Telling Lies in Scarce Environments

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Abstract

Scarcity of basic needs, such as food, time, or money, has a gripping psychological impact on those without. Evolutionary theorists from fields as diverse as psychology, biology, and computer science hypothesize that resource scarcity may have been the impetus for the evolution of deception. However, no research has tested whether scarce (vs. enriched) environments facilitate or impair the ability to tell lies successfully. Since successful deception depends on the same cognitive and emotional systems scarcity depletes, we hypothesized that environmental scarcity would lead to ineffective deception. We tested this hypothesis in three studies: Study 1 examined television footage of an international sample of criminal suspects ($N = 59$), including genuinely distraught individuals ($n = 33$) and to-be-convicted murderers ($n = 26$) emotionally pleading to the public for the return of a missing relative. Liars in scarce environments (vs. abundant) exhibited significantly more nonverbal cues of deception. Study 2 utilized a controlled experimental design ($N = 79$) to provide causal evidence linking environmental scarcity to greater deceptive behavior. During an interrogation about a theft, liars in a scarce environment (vs. abundant) exhibited more deceptive nonverbal cues, experienced a greater neuroendocrine stress response, and were more accurately detected by a sample of 66 naïve observers (Study 3). Taken together with prior research, findings suggest that while scarcity may increase the rate of deception, scarcity simultaneously decreases the ease and success with which lies are told. Results have implications for research and practice focused on lie-detection in organizational, forensic, and homeland security settings.
Telling Lies in Scarce Environments

A person might be considered cynical for saying, “everybody lies,” when in fact, that statement would be a gross underestimation of the ubiquity of deception on planet Earth. Lies are far from unique to human interactions. In fact, many living organisms deceive—including bacteria (Coyne, Reinap, Lee, & Comstock, 2005; Göpel & Görke, 2014), plants (Jersakova, Johnson, & Kindlmann, 2006), and human and non-human primates (e.g., Bryne & Corp, 2004; DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996). Even tiny wheeled robots with simple neural networks, programmed only to signal the presence of food and poison, quickly evolve deceptive communication strategies in order to survive (Floreano, Mitri, Magnenat, & Keller, 2005). Indeed, deception is theorized to have evolved in order to maximize survival (Hamilton, 1964), and poor lie-telling is considered a handicap (Zahavi & Zahavi, 1997), potentially encouraging the development of elaborate forms of self-deception (Krebs & Dawkins, 1978; von Hippel & Trivers, 2011).

Necessity is the Mother of Invention

If survival was the ultimate goal, environmental scarcity was likely a catalyst for the development and proliferation of deception. When access to resources was restricted, a wide variety of deceptive strategies are hypothesized to have emerged, improving the liar’s chance of survival. For example, when desired resources are scarce or closely guarded, mimicking a non-competitor may allow a deceiver precious access; by closely resembling angelfish, both in behavior and appearance, surgeonfish are permitted to forage on the territory of damselfish—who vigorously defend their territory from the latter but not the former (Rainey & Grether, 2007). In a more intentional form of deception, chimpanzees quickly learn to conceal information and actively mislead conspecifics when competition exists for a food reward (Woodruff & Premack, 1979), and humans will do the same when money is at stake in a competitive negotiation.
(Schweitzer, DeChurch, & Gibson, 2005). That is, research on human and non-human primates demonstrates that scarcity—operationalized a number of different ways—increases the rate of deception and other dishonest acts (in spider monkeys: Chapman & Lefebvre, 1990; in capuchin monkeys: Di Bitetti, 2004; Hauser, 1992; Hauser & Marler, 1993; Wheeler, 2010; and in humans in organizational contexts: Bohle & Meier, 2002).

