM) and the metacognitive processing of self-monitoring, self-control, and explicitly finding information in memory (Baddeley, 1996). All of these capacities are needed in deceptive responding (Debey et al., 2012; Gombos, 2006; Visu-Petra et al., 2014; Visu-Petra et al., 2012) more than in truth telling.
- {b} Visuo-spatial sketchpad:** a temporary store where visual/spatial images are manipulated.
- {c} Phonological loop:** a buffer for auditory/verbal information, for instance, the words of a question recently asked. Its capacity is small, about seven chunks, which quickly decay without rehearsal.
- {d} Episodic buffer:** a limited capacity, temporary store for integrating memories from diverse sources across space, time, and sensory modalities, such as retrieved autobiographical memories (Baddeley, 2000).
- {e} Respondent:** one who faces a truth solicitation, i.e., a social context calling on him or her to share accurate information.
- {f} A lie:** a verbal communication in response to a solicitation of a truth made with the intention of deceiving the target, who is unaware of the intent (Ekman, 1996).
- {g} Target's View:** Any incomplete, false, or otherwise inaccurate representation of reality a respondent intends to induce in a target. Views can vary in complexity from a correct understanding less an important detail (lie of omission) to an elaborate fabrication (e.g., false alibi of the perpetrator's whereabouts during the crime). Analogous to the propositional base of the Manstein model (Herrmann, 1983), the Target's View in the respondent's mind can consist of propositions, images, and other cognitive representations that, when delivered, may manifest in a variety of ways (e.g., narrative, a denial, non-verbally).
- {h} Cognitive resources:** the limited pools of attention and working memory available to "respondents" (see {e} above).
- {i} Cognitive load:** the demand on "cognitive resources" (see {h} above) made by tasks, environments, or other conditions facing respondents.
- {j} Intrinsic cognitive load:** adapted from Cognitive Load Theory (Merriënboer & Sweller, 2005), this is the demand on cognitive resources inherent to deceive well, which depends on the complexity of the social context (DePaulo et al., 2004). For instance, suppose that a perpetrator of a crime is preparing for a police interrogation when he will convey the false alibi. To avoid inconsistencies, he must infer what interrogators know and are likely to ask him and his partners in crime.
- {k} Extraneous cognitive load:** adapted from Cognitive Load Theory (Merriënboer & Sweller, 2005), this is any situational factor external to the act of deception that reduces respondents' cognitive resources while lying/truth telling. For example, to maximize cognitive load on liars, Vrij et al. (2008) suggested that respondents answer questions while operating a driving simulator so that the concurrent load induced might interfere more with lying than truth telling.
-

more of these four conversational maxims. (a) *Quality* refers to the expectation that the information conveyed is accurate. Falsifications are lies wherein incorrect information is knowingly communicated. (b) *Quantity* is the expectation that sufficient information is shared and important information is not withheld. Lies of omission violate this maxim. (c) *Relevance* (or *Relation*) pertains to the expectation that the information transmitted is pertinent to the discussion. Attempts to sidetrack targets from the information they seek are deceptive. (d) Finally, *Manner* is the expectation that information will be conveyed in an ordered, clear, and succinct way. Deceivers may intentionally be ambiguous or obscure to divert targets' attention away from particular information. IMT2 details when and why information sharing can be deceptive and explains the spontaneous lying of normal conversation but is less applicable to high-stakes lies (S. McCornack, personal communication, January 7, 2013). IMT2's focus on information manipulation is central to the present theory.

A fifth perspective is Sporer and Schwandt's (2006, 2007) Working Memory Model of deception. By it, lying requires more cognitive effort than truth telling due to its greater demands on "cognitive resources" {h}. Truth telling entails retrieving or reconstructing a memory. When lying, deceivers must invent new stories or modify those available from past experiences or scripts. Narratives must be plausible and not contradict themselves or what targets know. Liars must also monitor listeners for signs of suspiciousness. When there are no relevant past experiences or scripts in long-term memory (LTM), the working memories (WM) of liars will be heavily laden, reducing capacity for speech production. This model offers important insights we adopt on the sources of information that liars use to construct false narratives but does not detail cognitive processing.

The sixth perspective is the Activation-Decision-Construction Model (ADCM) of Walczyk et al. (2003, 2005), Walczyk, Mahoney, Doverspike, & Griffith-Ross (2009), which analyzes the act of answering questions deceptively into three components. First, a question heard or read *activates the truth* from LTM, usually automatically. Second, based on the truth and social context, a *decision to lie* may be made, typically to advance liars' goals. Responding honestly will then be actively inhibited, especially for well practiced truths that can interfere with lying the most. Third, a context-appropriate *lie is constructed* that must be coherent and plausible. In reviewing cognitive models of deception, Gombos (2006) found the ADCM to be promising, delving more deeply than others into the cognitive processes of deceit but criticized it as under-specified on the roles of executive, emotional, motivational, and social factors. It is the basis of the theory that follows, also incorporating insights from the other five perspectives.

3. Activation-decision-construction-action theory (ADCAT)

ADCAT is a cognitive theory of deception involving high-stakes (i.e., serious) situations as "respondents" {e} react to solicitations of truths, such as a guilty suspect interrogated by police, a unqualified job candidate interviewed for a coveted position, or an unfaithful spouse confronted by his wife. Such

deception usually entails planning and rehearsal (Colwell, Hiscock-Anisman, Memon, Taylor, & Prewett, 2007; Ekman, 1992; Hines et al., 2010; Strömwall & Willén, 2011). The theory is much better specified than the ADCM regarding cognitive, emotional, motivational, and social processes. ADCAT assumes that deception and truth telling do neither differ in basic underlying cognitive processes, nor do they utilize brain areas different from other cognitive processes (Mohamed et al., 2006). Memory processes are fundamental to both, as are decision making and problem solving (Gombos, 2006). Regarding the latter, lying is a means-ends problem solving strategy for closing the gap between the current state and respondents' goals (McCornack et al., in press). ADCAT is built from established constructs of cognitive science, such as "working memory", "theory of mind", and the "central executive" {a}. Finally, ADCAT is a cognitive theory of deception, emphasizing the manipulation of information over the impression management aspect (i.e., the monitoring of and control over non-verbal behavior; see Hartwig, Granhag, Strömwall, & Doering, 2010).

3.1. Roles of motivation and emotion

Liars' motivation to succeed moderates cues to deception. For instance, highly motivated liars tend to exhibit the most non-verbal cues in their attempts to control expressive behaviors (DePaulo & Kirkendol, 1989; Ekman & Frank, 1993; Sporer & Schwandt, 2006; 2007). ADCAT interprets level of motivation as the total cognitive resources respondents are willing to assign to lie well. The higher the motivation the greater and more sustained the allocation can be, a view of motivation that has been validated in skill acquisition (Kanfer & Ackerman, 1989).

Emotions have several key roles. First, they provide strong motivators for deception (Ekman, 1992). Second, high anxiety and other extreme emotional states can impose "extraneous cognitive load" {k} on respondents (Beilock & Carr, 2005; Eysenck, 1992), reducing resources for lying. Third and foremost, emotions or memories of the emotions elicited by the truth, the social context, or by the anticipated reactions of targets to the truth, to potential deceptions, or their detection impact the decision to deceive, deception construction, and delivery.

