Deception, Speaking and Writing

When addressing lying and deception in language production, it is imperative to acknowledge that behavioral indicators may play a role. This include evaluation of multiple distinct verbal and nonverbal behavioral indicators, such as gaze cues, pulse rate, hand movements, and manifestations of nervousness. Here, the role of cognitive load during speaking and writing, and how cognitive load due to the parallel tasks of deciding what to say/write, and how to say it while actually expressing the thought may be visible during language production is discussed. The assumption is that lying and deception would increase the cognitive load and that this will, to some extent, be observable through the behavioral indicators.

1. Introduction

Being able to lie is an important skill to develop in life, for example, to respond politely when your mother-in-law asks you if you like her horrendous stew (Talwar 2019). Thus, lying has a social function, but there are also instances when it is important to be able to tell if a person is lying or not. This apply to our day-to-day lives, as well as to our legal system, where, for example, witness accounts need to be judged for their credibility in a safe and just way. While there have been attempts at creating a "lie detector", so far these efforts have not reached a reliable and safe conclusion and no single "symptom" of a lie has been identified that can be used for diagnosing a story as deception (Ofen et al. 2017; Mann 2019; Vrij et al. 2022).

Instead, discriminating a lie from the truth is typically contingent upon a comprehensive evaluation of multiple distinct verbal and nonverbal behavioral indicators, such as gaze cues, pulse rate, hand movements, and manifestations of nervousness, among others (Newman et al. 2003; DePaulo et al. 2003; Vrij et al. 2010; Granhag et al. 2015).

2. Deception and Cognitive Load

The relationship between deception and increased cognitive load has been the subject of extensive investigation in various studies. Cognitive load refers to the demand placed on working memory resources when solving immediate tasks (Baddeley 2007; Cowan 2010). The underlying assumption is that lying is a mentally demanding task, prompting suggestions that indicators of heightened cognitive load could be employed for deception detection. All forms of lie detection rely on individuals perceiving deception and identifying cues (either automatically or manually) that may suggest falsehood. A myriad of lie detection techniques has been proposed, particularly for use in interrogations and interviews (see Walczyk et al. 2013 for a comprehensive overview). These techniques may focus on attentional processes, aligning with the orienting response theory (Sokolov 1963), or delve into memory processes and inhibition, in line with the parallel task set model (Seymour 2001).

Several theoretical frameworks address deception and its relation to cognitive load. One is the four-factor theory of deception, advanced by Zuckerman et al. (1981), which posits that deception escalates cognitive load. Some theories include explanations as to why deception would increase cognitive load. For instance, the interpersonal deception theory (Buller and Burgoon 1996; Burgoon and Buller 2008) proposes that cues of deception stem from aspects of communication that remain "unmonitored" due to increased cognitive load. Another example is the self-presentation theory (DePaulo 1992), which outlines three cognitive phases governing behavior to appear truthful: intention to regulate behavior, intention translated into non-verbal behavior, and self-assessment of the behavior. Sporer and Schwandt (2006, 2007) introduced the Working Memory Model of Deception, which builds on Baddeley's (2007) working memory model and asserts that lying elevates cognitive load, potentially affecting speech production among other processes. Finally, the Activation-Decision-Construction Model (Walczyk et al. 2003, 2005, 2009) outlines a model for deceptive responses in the context of lie detection interviews, and this model has been expanded to account for repeated lies (2009).

These theories and models have undergone scrutiny, as exemplified by a study conducted by Repke et al. (2018) that tested two models—one assuming that increased cognitive load during deception would reduce linguistic complexity and another assuming that the lie's goal would determine the complexity of the deception. The latter model received empirical support, indicating that liars can adjust the complexity of their falsehoods based on their objectives. Other studies propose content analysis to assess statement credibility, such as criteria-based content analysis (CBCA) (Vrij et al. 2000), developed to evaluate statements from individuals who have experienced abuse, as well as analyses of vividness and spontaneity in lies versus truths (Colwell et al. 2007). These investigations have revealed that the content of statements is, to some extent, influenced by whether a person is lying or telling the truth, and complementing this knowledge of the content with future knowledge about the process of deceiving would most likely be rewarding.