While research supports the claim that scarcity leads to more lie-telling, it is not clear that scarcity will lead to effective lie-telling. In fact, we suspect the opposite. The psychological state caused by resource scarcity is an unpleasant one; scarcity causes anxiety and mental taxation, leading to poor decision-making, diminished learning and a decreased sense of control (Kraus, Piff, & Keltner, 2009; Mani, Mullainathan, Shafir, & Zhao, 2013; Mullainathan & Shafir, 2013; Shah, Mullainathan, & Shafir, 2012; Sweller, 1988). Thus while conditions of scarcity may increase the frequency of deception, they are also accompanied by a suite of cognitive and emotional effects that are likely to burden the liar and decrease the effectiveness of their lie—this is the focus of the current research. We predict that conditions of scarcity will make lies less effective by making them more difficult to produce and more vulnerable to detection.

**Effective Deception Depends on the Same Cognitive and Physiological Systems Scarcity Depletes**

Telling lies is a difficult task. A liar must provide enough detail to appear credible but not so much information as to make recollection of these details difficult or suspicious. Simultaneously, liars must stifle feelings of guilt and fear of detection while falsifying emotions consistent with their tall tale. Furthermore, liars often devote attention to controlling their behavior in an attempt to appear credible (Vrij, 2008). In most instances, the task of juggling these simultaneous demands is too much, and signals of anxiety or cognitive load are inadvertently revealed in the face, body, or voice of liars (DePaulo et al., 2003).
Scarcity may make lying even more taxing as it depletes the same cognitive and emotional resources that are necessary to effectively communicate deception. Under conditions of scarcity, liars experience compounding sources of cognitive load and anxiety, making behavior doubly difficult to control.

**Experiencing Scarcity**

While the effects of scarcity can be experienced when one has too little of a valuable resource (e.g., money, time; Mullainathan & Shafir, 2013), we propose that the psychological experience of scarcity occurs even upon entering a scarce environment. Such an effect is well-known in marketing research and practice. A store with harsh lighting, linoleum floors and narrow aisles has a sparse “discount” image, while luxury stores are opulent and outfitted with soft lighting, carpet, and wide aisles (Gardner & Siomkos, 1986). Customers feel more comfortable in the abundantly-decorated settings, items in these “rich” environments are perceived to be more valuable, and greater intentions to purchase are reported, relative to sparsely-decorated stores (Baker, Parasuraman, Grewal, & Voss, 2002). In effect, abundantly-decorated environments can prompt us to behave as if we have means, while scarcely-decorated environments prompt us to behave as if we are without means.

Importantly, the more basic cognitive and emotional effects of scarcely-decorated spaces mirror the experience of having too little. Participants in a scarcely-decorated office report feeling more anxiety and make more mistakes on an attention task, relative to those in an office abundant with brightly colored posters and plants (Knight & Haslam, 2010). These are the effects of scarcity that we expect will compound with the inherent challenges of lying to make deceit even more difficult to conceal. One need only examine the stereotypical set of a Hollywood criminal interrogation room to recognize our collective hypothesis regarding the difficulty of lying in a scarce environment. And though real interrogation rooms rarely take this stereotypical
form (D. Baxter, personal communication, March 21, 2014), we provide a theoretical framework and empirical evidence to suggest that environmental scarcity may indeed make it easier to spot liars.

**The Current Research**

We tested the hypothesis that environmental scarcity would lead to ineffective deception. Liars in scarce environments were expected to exhibit greater signs of deceptive behavior (signals of anxiety and cognitive load; Hypothesis 1) and be more accurately detected by naïve observers (Hypothesis 2) relative to lies told in an abundant environment and truths in either setting. In Study 1, we examined the effect of environmental scarcity on behavior during extremely high-stakes, emotional pleas to the public for the return of a missing loved one; pleaders were potential suspects in a missing persons case and were later determined to be either deceptive murderers, eventually convicted of killing the person they pleaded to find, or genuinely distraught relatives with no involvement in the missing person’s disappearance. In Study 2, we manipulated environmental scarcity and truth in an experiment in which participants genuinely or falsely plead their innocence in the theft of $100. Subjects completed measures of stress and provided saliva samples to be analyzed for neuroendocrine stress response. Interrogation videos were coded for cues of deceptive behaviors and were shown to a separate sample of naïve observers to examine whether liars in scarce environments were easier to detect than liars in abundant environments and truth-tellers in either environmental condition (Study 3).