3.2. The components of ADCAT, core constructs, and central principle

Four components are hypothesized for most instances of serious deception, usually in the order described, not always occurring closely in time. The Activation Component concerns any aspect of the social environment that causes respondents to understand that a truth (accurate information sought by targets) is solicited and then retrieve or encode it to WM if possible. The Decision Component involves the social context persuading respondents to deceive in a particular way or reminding them of a decision made previously, which sets the level of motivation for dishonesty. The Construction Component is the manipulation of information (see McCornack, 1992) to falsify, equivocate, omit, exaggerate, or understate or the recall of a prepared deception then adjusted for the social context. Lastly, the

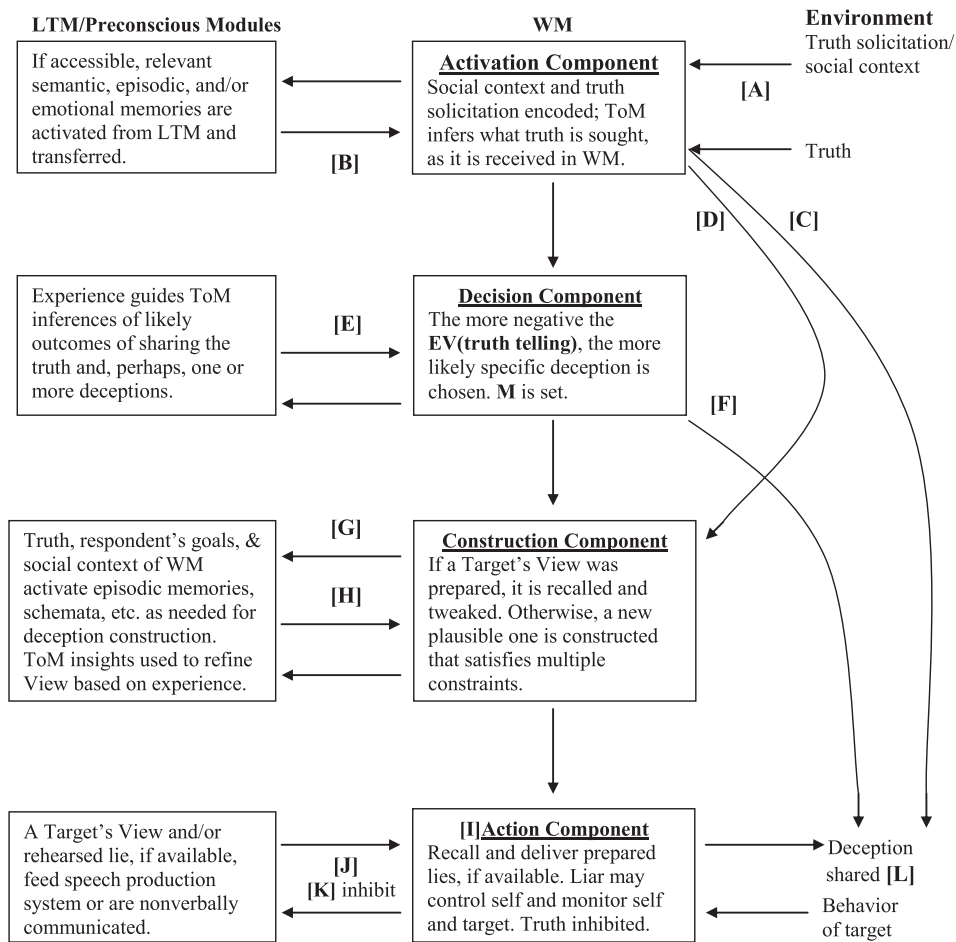


Fig. 1. The flow of information and processing among the four components.

Action Component, new to ADCAT, corresponds to liars delivering lies to targets. Fig. 1 shows the typical processing flow for serious lies. Milestones are marked jointly in the text and figure with the letters [A] through [L]. Although components are presented sequentially as distinct processing steps for illustration, they often execute *automatically, unconsciously, seamlessly, and in parallel*. Moreover, they draw on modules of the mind providing output to WM whose processing occurs beneath conscious awareness (Baars & Franklin, 2003, 2007; McCornack et al., in press).

A core construct permeating ADCAT is *theory of mind* (ToM), which supports social-cognitive functioning (Apperly, Samson, & Humphreys, 2009). It is “the ability to infer others’ mental states, thoughts, and feelings” (Kobayakawa, Tsuruya, & Kawamura, 2012, p. 341) and reason about their beliefs, desires, intentions, and knowledge (Astington & Baird, 2005). This capacity is needed to create false impressions in targets (DePaulo, 1992; Peskin, 1992; Talwar, Gordon, & Lee, 2007; Wellman, Cross, & Watson, 2001; Wimmer & Perner, 1983) and plays other central roles in lying, such as when respondents guess the likely impact on targets of sharing the truth or assess whether potential lies are plausible (Gombos, 2006). Research shows that the central executive supports ToM

inferences, which can be abstract and indirect (Gombos, 2006). A first-order inference is ascribing a mental state to another (e.g., “This cop thinks that I am the burglar.”). A second-order inference ascribes a mental state to one concerning the mental state of another (e.g., “The cop also believes Johnny was duped by me into being an accomplice.”, Apperly et al., 2009; Talwar et al., 2007), and so forth. First-, second-, and third-order inferences can occur in high-stakes deception and burden working memory (Apperly, Back, Sampson, & France, 2008). The central executive also helps overcome interference of the truth when inducing false beliefs in others (Apperly et al., 2009) by temporarily repressing the truth (Apperly et al., 2008).

Another core construct is *cognitive resource*. Related to it is the Central Principle: *Because cognitive resources are limited and respondents generally seek to appear sincere, fluent, and relaxed during delivery (Ekman, 2001), they will take steps to minimize “intrinsic cognitive load” [j] during the Action Component and minimize extraneous load throughout.*

3.3. Activation component

[A] Many signals within a social context can tell respondents that an important truth is solicited by targets.

Implicit signals include the sight of a police officer approaching the driver side window of the car of an intoxicated driver who was pulled over after leaving a bar. An explicit signal can be a question asked in a serious tone during a job interview. For both, a related truth will enter WM if accessible (Duran, Dale, & McNamara, 2010), often based on respondents' ToM inferences of the information targets are seeking and possibly why it is sought. In the first case, the driver infers that it concerns how much she drank. The ADCM assumed that truths are retrieved from LTM or constructed from memories (Walczyk et al., 2003). Sometimes, however, they are constructed impromptu based on information encoded directly from the social context, such as after the police officer asks the driver "Do you know why you were pulled over?" The solicitation may require that an episodic memory corresponding to the truth be retrieved from LTM (Ekman, 2001). If a question is asked, as each word is encoded into the "phonological loop" {c} of WM, word meanings are activated from semantic memory along with related episodic memories (Baddeley, 1992; Kintsch, 1998).

If applicable and accessible, the episodic memory of the truth is transferred from LTM to the "episodic buffer" {d} of WM, [B] often receiving the highest cumulative activation (Baddeley, 2000; Ericsson & Kintsch, 1995). Although transfer is typically automatic (Duran et al., 2010; Johnson, Barnhardt, & Zhu, 2004; Walczyk et al., 2003), when episodic or semantic truths are accessed infrequently or not recently, cognitive resources may be required to search memory explicitly for them, which involves the central executive (Conway, 2002; Glenberg, Schroeder, & Robertson, 1998; Menson, Boyett-Anderson, Schatzberg, & Reiss, 2002). One caveat, "truths" may be unavailable or inaccurate unbeknownst to respondents due to memory distortions, especially with long intervals between encoding and retrieval (Alba & Hasher, 1983; Loftus, 2007). Essential to deception is respondents' intent to deceive, not the accuracy of what they believe is true (Ekman, 1996).