Similarly, Leins et al. (2012) explored the impact of different reporting modes on deception from a forensic perspective. They discovered that, when individuals were asked to recount the same event through spoken and pictorial modes, liars exhibited less consistency across the two modes compared to truth-tellers. Thus, while liars can tailor their lies to specific goals in a given context, transferring lies across different reporting modes appears more challenging. Further investigation into this phenomenon across various language modalities could be valuable. Additionally, Vrij et al. (2008) found that, when asked to narrate a series of events in reverse order, both verbal and nonverbal cues indicative of deception (e.g., filled pauses, hesitations, and leg movements) increased among liars. Moreover, they observed an improvement in lie detection accuracy among police officers in the reversed condition, surpassing chance levels.

Regarding heightened cognitive load during deception, reaction time studies have been a common approach. For instance, Duran et al. (2010) reported a significant increase in reaction time when participants were instructed to lie in response to simple yes/no questions, a pattern consistent with numerous other studies (e.g., see Suchotzki et al. 2017 for a review of studies measuring reaction time in relation to deception). Furthermore, Debey et al. (2012) found that, when given additional time to examine a stimulus after being instructed to lie, participants exhibited significantly longer reaction times when lying compared to responding truthfully.

Many studies investigating deception cues primarily focus on interview responses or spoken language. Apart from reaction time latency, some also assess speech rate and hesitations as verbal cues of deception. For instance, Vrij et al. (2008) examined speech rate (calculated as the number of words divided by the length of the answer) and found that liars had a slower speech rate than truth-tellers, along with more hesitations. A limited number of studies have specifically looked at deception related to aspects of speaking and writing. One example is the study by Goupil et al. (2021), who found that the speech signal itself may be perceived as more or less honest. A few recent examples include studying deception during written language production, with interesting findings, such as liars engaging in more revisions and producing shorter texts (Banerjee et al. 2014). Another result has demonstrated that, in synchronous chat settings, liars exhibit not only increased revisions and shorter texts but also longer response times (Derrick et al. 2013). The latter study also noted a significant age-related effect, with older participants displaying these behaviors more prominently than younger individuals. Finally, studies have demonstrated that writing processes can be disrupted due to background speech, especially regarding semantic aspects, something that may be relevant for inducing increased cognitive load in experimental settings (Sörqvist et al. 2012).

In sum, the connection between cognitive load and deception is underpinned by theoretical models as well as empirical findings. The review of the field further highlights that the examination of behavior during the production of language may add insights into when and how deception occurs.

3. Language Production and Cognitive Load

The concept of cognitive load, and especially the notion of *working memory* has further been influential in descriptions of language production. Across all kinds of language production, we depend on our working memory resources to perform tasks, such as planning what to say/write, actually expressing it, and evaluating the result of it (McCutchen 2000; Baddeley 2007). In studies on speaking and writing, working memory demands have been investigated through analyses of pauses and disfluencies (cf. e.g., Goldman Eisler 1968; Matsuhashi 1981; Spelman Miller 2006b). The underlying idea posits that, when too much information needs to be processed simultaneously, our limited working memory capacity becomes overloaded with information and additional time is needed to plan for spoken and written expressions. This often results in longer pauses and/or more frequent pausing (Spelman Miller 2006a), alongside an increased occurrence of other expressions of disfluencies in speaking, such as filled pauses, elongated words and word segments, and repeated words and expressions (Goldman Eisler 1968; Clark and Wasow 1998; Heldner and Edlund 2010), and in writing, such as deletion of word fragments, words, and expressions, additions, and substitutions, both locally and globally.

Numerous factors may contribute to cognitive load during language production (for examples and overviews addressing different factors influencing cognitive load see Barkaoui 2019; Bourdin and Fayol 1994; Feng and Guo 2022; Johansson 2009; Kellogg 2008; Kellogg et al. 2016; Lively et al. 1993; Lourdes Ortega 2009; Manchón 2020; Song and Li 2020). Existing research in this area suggests that writers' and speakers' linguistic proficiency (including factors such as producing in one's first or second/third language, as well as overall grammatical and lexical knowledge), age, and education will influence fluency during language production. In addition, factors such as knowledge of genre, topic, and the amount of preparation, as well as grammatical complexity will have an impact. Finally, contextual factors such as sleep, hunger, general comfort, distracting factors in the current situation, etc., will sway the performance. In sum, differences in execution at the group level are expected; for example, first-language speakers are generally more fluent than second-language speakers, or increased age and education lead to more fluent speaking and writing (compared to children). Apart from this, overall between-subject findings and substantial within-subject findings can also be expected. That is, a person does not always pause, revise (in writing), or demonstrate disfluencies (in speaking) in a consistent way. The context will matter in this respect. For all these reasons, it is necessary to establish an individual baseline or include a control condition in all research using the assumed symptoms of cognitive load during language production (such as pausing and revision) as indications of—in this case—lying.