**Study 1**

To conduct an ecologically-valid test of Hypothesis 1, we examined field data of suspected murderers in Canada, the US, the UK and Australia from 1985 to 2009 to test whether deceptive behavior was related to the scarcity of the environment in which genuinely distraught relatives and deceptive murderers appealed for missing persons.
Methods

Persons of Interest: Deceptive Murderers and Genuinely-Distraught Relatives

Televised footage of (N = 59) criminal suspects emotionally pleading to the public for the return of a missing relative was previously collected and coded for deceptive behaviors by ten Brinke and Porter (2012). Of these suspects, 26 (20 male) were deceptive murderers who were guilty of killing the person they pleaded to find. The remaining 33 suspects (17 male) were not involved in their relative’s disappearance and were genuinely pleading for their safe return. Deceptive murderers were labeled as such if they had been convicted of the missing person’s murder based on strong physical evidence (e.g., possession of the murder weapon or the victim’s remains, DNA, etc.). Genuinely distressed individuals were labeled as such if they were innocent of murdering the missing loved one they pleaded for on television. These missing persons were either determined to have gone missing in the absence of foul play (e.g., ran away; suicide) or were murdered by another, unrelated individual who was eventually convicted based on similarly strong physical evidence as described above (ten Brinke & Porter, 2012). All videos were previously shown on public television in the United States, Canada, the United Kingdom, or Australia. Inclusion in this study was limited to appeals that occurred in an indoor environment.

Coding Environmental Scarcity and Deceptive Behavior

Environmental Scarcity. Three ratings of scarcity dimensions were made for the environment in which each individual provided their public appeal. Ratings of scarcity of color, objects, and texture were made on 7-point Likert scales. Ratings were combined into a mean scarcity score to describe each pleader’s environment. Inter-rater reliability was established on the full set of videos, with two independent coders.¹

¹ The primary coder was not entirely blind to the veracity of appeals; however she was highly reliable with two other coders blind to veracity and/or hypotheses (average Crohnbach’s alpha =
Deceptive Behavior. Behavioral cues to deception were selected based on what had previously been found to reliably dissociate truth-tellers from liars in this high-stakes, emotional context (ten Brinke & Porter, 2012). A composite deceptive behavior score was created for each pleader by calculating their mean rating on each of the following z-scored variables, tapping cognitive load and emotional arousal: decreased word count, tentative word use, increased duration of smiles (up-turned lips; zygomaticus major activation; this behavior is considered inappropriate in a genuine appeal and may signal duping delight; Ekman, Friesen, & O’Sullivan, 1988), and decreased duration of sadness (particularly among muscles in the forehead: frontalis and corrugator; this behavior is consistent with a genuine appeal but is difficult to falsify in the absence of genuine sadness; ten Brinke, Porter, & Baker, 2012).

Results & Discussion

Supporting Hypothesis 1, environmental scarcity increased deceptive behavior of lying murderers, $r(26) = .512, p = .008$, but not genuinely distressed individuals, $r(33) = .026, p = .884$ (see Figure 2). A $z$-test, comparing the Pearson correlations coefficients for genuine and deceptive appeals, revealed that the effect of environment was significantly greater for deceptive individuals, $z = 1.95, p = .051$. That is, environmental scarcity was associated with ineffective deception even among a highly-motivated, forensic sample of murderers.
Figure 2. Effect sizes (r) of the relationships between environmental scarcity ratings and deceptive behaviors during genuine and deceptive public appeals.