Respondents for whom lying is not contemplated, for instance, because of their honest personalities (Hood, 1982) or who have nothing to hide (e.g., an innocent suspect), who need share only simple facts [C] (e.g., first name) can do so easily. [L] If these respondents must assemble truths, they will go to the Construction Component [D].

3.3.1. Summary of core constructs

Respondents will often use their ToM to infer the truths sought by targets and why. Truth retrieval generally occurs automatically in both lying and truth telling, except when a truth is remote or unavailable in memory. If a truth need not be newly constructed, for infrequently accessed truths, explicit memory searching can impose a high intrinsic cognitive load on respondents, especially truth tellers (Vrij, Granhag et al., 2010).

3.4. Decision component

This component, the most important of ADCAT, concerns that which convinces respondents to manipulate deceptively the information shared in high-stakes truth solicitations. Typical motives appear in Table 2, a non-

exhaustive list. Emotions commonly propelling such lies are also noted. Serious lies usually entail respondents highly motivated to achieve important goals (DePaulo et al., 2004; Porter & ten Brinke, 2010), such as getting away with a crime (motive 2-Table 2), obtaining a coveted job (motive 1), or staying married (motive 8).

3.4.1. Rational and quasi-rational decision making

Decision making is influenced by emotional reactions to choice options and can occur largely unconsciously (Baars & Franklin, 2003, 2007). The brain's orbitofrontal cortex supports forming expectations and evaluating the affective value of possible reinforcers, which allows respondents to compare likely outcomes of choices (Bechara, Damasio, & Damasio, 2003; Damasio, 1994). Truth solicitations can present respondents with a decision: should the information sought by targets be fully and accurately shared or be altered deceptively in quantity, quality, relevance, and/or manner (see McCornack, 1992) to achieve respondents' goals? *Genuine rational decision making* is choosing the option among viable alternatives that optimizes goal

Table 2
Common motives of serious deception.

Motive	Description
1. <i>Instrumental</i> :	This lie obtains rewards, power, social position, or other advantages, sometimes by exploiting others. (Delight at a sense of control, excitement at prospect of reward; greed; Camden, Motley, & Wilson, 1984; DePaulo et al., 2004; Lindsold & Walters, 1983; O'Hair & Cody, 1994; Turner, Edgley, & Olmstead, 1975) ^a
2. <i>Avoid punishment</i> :	A lie prevents punishment or blame for wrongdoing. (Desire for a sense of relief, lower anxiety; DePaulo et al., 2004; Ekman, 1989)
3. <i>Protect self</i> :	This lie protects liars, often psychologically, by avoiding confrontation or embarrassment. (Insecurity, fear of embarrassment, reduce anxiety; DePaulo et al., 2004; Seiter, Brusckie, & Bai, 2002; Turner, Edgley, & Olmstead, 1975)
4. <i>Identity-relevant, self-presentation, face-saving</i> :	These lies create false impressions about liars' identities or identity-relevant experiences. (Desire for respect, sense of pride, reduce insecurity; Camden et al., 1984; DePaulo et al., 2004; McCornack, 1997; O'Hair & Cody, 1994)
5. <i>Protect/help others</i> :	An altruistic lie is told to protect targets or others. (Compassion, empathy, nurturance; O'Hair & Cody, 1994; DePaulo et al., 2004; Metts, 1989; Seiter et al., 2002)
6. <i>Entitlement</i> :	Liars feel justified in hiding a truth they feel is unfairly disapproved of or prohibited by targets. (Sense of resentment or indignation; DePaulo et al., 2004)
7. <i>Hurt others</i> :	A lie is shared in reprisal to hurt the target. (Anger, vengeance; DePaulo et al., 2004; O'Hair & Cody, 1994)
8. <i>Affect Interpersonal Relationships/Affiliation</i> :	A lie is told to increase, decrease, maintain, or terminate interaction with another or control the intimacy. (anger, out of insecurity; Camden et al., 1984; Lippard, 1988; Turner et al., 1975)

^a Likely emotions impelling lies.

attainment, which assumes that the actual likelihoods and costs/benefits of the different choices are known and are properly evaluated, for instance, by using the expected value formula presented below (Stanovich, 2010). ADCAT postulates that the choice of whether and how to be deceptive is made quasi-rationally if respondents have sufficient time, are clear-headed, etc. *Quasi-rational decision making* is making a choice among the options considered that, although not optimally, is perceived by respondents to best attain goals after they carefully evaluate utilities and likelihoods of salient pros and cons of choice options. Among the reasons quasi-rational decisions do not optimize goal attainment, estimates of outcome utilities and their probabilities can be inaccurate. For instance, the affective impact of future events is often overestimated (Wilson & Gilbert, 2013), and their probabilities can be over or underestimated based on the ease with which relevant examples are brought to mind (availability heuristic, Tversky & Kahneman, 1982).

Recall that emotional inputs affect decisions (Dawes, 2001; Stanovich, 2010), triggered partly by the social context and the truth if accessible. For example, “detection apprehension” over getting caught weighs against dishonesty, whereas “duping delight” in anticipation of lying successfully encourages it (Ekman & Frank, 1993). ToM inferences are also crucial in this decision making. Respondents may infer targets’ likely cognitive, affective, or behavioral responses to learning the truth and predict other consequences of honesty, anticipate targets’ responses if the information sought is manipulated deceptively in a particular way or two, and perhaps the likely fallout if deception is detected. In short, ToM [E] and other central executive functions (Debey, Verschuere, & Crombez, 2012; Visu-Petra, Miclea, Bus, & Visu-Petra, 2014; Visu-Petra, Miclea, & Visu-Petra, 2012) allow respondents to infer then combine the costs and benefits and their likelihoods of sharing fully and accurately the information that targets seek, which can be compared with the same of one or more deceptions.

The expected value of a decision or a bet, **EV**, is calculated by $\sum p_i v_i$, where p_i is the probability of a particular outcome, multiplied by v_i , the gain or loss of that outcome expressed in terms of money or subjective utility. Summing these products yields the payoff in the long run for a decision. The option with the highest **EV** from respondents’ perspectives maximizes utility and quasi-rationally should be chosen (Stanovich, 2010). ADCAT assumes that the default for most respondents is honesty, deceiving as little as needed to achieve their goals (Levine, Kim, & Hamel, 2010). The theory postulates in high-stakes truth solicitations that with sufficient time, etc. respondents first intuitively evaluate the **EV(truth telling)** as if the formula above were used, that is, assess the overall cost/benefit of fully and accurately sharing with targets the information they seek. The more negative it is the more likely that one or more deception options will be considered and their **EV** intuitively computed as if the formula were used, guided by what has worked in respondents’ pasts or with acquaintances in similar situations (McCornack et al., in press). ADCAT posits that three germane cognitive factors will generally be active in WM: respondents’ goal(s), the social context (e.g., ToM inferences of what targets know), and the truth if accessible. As sources of spreading activation

and inhibition, they will impact the deceptions considered. For instance, the truth and social context can activate relevant life memories or schemata as potential bases of the “Target’s View”. {g} The central executive will inhibit any of the small pool of deceptions that are irreconcilably inconsistent with respondents’ goals or with what targets’ may know. Estimating subjective utilities (personal gain/loss) and likelihoods of events occurs intuitively based on preferences, experience, etc. (Ekman & Frank, 1993; Sip, Roepstorff, McGregor, & Frith, 2008) and again can be inaccurate (Tversky & Kahneman, 1982; Wilson & Gilbert, 2013).