Thus, with all things being equal, in this case, it is assumed that, when a person engages in deceptive communication, an augmented cognitive load can be reflected in the language production processes. As mentioned, reaction time studies on deception have shown that both prompted and unprompted lies lead to an increase in response time during lies (Duran et al. 2010; Debey et al. 2012; Williams et al. 2013; Walczyk et al. 2013; Suchotzki et al. 2017; Bott and Williams 2019). Increased cognitive load during lying would be caused by the speakers/writers having to concurrently devise *what* to say/write and determine *how* to say/write it: organize the sequence of (for instance) narrative events, select an appropriate syntactic structure, and choose the lexical items. Additionally, the speakers/writers would have to actively maintain a mental representation of the truthful version of the events and continuously decide *when* and *how* they wish to deviate from this. All these factors add to working memory demands.

4. Speaking and Writing

Language production is an over-arching term for the modalities of speaking, writing, and using sign language (which will not be addressed here). Below, researchers outline some fundamental characteristics that apply to spoken and written discourses and that will influence the behavior of speakers/writers. These factors will thus be relevant to keep in mind when one discuss causes for increased cognitive load during language production. Here, researchers disregard situations such as instant messaging or fast-written conversations, spoken conversations on the phone, or messages in delayed mode (i.e., voice mail and voice messages), where some of the characteristics of the modality will be less prominent. Researchers use a contrastive focus and address the three themes: *time*, *receiver*, and *permanence*.

4.1. Time

The difference in production speed is an essential factor for understanding how speakers and writers distribute their resources during language production. The rate at which language can be produced in the two modalities is profoundly different; we speak much faster than we write. A common estimation is that speaking (in English) allows for a speed of 120 to 200 words per minute, corresponding to approximately 2–10 syllables or 8–15 phonemes per second (Crystal and House 1990; Schreiber and McMurray 2019), while a proficient typist would produce 38–40 words per minute (Hayes and Chenoweth 2006). The differences can mostly be attributed to the fact that speaking "only" requires the use of the vocal apparatus for expression, whereas writing requires the use of some artifact, e.g., pen and paper, keyboard, screen, etc. The writers' mastering of the artifact and often, the limitation of the artifact itself, introduce an intrinsic latency in the transformation from one's thoughts into linguistic expression (Grabowski 2008).

In the context of speaking, there are one or more listeners waiting for the delivery of the message and they can potentially interrupt. As a result, speakers will often experience time constraints and consequently use strategies that allow them to plan what to say while keeping the floor. This encompasses the use of filled pauses (*eh, um*) to indicate that more will come, to repeat and reformulate words and phrases, and to allocate silent pauses within syntactic units. These strategies are typically learned very early in life through numerous interactions and observations of spoken contexts, and speakers are very rarely aware of this behavior. The context for writing is normally different: even in stressful situations, writers will have comparably more time to think, generate text, and edit it before handing it over to a reader.

4.2. Receiver

Another substantial distinction between the modalities is the presence or absence of a receiver, or in other words, a listener or reader (Chafe and Danielwicz 1987; Chafe and Tannen 1987). Speakers often rely on the listeners' reactions to determine if, and when, more information is required (Levelt 1989; Barker et al. 2020). Conversely, writers must anticipate the readers' knowledge and needs and tailor the text accordingly. This inherent uncertainty can result in extensive revisions during and after text production (Flower and Hayes 1981; Hayes et al. 1987). However, these revisions and alterations are usually not visible to future readers, something that can be contrasted to the spoken context where listeners will be aware of all modifications made during speaking. Speaking is thus described as a dialogic activity, while writing is characterized as monologic (Linell 2009).