Experiment 2

Following dramatic evidence for the effect of environmental scarcity on deceptive behavior in a sample of murderers, we conducted an experiment (a) to establish that scarcity causes ineffective deception and (b) to investigate the behavioral and physiological outcomes related to deception under scarcity. To this end, participants genuinely or falsely pleaded their innocence in the theft of a $100 bill, either in a scarcely or abundantly decorated office. Testing Hypothesis 1, we compared behavior exhibited by liars in the scarce environment to the behavior of liars in the abundant environment and truth-tellers in both environmental conditions.

Method

Participants

A total of 81 subjects (M_{age} = 20.86, SD = 2.39; 41 females) participated in exchange for either $16 or course credit. Participants were randomly assigned to plead, genuinely (n = 44) or falsely (n = 37), that they did not steal a $100 bill from a scarcely (n = 43) or abundantly (n = 38) endowed physical space. An additional four subjects completed the experiment but were excluded from subsequent analyses for not following instructions.
Materials & Procedure

The experiment used a 2 (scarce vs. abundant environment) x 2 (genuine vs. deceptive denial) between-subjects design. Subjects were randomly assigned to complete the experiment in either a scarcely or abundantly decorated office. After completing a consent form, participants provided a baseline saliva sample. The experimenter left the room and subjects were randomly assigned and instructed by computer to either steal or not steal a $100 bill hidden in a wallet in the room. All participants were instructed to deny stealing the money and financially incentivized to do so successfully. Following the theft, the experimenter, who was blind to veracity condition, entered the room and interrogated the subject. After the interrogation, the subject completed filler questionnaires on the computer for an average of 22 minutes (SD = 4.15) to allow salivary cortisol reactivity to approach its peak level. Following this, the participant provided a post-interrogation saliva sample, was debriefed, paid and excused.

Manipulating Environmental Scarcity

A standard office space was manipulated to be either scarcely or abundantly endowed. In the scarce condition, the office contained only an empty desk, simple chair, small computer screen and plain overhead cabinet—minimal objects necessary for completion of the experiment. In the abundant condition, extending a manipulation used by Knight and Haslam (2010), many colorful, textured, varied, and complex items were added to the environment—all were items possibly found in an office setting (e.g., pens, highlighters, post-it notes, framed pictures, posters, candles, an alarm clock, a lamp, a figurine and a potted plant) were added. These were intended to enrich the space by increasing the presence and variation of colors, objects and textures in the room (see Figure 3).
Top panel depicts all of the objects that were placed in the abundantly-decorated room to manipulate environmental scarcity. The scarcely-decorated condition included no decorative objects and only a dark brown chair on which the participant sat (bottom panel).

A pilot test examined the psychological mindset caused by these two scarcity conditions (scare vs. enriched). Participants ($N = 77$; 41 female; $M_{age} = 21.55$, $SD = 2.50$) rated their experience while sitting in the rooms in a between-subjects design. A manipulation check question which read “This room is decorated” was answered on a 1 (strongly disagree) to 7 (strongly agree) scale and confirmed that participants found the scarce environment ($M = 1.64$, $SD = .96$) to be less decorated than the abundant environment ($M = 5.71$, $SD = 1.06$), $t(75) = -17.64$, $p < .001$. Importantly, those assigned to the scarce environment rated the room as less
psychologically comfortable ($M = 4.06, SD = .78$) than those in the abundant environment ($M = 4.56, SD = .73$) using a 9-item measure developed by Knight and Haslam (2010), $t(75) = -.2.91, p < .01$. For example, participants in the scarce environment agreed less with statement: “I felt at ease in this room,” and agreed more with the statement: “I felt tense in this room.” Finally, participants in the scarce environment had many more scarcity-related semantic concepts available and accessible to them relative to those in the enriched environment. Specifically, using a lexical decision task, participants in the scarce environment were significantly faster at identifying scarcity-related words (e.g., lack, bare, less, scant, scarce, shortage) than matched control words ($M_{difference \ (scarcity - matched \ control)} = -4.06, SD = 66.86$), as compared to those in the abundant environment ($M_{difference} = 30.61, SD = 80.56$), $t(74) = -2.04, p = .045$. Together, these findings provide evidence that the scarcely-decorated room shifted mindsets toward scarcity—participants felt significantly less comfortable and poverty, scarcity, and having too little were top of mind.