To illustrate quasi-rational decision making, suppose a study is conducted testing this account with actual lying. An 11 point Likert scale is used to assess the subjective utility of possible outcomes (−5 = extremely undesirable to respondents, 0 = neutral, 5 = extremely desirable). Consider the example of a spouse who is deciding whether to admit to a recent infidelity he had with a friend of his wife in anticipation of being confronted by her on his whereabouts on the night of the infidelity. [We concede that wives also cheat on spouses but randomly selected a particular gender, male, for the cheater for ease of writing.] A one-time event he regrets, his goal is to stay happily married. In evaluating the truth option, he intuitively estimates about a 90% chance of divorce if he discloses his tryst. On the other hand, even if the marriage survives, trust and intimacy will be gone.

$$\begin{aligned} EV(\text{truth telling}) &= .90(-5 : \text{divorce}) + .1(-1 \\ &: \text{together without intimacy}) = -4.6 \end{aligned}$$

Because of the truth’s negative **EV**, he first considers understating it by telling his wife he slept with a stranger he met at a bar while drunk that meant nothing emotionally. He infers that this would lessen slightly the probability of divorce but still yield an unacceptable **EV**.

$$\begin{aligned} EV(\text{understating truth}) &= .70(-5 : \text{divorce}) + .3(-1 \\ &: \text{together without trust}) = -3.8 \end{aligned}$$

Finally, he infers that, because of how negatively his wife would likely receive any news of infidelity and the terrible consequences on their relationship, only a complete fabrication can achieve his goal. In evaluating this option, he intuitively estimates an 80% chance that the tryst and lie will go undetected in the long run but knows he will feel guilt at not confessing, thus a subjective utility rating of 4 rather than 5.

$$\begin{aligned} EV(\text{denial false alibi}) &= .80(4 \\ &: \text{stay married feeling guilty}) + .20(-5 \\ &: \text{divorce}) = 2.2 \end{aligned}$$

Because it has the largest **EV**, the denial and false alibi are chosen. In support, research shows that respondents tend to choose deception when it maximizes utility (Gneezy, 2005; Hurkens & Kartik, 2009; Sip et al., 2008). However, if no deception option considered produces an **EV** greater than that of truth telling, honesty will be selected, even with a negative **EV**.

Four caveats are noteworthy. First, complex social contexts can impose high cognitive loads given the nuance that must be considered. For instance, they require more ToM inferences (Apperly et al., 2009) when the target knows the respondent well. A deception plausible to a stranger can fail with a close friend (DePaulo & Kashy, 1998).

Second, the **EV(truth telling)** can be negative not only when honesty is likely to produce unpleasant results, such as arrest or divorce, but also by not producing sufficient positive results per respondents' goals. As an example, when asked about his job-related experiences, a job candidate decides to exaggerate them, because he anticipates that the truth will result in a starting yearly salary below his goal of \$150,000.

Third, ADCAT maintains that the level of seriousness of a truth-soliciting context is not dichotomous: low or high. Rather, the boundary between the two is fuzzy. The stakes occur on a continuum from very low to very high. ADCAT defines the level of seriousness as how negative the **EV(truth telling)** is for respondents. Recall that IMT2 (McCornack et al., in press) describes well the impromptu production of everyday (not so serious, i.e., low stakes) deception of normal conversation. We propose that IMT2 applies more when **EV(truth telling)** is slightly negative. As **EV(truth telling)** becomes moderately or severely negative, ADCAT is more apropos for understanding the cognition of deception. A related contrast, IMT2 asserts that deception is often chosen because it is cognitively easier than truth telling, which is plausible in normal conversation. ADCAT, however, posits that when the stakes are higher, minimizing cognitive load is less important to respondents than attaining their other goals (e.g., staying out of jail). A final contrast, compared to IMT2, ADCAT is more of a top-down theory of deception by actively involving the central executive, especially when the social context is complex, unfamiliar, and deception is unrehearsed. When the context is simple, familiar, or deception is well rehearsed, even serious deception involves more bottom-up processing.

Fourth, emotions influence subjective utility ratings of outcomes, as with the spouse's rating of 4 for the undetected lie, reflecting his self-knowledge that he would experience guilt. Personality, religion, and other individual differences affect the utility ratings assigned as well. For instance, some personalities loathe lying under any circumstances (Hood, 1982) or know that they are poor liars (Van Swol, Braun, & Kolb, 2014). ADCAT postulates that they intuitively assign low subjective utilities (e.g., 1) to gains from possible deceptions and assign large negative utility ratings (e.g., -5) to potential losses.

3.4.2. Motivation to lie

If a decision is made to deceive, the level of motivation for dishonesty, **M**, is then set intuitively as if this formula were followed: **EV(deception chosen)–EV(truth telling)**. Conceptually, this is the gap between the net good expected from deception and the comparative net bad expected from honesty. Using the subjective utility rating scale above, **M**'s possible range is from a high of 10 (lying-extremely desirable, truth telling-extremely undesirable, both with estimated outcome probabilities of 1) to a low of 0 (i.e., each deception considered with an $EV \leq EV(\text{truth telling})$). The larger **M** is the more cognitive resources respondents are

willing to assign to preparing Target's Views, monitoring and adjusting behavior, etc. (Colwell et al., 2007; Ekman, 1992). In support, highly motivated liars tend to control their non-verbal behavior more than liars less motivated or truth tellers (DePaulo & Kirkendol, 1989; Porter & ten Brinke, 2010). Even if **M** is large, if the social context is highly familiar or simple, a large allocation will not be required. The cheating spouse's decision yields an **M** of 6.8, which is high.

3.4.3. Choosing honesty or remembering to lie

To illustrate deciding on honesty, suppose that an innocent male suspect is interrogated by police. Given the circumstantial evidence incriminating him, he intuitively estimates about a 75% chance of being believed if he is completely honest; **EV(truth telling)** = .75(5: no longer a suspect) + .25(-1: not believed and still a suspect) = 3.5. He briefly considers lying to get out from under suspicion but feels it would eventually be detected: **EV(lie)** = 1.00(-5: caught lying is like confessing guilt) = -5. At -8.5, the motivation to lie becomes 0, and honesty is chosen. Respondents who choose honesty [**F**] and need only convey simple factual information can disclose it [**L**], experiencing less cognitive load than those who must construct lies or truths, both of whom will proceed to the next component, although it is beyond ADCAT's scope to explicate how truths are constructed.

Respondents who previously decided to lie about a particular truth will now remember to deceive as the memory cue of a truth solicitation arises. If respondents have mentally linked the decision to likely truth-soliciting contexts, it should be quickly activated (see Anderson, 2000). To illustrate, now that the spouse has decided to convey a false alibi, he anticipates situations when he may be confronted by his wife, also a central executive function (Gombos, 2006).