4.3. Permanence

The visibility and (relative) permanency of the written message in relation to the fugitive nature of the spoken message is yet another factor to consider. The fleeting spoken discourse necessitates repetition if the speakers need to reinforce certain points (Levelt 1989; Clark 1996). The listeners can also readily discern hesitations and repetitions, phenomena that help signal that the turn is ongoing and that the speakers want to keep the floor (Norrby 2014). Importantly, studies suggest that these disfluencies also facilitate the understanding of the spoken message (Clark 1996; Fox Tree 2001; Fox Tree and Schrock 2002). Conversely, when readers encounter a written text, it typically lacks visible traces of prior revisions.

The permanent condition of the written message is one contributing factor to the higher status of written language (cf. Chafe 1994). The visible language and the delay between the written production and the readers' reception also lead to a strong cultural expectation (reinforced by, e.g., the importance of writing skills posed by formal education and schooling) that the message should be edited and perfected before being handed over (cf. the different functions of spoken and written language outlined by, e.g., Biber 1988; Halliday 1985). The permanency is probably also a fundament for researchers' view that written agreements and contracts are more reliable and binding than (undocumented) oral equivalents: it is more difficult to prove what was said than what was written. Writing thus includes an important component of understanding that one can and is expected to revise the written text before it is finished and that the revisions will be (largely) invisible to readers, especially for computer-written texts (Einarsson 1978). This belief would contribute to writers' revision behavior and how it is distributed throughout a writing session.

In summary, on the one hand, speaking is characterized by its quick, instantaneous, and synchronous nature, with (typically) present listeners who witness the entire overt language process and can actively contribute to the spoken message through oral and visual feedback (e.g., nodding or asking questions). On the other hand, writing typically unfolds more slowly, in isolation without readers present. The written message needs to be decontextualized and is read later and (often) in a different place, which, in turn, requires that writers anticipate what the future readers need to understand the context. The characteristics of spoken and written discourse will influence the type of processes that can be observed during language production in the two modalities.

5. Models of Language Production in Speaking and Writing

The description of spoken and written modalities outlined above have been addressed in theoretical models attempting to identify and sequence the different processes involved in speaking and writing. Overarching models, covering both speaking and writing are hard to find (but see Cleland and Pickering 2006). Instead, researchers here present some features in the most seminal models for speaking and writing to establish a terminology for the most described processes during language production (note that the description is delimited to stage models):

Models of speech production (e.g., Fromkin 1973; Levelt 1989) distinguish between different stages of production that unfold (somewhat) successively. In a simplified description of the process, it commences with *conceptualization*, where the content is decided, followed by *sentence formation*, where lexical decisions are made, and *syntactic structuring*, determining word order, and ultimately *articulation*. During articulation, the speaker is also engaged in constant *monitoring* of what they are saying, as well as being attuned to the listener's reaction (while at the same time moving on with the production of the next utterance).

Other theories of spoken production emphasize that the speech process is facilitated by certain mechanisms. For instance, Linell (2009) highlights that grammatical constructions used in speech have been internalized by the speaker through prior practice in various situations (cf. Clark 1996 who described how much is given in a conversation, for

example, in question-answer constructions). Despite these facilitating mechanisms during speech production, the task of having to *plan what to say while saying it* can still be daunting.

Models of written production (e.g., <u>Flower and Hayes 1981</u>) distinguish between three main processes: *planning*, *translating*, and *revision*. Planning entails the formulation of ideas, text organization, and text generation (on a conceptual and linguistic level), while translating involves rendering these ideas into their orthographic form. Revision encompasses reading and evaluating the text to align with the writers' intended goals, and based on this, editing the text if necessary. These processes are iterative and recursive during the unfolding of text production; thus, one should understand the processes of planning, translation, and revision to be carried out at a local level within short time frames, although they could also be applied for understanding the writing process at a more global text level and on a long-term perspective.

Revisions in writing can take place at any point during the writing process, whenever the writers see fit. This flexibility means that revisions can occur at various locations within the text; writers may edit at the leading edge of the text they have produced so far or make changes at some other point in the text they have already written (<u>Lindgren et al. 2019</u>).

In sum, the theoretical frameworks for speaking and writing, despite differences in terminology, include some common components, such as those of *pre-activities*: conceptualization, sentence formation and syntactic structuring in speech, and planning in writing, those of *text generation*: articulation and translating, and finally, those of *post-activities*: monitoring and revision. Of these processes, it is only the articulation and translation components that are overt and observable, while the other processes need to be inferred or rely on self-reporting methods. Cognitive load during speaking and writing will thus typically be discernible through interruptions in the execution of the message.

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