3.4.4. Heuristics use when quasi-rational decision making is impossible

According to dual processing theory, two types of decision making exist: a careful central route such as the quasi-rational approach just described and a peripheral route involving shortcuts (Petty & Cacioppo, 1986). Regarding the latter, ADCAT posits that when respondents are surprised by truth solicitations and must decide quickly, in extreme emotional states like high stress, or when cognitively impaired (e.g., tired, intoxicated), rather than quasi-rational decision making, heuristics (frugal, quick rules of thumb applied when information is limited, Gigerenzer, 2008) become more probable in deciding whether and how to deceive. As one example, respondents are likely to use the heuristic of "denying wrongdoing" when tired (Kouchaki & Smith, 2013; Mead, Baumeister, Gino, Schweitzer, & Ariely, 2009). Another likely heuristic is "imitating success" (Boyd & Richerson, 2005): deceiving because the respondent or another did so successfully in a similar situation. Another one likely is "satisficing" (Todd & Miller, 1999): quickly searching alternatives, not for the best solution, rather for one good-enough per respondents' goals. Only readily accessible or environmentally salient positive or negative consequences of truth telling will enter WM and be compared with those of the most obvious applicable deception. Reduced capacity, time pressure, etc.

Table 3

Factors affecting the cognitive load of lying and truth telling.

Constraints & other factors adding to the cognitive load of serious deception by component^a*Decision Component*

1. Has no decision to lie been made in anticipation of a specific truth solicitation?
2. Is the decision embedded in a complex (e.g., numerous ToM inferences) and/or unfamiliar social context?

Construction Component

3. Is the Target's View internally consistent (no conflicting details, Ekman & Frank, 1993; Granhag & Hartwig, 2008; Zuckerman et al., 1981)? Can this consistency be maintained over time?
4. Is the Target's View externally consistent (congruent with targets' knowledge, Ekman & Frank, 1993; Zuckerman et al., 1981)? To be plausible, does the View require taking account of second-order inferences (e.g., The cheating spouse considers what his wife may tell her friends about his alibi in light of what they are likely to have seen at the time of the infidelity.). Are third-order inferences required (Apperly et al., 2009)?
5. If the deception is a false narrative, is the underlying Target's View detailed enough with multimodal information or a realistic timeline to convince targets (DePaulo et al., 2003; Vrij & Mann, 2001)?
6. Beyond going undetected, are lies based on the Target's View likely to achieve respondents' goals, for instance, enhance the liar's image in the target's eyes or obtain resources?

Action Component

7. Is the respondent highly motivated to lie (Caso, Gnisci, Vrij, & Mann, 2005; DePaulo & Kirkendol, 1989; Vrij & Mann, 2001)?
8. How much monitoring of and control over the self is the respondent exercising to appear sincere or stay in his/her deceptive role (Buller & Burgoon, 1996; Zuckerman et al., 1981)?
9. How much is the liar monitoring the target's behavior to see if the lie is convincing (Buller & Burgoon, 1996)?
10. Is the truth deeply entrenched, does truth telling elicit strong emotions, or is truthful responding habitual so that honest responding proactively interferences with deceptive responding and must be actively suppressed (Banse & Greenwald, 2007; Morgan, SeSage, & Kosslyn, 2009; Osman et al., 2009; Walczyk et al., 2009)?
11. Is an adequate Target's View unavailable and/or is delivery of a lie unrehearsed?
12. Is the liar highly anxious (Beilock & Carr, 2005; Eysenck, 1992)?
13. Is the liar having to search LTM to recall the appropriate non-verbal signs of honesty to display?

Factors adding to the cognitive load of truth telling^a

14. Is the truth teller highly anxious about being believed?
15. Is the truth teller highly motivated to be believed (Caso et al., 2005)?
16. Does accessing the truth require fetching episodic or semantic memories that have decayed or not been retrieved recently, or is the truth unavailable in memory (Altman & Gray, 2002; Walczyk et al., 2005; Wixted, 2004)?
17. Is a deceptive response well rehearsed compared to the corresponding truthful response (Greene et al., 1985; O'Hair et al., 1981)?
18. Does a truthful response require elaboration or qualification to be accurately understood by targets? For example, must truth tellers use their ToM in preparing and sharing truths to make them comprehensible? (Gombos, 2006)? Must the truth be edited to spare the feelings of someone close (DePaulo, 1992)?
19. Does a truthful response require the generation of a novel opinion, judgment, evaluation, or emotional reaction (DePaulo et al., 2003; Gombos, 2006)?
20. Does honest communication require conveying complex ideas needing careful translation to be understood by targets?

^a These lists are *not* exhaustive; additional entries and other modifications are likely based on research.

typically will attenuate accuracies of estimates of outcome utilities and their probabilities below those of quasi-rationality. To illustrate satisficing, the intoxicated driver, who believes she is under suspicion for drunk driving, briefly considers honesty as the officer approaches but quickly infers that only denying having imbibed might avert arrest. Deception is quickly chosen. In fact, she overestimates the chance of being believed in her deception due to an impaired central executive and is arrested.

$$EV(\text{truth telling}) = 1.00(-5, \text{fail inevitable field sobriety test}) \\ = -5$$

$$EV(\text{deny drinking}) = .70(5 \\ : \text{will be believed, no test}) \\ - .30(-5, \text{fail test}) \\ = 2$$

3.4.5. Summary of core constructs

ToM is needed for inferring targets' reaction to the truth, the deceptive information manipulation most likely to achieve respondents' goals, and the likely responses in targets if lies are detected. Items 1 through 2 of Table 3 are factors adding to the load of this component. It is higher the

more complex or unfamiliar the social context is, perhaps requiring second- or third-order ToM inferences. Cognitive resources are potentially allocable proportionally to the level of motivation to lie, **M**. More complex or unfamiliar social contexts will draw more on this allocation. Deciding to lie in advance and anticipating truth-soliciting contexts lowers intrinsic load at delivering.

3.5. Construction component

With the decision to manipulate information in a particular deceptive way, details of the social context, respondents' goals, and the truth, if accessible, active in WM, during this component Target's Views are elaborated as needed to go undetected and achieve their other goals. Whether respondents chose to falsify, equivocate, exaggerate, understate, and/or omit influences the cognitive load now imposed. For instance, the cheating spouse's decision to produce a false alibi will impose a high load during construction as an extensive quality violation (McCornack et al., *in press*), because his wife knows his habits, preferences, etc. (DePaulo & Kashy, 1998). At the other extreme, constructing a false denial when asked by a prospective employer and stranger "Have you ever stolen anything from the work place?" imposes little load as a

minor violation of quantity (McCornack et al., *in press*), since the respondent infers that the target cannot check the veracity of the answer.

The social context and the truth provide quickly accessible links to networks of semantic, episodic, and emotional memory (Ericsson & Kintsch, 1995). These pathways are useful for elaborating Target's Views, anticipating questions from targets, and preparing deceptive answers. [G] The truth or related authentic information of episodic memory will be preferred and recalled to the episodic buffer as the basis of a Target's View, followed by alteration (Leins, Fisher, & Ross, 2013; Malone, Adams, Anderson, Ansfield, & DePaulo, 1997; Strömwall & Willén, 2011; Walczyk et al., 2003), a heuristic that enhances lie plausibility (DePaulo et al., 2003). The central executive again activates ToM, enabling inferences of what targets know, suspect, and will believe based on experience [H] (Talwar et al., 2007; Wellman et al., 2001; Wimmer & Perner, 1983). Target's Views' frequently must satisfy restrictions to achieve goals like items 3 through 6 of Table 3. More are applicable, each adding intrinsic cognitive load, the more complex the social context is (DePaulo et al., 2004). When liars can prepare in advance, Target's Views will satisfy more constraints (Vrij et al., 2009; Walczyk et al., 2009) and the load at delivery attenuates (Greene, O'Hair, Cody, & Yen, 1985; O'Hair, Cody, & McLaughlin, 1981).

3.5.1. Plausibility principle

Although some deceivers are very inventive (Walczyk, Runco, Tripp, & Smith, 2008), to be plausible, serious lies are unlikely to be creative. Based on ToM beliefs of what targets' find believable, in crafting Target's Views, especially for false narratives, respondents will intuitively tend to (a) first try to alter the truth or a related episodic memory of an event personally or vicariously experienced (Levine et al., 2010; Malone et al., 1997; Strömwall & Willén, 2011; Walczyk et al., 2003) or other personally experienced sources of vivid, authentic detail (e.g., a scene from a realistic movie), a notion consistent with IMT2's proposition IM5 (see McCornack et al., *in press*) by which deception involving quality violations are built largely on truthful memories. Recently encoded or activated memories will be preferred (Leins et al., 2013) due to minimal decay of detail. If authentic memories are unavailable, perhaps due to limited relevant life experience, (b) schemata and scripts of what are typical in a particular social context will serve as the basis, which are vaguer but conventional (Sporer & Schwandt, 2007). If they are unavailable, (c) Target's Views will be assembled inferentially from assorted information activated from LTM and in the environment (Smith, 1998), imposing high cognitive load (Sporer & Schwandt, 2007). This predicted ordering is the *plausibility principle*. From (a) to (c), intrinsic cognitive load of construction generally increases, and lie plausibility generally decreases.

Little research has examined how lies are constructed. A report by Leins et al. (2013) supports this principle. In two studies, adults were instructed to lie about a recent life event and later describe how they did so; 67% of participants in Study 1 and 86% in Study 2 reported altering a memory of an actual event, usually recent. The remaining 33% of participants of Study 1 reported "a plausible story",

suggesting that schemata or scripts were used. As the second choice predicted by the plausibility principle, they should provide the basis of Target's Views less often. Also supportive of the principle, when constructing Target's Views, children are likely to alter memories of actual events (Strömwall, Granhag, & Landstrom, 2007).

Another study by Strömwall and Willén (2011) also provides support. Investigators asked 35 convicted criminals to describe strategies they use in deceiving authorities. Those relevant to information manipulation are recounted here. Staying close to the truth, because such deceptions are easiest to remember, was the most common strategy reported, followed by keeping responses simple, plausible, and as rich in detail as required. Generally, these strategies attempt to minimize cognitive load and maximize believability by using authentic experiences, all consistent with the plausibility principle. Similar strategies of deceptive information manipulation have been reported by Colwell, Hiscock-Anisman, Memon, Woods, and Michlik (2006).

3.5.2. Multimodal Target's Views

In anticipation of high-stakes truth solicitations, respondent who decide on deception often prepare in advance (Hines et al., 2010; Strömwall & Willén, 2011). Recall that respondents typically keep the information shared simple, lest they contradict themselves or targets' knowledge with a stray detail (Strömwall & Willén, 2011; Strömwall, Hartwig, & Granhag, 2006). ADCAT holds that, based on respondents' experiences with similar truth-soliciting context and ToM inferences of what targets' are likely to ask, Target's Views will be embellish as needed, which relies on the central executive. For instance, a View involving a false narrative may need auditory, visual, or tactile details of events and a believable timeline (Vrij & Mann, 2001). Suppose the cheating spouse's false alibi will be that he had dinner with his buddies at the time of his infidelity, salient in memory because it is a typical activity for him that they will corroborate. Enough detail must be in the View or readily accessible for him to answer convincingly his doubting wife's potential queries: "Who sat to your left?" "How could dinner take four hours?" (Vrij et al., 2009). An actual episodic memory of a previous 2 h dining experience is the basis. Once recalled to the episodic buffer, [H] this true narrative is expanded to 4 h by inserting plausible events (e.g., very slow service) and tweaked to satisfy constraints of Table 3 (Vrij, Granhag et al., 2010), all guided by ToM. Second- or third-order inferences may be required to add sufficient detail to ensure long-term plausibility (see item 4 of Table 3). If no episodic memory is available, the central executive can use the "visuo-spatial sketchpad" {b} to generate a deceptive restaurant account. His restaurant schema can inform seating arrangements and other spatial details. His "dining out" script can guide the sequencing of events, etc. (Alba & Hasher, 1983; Kintsch, 1998; Loftus, 2007; Sporer & Schwandt, 2007). Lie construction imposes cognitive load (DePaulo et al., 2003; Greene et al., 1985; Heilveil, 1976; Walczyk et al., 2003, 2005).

3.5.3. Cognitive load and rehearsal

Per the central principle, when possible, respondents will commit Target's Views to LTM to lessen the cognitive load of

lie delivery. For instance, instead of having to generate a lie impromptu on hearing a question, the question and social context will activate the View, which may require tweaking to fit the social context (Vrij, Granhag et al., 2010). Anticipating truth solicitations and preparing Target's Views and related lies are load reducing acts that lower response times, inconsistencies, or other signs of load compared to unrehearsed lying (DePaulo et al., 2003; Hu, Chen, & Fu, 2012; Van Bockstaele et al., 2012; Verschuere, Spruyt, Meijer, & Otgaar, 2011; Vrij et al., 2009). Extended rehearsal can lower load below that of truth telling (Dike, Baranoski, & Griffith, 2005; Greene et al., 1985; O'Hair et al., 1981). Slight rehearsal may impose loads a bit higher (Walczyk et al., 2009). Remembering to lie and recalling a new one can be more effortful than typically automatic truth retrieval (Glenberg et al., 1998; Pirolli & Anderson, 1985).

3.5.4. Summary of the core constructs

ToM inferences ensure that Target's Views are plausible and achieve respondents' goals. Per the central principle, when possible, respondents will prepare Target's Views and practice lying based on them to reduce intrinsic load at delivery (Colwell et al., 2007; Ekman, 1992; Hines et al., 2010; Strömwall & Willén, 2011) and will intuitively follow the plausibility principle when constructing Target's Views to minimize load and maximize believability at delivery.

3.6. Action component

Now respondents deliver lies to targets. [I] Recall that a truth has been solicited and is now active in WM, if available, (see *Activation Component*) or newly encoded. When the stakes are high, both liars and truth tellers generally attempt to appear sincere and relaxed, but liars take their credibility less for granted and may need to hide signs of guilt or shame (Ekman, 2001; Ekman & Frank, 1993; Vrij, Granhag et al., 2010) whereas truth tellers are more likely to believe their honesty will show through (Hartwig & Granhag, 2007; Masip & Herrero, 2013). Respondents' ToM beliefs are often mistaken about truth tellers' actual behavior, including that they are always relaxed and never convey narratives with imperfections like forgotten details (DePaulo et al., 2003). As a result, particularly in serious situations, liars can be betrayed by too much self-regulation (Butterworth, 1978; DePaulo & Kirkendol, 1989). If a decision to lie about a particular truth was made, an adequate Target's View is prepared, and lies based on it are well rehearsed, [J] the cognitive load of delivery will be low (Greene et al., 1985). As these are absent, load will increase and manifest during delivery. The heaviest load is predicted when a truth solicitation embedded in an unfamiliar, complex social context surprises respondents who choose to deceive by constructing a false narrative (Walczyk et al., 2005). Items 7 through 13 of Table 3 are factors that add to the intrinsic or extraneous load of delivering lies. Generally, more apply the higher the stakes, the more complex or unfamiliar the social context, and the more unrehearsed the deception (Buller & Burgoon, 1996; DePaulo & Kirkendol, 1989; O'Sullivan, Frank, & Hurley, 2009). Although Table 3 acknowledges the load-inducing nature

of non-verbal aspects of deception, recall that ADCAT is focused on cognitive aspects, particularly information manipulation.

3.6.1. Proactive interference of honest responding with lying

Because truth telling is normative (Greene & Paxton, 2009; Levine et al., 2010; Saxe, 1991), it can cause a Stroop-like interference with the often incompatible response of lying (Mohamed et al., 2006; Osman, Channon, & Fitzpatrick, 2009; Pennebaker & Chew, 1985). ADCAT posits that with the decision to deceive in a particular way active in WM, the central executive suppresses the accurate sharing of specific information, [K] often involving active inhibitory centers in the frontal lobe (Johnson et al., 2004; Kozel, Padgett, & George, 2004; Mohamed et al., 2006). The intrinsic load of inhibiting truthful responding depends on how elaborate truth-related memories are and how habitual honest responding is (Van Bockstaele et al., 2012; Verschuere et al., 2011). For instance, if a truth was recently encoded or is unavailable in memory, it will cause minimal interference with lying. Deception involving well rehearsed truths, such as respondents' first names or deeply held beliefs, will entail more proactive interference (Banse & Greenwald, 2007; DePaulo, 1992). In support, using answer response time as the cue, Walczyk et al. (2009) found better discrimination between college students who lied or told the truth about their living arrangements or academic majors than doing so about what they did on Saturday night or their job histories. The first two foci, well rehearsed by daily living, resulted in prompt answers in truth tellers and proactive interference in liars.

3.6.2. Lowering load, enhancing lie generation, and speech production

High motivation to lie can heighten "detection apprehension" (Ekman & Frank, 1993). Per the central principle, when respondents must deliver lies under high intrinsic cognitive load (e.g., convey an unrehearsed false narrative), they will act to reduce extraneous load. Table 4 lists behaviors hypothesized to lower it by attenuating anxiety as well as environmental or bodily distraction so that liars can allocate maximum cognitive resources to lying. For example, breaking eye contact reduces load by lowering anxiety (Vrij, Mann, Leal, & Fisher, 2010; Walczyk, Griffith, Yates, Visconte, & Simoneaux, 2013). Averting eyes away from people or other visual distraction can help liars focus on memory retrieval, infer targets' mental states, and do other internal processing needed for lie construction (Doherty-Sneddon & Phelps, 2005; Doherty-Sneddon, Burce, Bonner, Longbotham, & Doyle, 2002; Glenberg et al., 1998; Rayner, 1998; Walczyk et al., 2012). Whereas long response times and dilated pupils are direct indices of cognitive load (Anderson, 2000; Heilveil, 1976; Rayner, 1998), averting gaze and reducing eye movement are postulated to be indirect signs, reflecting liars' attempts to reduce load. Table 4 also presents actions of unrehearsed liars that can facilitate lie construction during delivery, including stalling for time for lie construction.

As does IMT2 (McCornack et al., *in press*), ADCAT postulates that the same speech production modules underlie truthful and deceptive discourse. Moreover, analogous to the

Table 4

Cognitive load-reducing and deception-generating behaviors of the action component.

Behavior	Benefit for liar
<i>Extraneous load reduction</i> ^a	
1. Close eyes	Minimize environmental distraction, anxiety, guilt, etc. (Doherty-Sneddon & Phelps, 2005; Doherty-Sneddon et al., 2002; Glenberg et al., 1998)
2. Avert gaze away from, focus on a neutral stimulus	Minimize distraction, anxiety, guilt, etc. (Doherty-Sneddon & Phelps, 2005; Doherty-Sneddon et al., 2002; Glenberg et al., 1998; Vrij, Mann et al., 2010; Walczyk, Griffith et al., 2013)
3. Reduce eye movements	Minimize environmental distraction (Walczyk et al., 2012)
4. Reduce body movements	Minimize intrapersonal distraction, lower anxiety
5. Engage in relaxation	Reduce extraneous load by lowering anxiety
<i>Enhance deception construction</i> ^a	
6. "Time-buying" strategies (e.g., asking that a question be repeated, long pause before or while answering or within narratives)	Increase the time for lie construction or lie recall (DePaulo et al., 2003; Walczyk et al., 2003).
7. Increase eye movements/scan	Seek environmental hints for lie construction

^a These lists too are not exhaustive and will likely expand with research.

propositional base of the Mannheim Model of speech production (Herrmann, 1983), a Target's View consists of one or more of the following representations of information: propositions, schemata, visual/auditory images, episodic memories, a timeline of events, etc. A View can guide the speech production module [J] and be conveyed equivalently with different verbal productions (see Dell, Chang, & Griffin, 1999).

3.6.3. Summary of core constructs

ToM beliefs guide delivery based on what respondents think targets find sincere. The targets' behavior and that of the self may be monitored to infer whether lies are believed. If no Target's Views or lies were prepared, deceptions will be constructed impromptu, often at high cognitive load. Cognitive resources may be needed by the central executive to overcome the proactive interference of truth telling, especially when truths are entrenched or responding honestly is habitual. Unrehearsed liars will tend to use the behaviors of Table 4 to reduce extraneous load and will follow the plausibility principle in constructing deception. If adequate Target's Views have been prepared, they will be navigated [J] in response to specific questions or other truth solicitations. If Views satisfy items 3 through 6 of Table 3 in advance, lying should impose minimal intrinsic load at delivery so that respondents can appear relaxed.

3.7. Major hypotheses of ADCAT

Based on the preceding, major hypotheses of the theory are shown in Table 5. They summarize ADCAT and can open up new lines of research. Some are also predictions of the other cognitive perspectives we reviewed, such as the

activation of the truth (#1) and proactive interference of truthful responding with deception (#9). Those pertaining to the decision to deceive (#3), the motivation to deceive (#4), the plausibility principle (#5), facilitating lie construction (#6), and the management of cognitive load (#10) are new. The most important contribution here is their integration within a single theoretical framework.

4. Cognitive load of dishonesty versus honesty: implications for lie detection

As with most truth telling, most everyday deception makes minimal demands on cognitive resources (DePaulo & Kashy, 1998; DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996). DePaulo et al. (2003), Vrij, Granhag et al.

Table 5

Major hypotheses of ADCAT by component.

Activation Component

- The truth (accurate information sought by the target), if available, will generally be automatically activated from LTM or be encoded directly from the environment in response to a truth solicitation.
- Cognitive load will be imposed on respondents as predicted by Fig. 1. For instance, those who intend to be honest at the outset, from whom simple factual truths are solicited, will have the lowest cognitive loads of all respondents, because only the Activation Component is involved. [C]

Decision Component

- The probability of deception will increase as EV(truth telling) becomes more negative.
- Liars' effort and persistence at deception will be positively correlated with their motivation to lie, M, as given by $EV(\text{deception chosen}) - EV(\text{truth telling})$. Specifically, higher M values will be associated with a greater willingness to allocate cognitive resources to construct a Target's View, to generate ToM inferences, etc.

Construction Component

- When confronted with truth-soliciting contexts varying in familiarity, liars will construct Target's Views according to the plausibility principle, generally minimizing intrinsic cognitive load and maximizing believability, consistent with the central principle.
- When delivering novel fabrications, unrehearsed liars will tend to scan their environments and explicitly search LTM more than rehearsed liars or truth tellers when they have neither relevant episodic memories nor relevant schemata readily accessible in memory for generating Target's Views.

Action Component

- Lying will impose more cognitive load than truth telling to the extent that items 1 through 13 of Table 3 apply during the Action Component. More will apply the more complex, unfamiliar, or serious the truth-soliciting context is or the less rehearsed deceptive responding is. On the other hand, well rehearsed liars or those in highly familiar social contexts, for instance, are unlikely to need to monitor their own behavior (#8), that of the targets (#9), or unlikely to be anxious (#12). Well prepared and rehearsed liars will experience minimal cognitive load from items 1 through 6.
- Slightly rehearsed lying will entail more cognitive load than truth telling, whereas well rehearsed lying will entail less cognitive load than truth telling.
- Entrenched truths (e.g., those central to respondents' lives, deeply held beliefs) will cause more proactive interference with lying, that must be inhibited, than will peripheral or recently encoded truths.
- During delivery, unrehearsed liars will exhibit higher rates of the load-reducing behaviors of Table 4 than rehearsed liars and truth tellers who are relating corresponding truths.

(2010), and Zuckerman et al. (1981), among others, identify reasons why lying, especially involving high stakes, can impose greater cognitive load than truth telling, many appearing in Table 3. On the other hand, items 14 through 20 are occasions when truth telling can impose greater load, many noted by McCornack et al. (in press).

The ADCM (Walczyk et al., 2003) assumed that lies are constructed and truths are retrieved. ADCAT notes that rehearsed deception entails retrieved lies, and truths sometimes are constructed (DePaulo, 1992; DePaulo et al., 2003; Gombos, 2006; Sporer & Schwandt, 2006, 2007). The theory advances understanding of when lying is more cognitively demanding than truth telling, vice versa, and informs when indices of cognitive load signal deception. Fig. 1 is helpful in comparing cognitive loads. Based on it and Table 3, some generalizations are warranted regarding the load of cognitive aspects (e.g., information manipulation) of deception versus truth telling. Whichever requires a more complex response (e.g., constructed, edited, not simply recalled), honesty or dishonesty, will impose greater cognitive load (McCornack, 1997; McCornack et al., in press). Whichever requires a more spontaneous (unrehearsed) or novel response will as well. Whichever requires more explicit memory searching, either to retrieve a truth or to find information useful for lie construction, will entail more load. Of course, complex and spontaneous responding can co-occur with explicit memory searching as when respondents answer unrehearsed and honestly the question “What was your favorite childhood vacation?”

New cognitive load-inducing methods of lie detection have recently been proposed. For instance, Vrij et al. (2008) suggested that extraneous load could be selectively increased on deceptive respondents by adding a concurrent task during interrogation (see {k} of Table 1) that might interfere with lying more than truth telling and amplify cues to deception. Vrij, Granhag et al. (2010) reviewed other such proposals for inducing load on liars, including having respondents recall events in reverse chronological order or answer unanticipated questions. Although innovative, these techniques generally are neither based on a theory of deception nor have their proposers typically adequately considered the load-reducing countermeasure of rehearsal (Walczyk, Griffith et al., 2013; Walczyk, Igou et al., 2013). Recall that a major criticism of the CQT of the polygraph is that it is not based on a valid theory of deception. It is important not to repeat this mistake with these promising new approaches (Walczyk, Griffith et al., 2013; Walczyk, Igou et al., 2013).

ADCAT can help refine and expand cognitive load-inducing techniques by illuminating underlying cognitive processes. Recall, for instance, that the theory incorporates rehearsal, likely in high-stakes situations (Colwell et al., 2007; Ekman, 1992; Hines et al., 2010; Strömwall & Willén, 2011). Research testing and expanding ADCAT may reveal under what circumstances lying imposes greater load than truth telling and when the results of studies generalize to the field (National Research Council, 2003). As another example, per the plausibility principle, liars first try to use the truth or recent memories of life events to construct Target's Views, which minimizes cognitive differences between liars and truth tellers, a

notion consistent with the Reality Monitoring (Masip, Sporer, Garrido, & Herrero, 2005; Sporer, 2004) and Criteria-based Content Analysis (Vrij, 2005) approaches to lie detection. If accurate, then those developing cognitive load-inducing approaches should note that load differences between liars and truth tellers may not be as large as previously hypothesized (Buller & Burgoon, 1996; Zuckerman et al., 1981). One final example, ADCAT's emphasis on ToM suggests that in truth tellers' narratives, first- or second-order inferences of the mental states of others are made naturally. Asking surprise questions requiring such inferences (e.g., the wife asking her cheating spouse “What was Andy thinking about during dinner?”) should induce high cognitive load in liars, which may amplify cues to deception.

5. Research opportunities

The hypotheses of Table 5 provide a few new avenues for research. Additional ones are now considered. Five of the six cognitive perspectives on deception we reviewed (all but the ADCM) are largely silent on the decision making process of whether to deceive. According to ADCAT, this component is crucial to serious lying in determining the type of deceptive information manipulation and the level of motivation. The theory posits a mathematical account by adapting a formula from the decision making literature to capture how respondents intuitively combine estimates of outcome likelihoods and subjective utilities as well as a related formula for the motivation to lie. The expected value approach is a parsimonious, testable way of understanding how respondents may integrate the pros and cons of truth telling then compare them with those of feasible deceptions to arrive at quasi-rational decisions. Related questions present themselves. How much time pressure or cognitive impairment must occur before heuristics are used in lieu of quasi-rationality? When pressed for time or impaired, do respondents use the “satisficing” or “imitate success” heuristics? Which others may be used?

What are ADCAT's implications for understanding developmental improvement in deception? The expanded roles of the central executive and ToM to all four components are relevant (Gombos, 2006; Wellman et al., 2001). Cognitive developmental psychologists will find Fig. 1 useful for generating research questions and hypotheses. With age, do children's decisions to lie become more quasi-rational by maximizing EV? Few studies have examined how children construct lies (e.g., Strömwall et al., 2007). Do they do so in greater approximation to the plausibility principle with age, that is, come to adopt the ToM belief that lies based on actual experiences are most likely to succeed?

6. Limitations and conclusion

Some limitations of the theory are noteworthy. First, the examples of serious deception we emphasized concerned manipulating episodic memories. Other kinds must be considered with refinement like the telling of high-stakes lies for personal gain when no truths are solicited. For instance, a conman approaches an elderly couple, pitching

an investment opportunity to double their money within five years. Second, although ADCAT is based on established constructs, elements of the theory have yet to be thoroughly tested (e.g., hypotheses 3–5 of Table 5). Third, for furthering understanding of serious lies, refinement of ADCAT's four components will be necessary based on research. Finally, non-verbal aspects (i.e., impression management, Hartwig et al., 2010) are important and will have to be incorporated as ADCAT is expanded.

As captured in Fig. 1, ADCAT details the social cognition of high-stakes deception, much of which occurs in parallel, intuitively, and seamlessly when the social context is simple, familiar, or deception is well rehearsed. As these are absent, serious deception involves more executive (top-down) processes. The theory also underscores the pervasive roles played by ToM and cognitive resources in all four components. It can help researchers understand and integrate theoretically major aspects of the cognition of high-stakes deception, open up new areas of research, and advance cognitive load-inducing lie detection.

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