**Salivary Collection Procedures**

Standard salivary-hormone collection procedures were used to measure cortisol (Dickerson & Kemeny, 2004; Stanton & Schultheiss, 2009). Participants were asked not to eat, drink, or brush their teeth for at least 2 hours prior to providing saliva and completed a questionnaire so that refrainment from these activities could be verified. Additional questions asked participants about menstrual cycle and exercise—no data exclusions were necessary. Experimental testing was conducted between 11 am - 5 pm. Before providing both saliva samples, participants rinsed their mouths with water to remove debris and then provided approximately 1.5 ml of saliva through a straw into a sterile polypropylene microtubule using a passive drool method. Samples were immediately frozen to avoid hormone degradation and to precipitate mucins. Analysis was conducted by Salimetrics. A subset of all samples (10%) were
assayed in duplicate for salivary cortisol using a highly sensitive enzyme immunoassay; duplicate assays were highly reliable. The intra-assay coefficient of variation (CV) for duplicate assays was 3.36%. One individual’s baseline cortisol level was far outside of the normal range at 1.960 µg/dl (> 16 standard deviations above the mean), likely indicating contamination of the sample; this individual was excluded from analysis. Three additional participants’ data were not analyzed as they were unable to provide the requested volume of saliva necessary for reliable measurement. Cortisol levels of the remaining 77 participants were in the normal range at both baseline ($M = .175$ µg/dl, $SD = .106$) and follow-up ($M = .197$ µg/dl, $SD = .16$). A standardized $z$-score measure of cortisol reactivity was calculated for each participant after subtracting their baseline cortisol level from their post-interrogation measurement.

**High-Stakes Mock Crime**

A “high-stakes mock-crime paradigm” was borrowed from the criminal justice literature (for a review, see Kircher, Horowitz, & Raskin, 1988). This paradigm has also been used in the social psychological deception literature (e.g., Carney, Yap, Lucas, Mehta, McGee, & Wilmuth, 2014; DePaulo, Wetzel, Sternglanz, & Wilson, 2003; Frank & Ekman, 1997).

Once alone in the room, subjects were randomly instructed by the computer to steal or not steal a $100 bill from a wallet in the room. Subjects in both conditions were told that if they could successfully convince the experimenter that they had not taken the $100 bill, they would be allowed to keep the money. Thus, all participants were significantly incentivized to be convincing during the subsequent interrogation. See Figure 4 for the verbatim instructions subjects were given.
Figure 4. Verbatim computerized instructions for participants in the truth (left) and lie (right) conditions.

After subjects indicated that they were ready for further directions, the experimenter entered the room and interrogated the subject by asking a series of questions. First, “baseline questions” (i.e., neutral questions not pertaining to the mock theft but which are verifiable) were asked, followed by “critical questions”. A baseline question, for example, was: “What are you
wearing today?” Examples of critical questions include: “Please describe to me, in as much detail as possible, everything that happened since you arrived to participate in this experiment,” “Did you steal the money from this office?” and “Why should I believe you?”

Sixty-three participants provided consent for the use of their videos in future research; these videos (36 truthful, 27 deceptive) are freely available for research use from the authors.

**Coding Deceptive Behavior**

Interrogations were recorded with a video camera and later coded for behavioral cues associated with deception. In particular, the following behaviors, indicating elevated cognitive load and anxiety, were coded: decreased word count, slowed speech rate, increased speech hesitations, greater appearance of “thinking hard”, a general impression of being uncooperative, increased expression of false smiles, and fewer pronouns. These cues have all been established as reliable signals of deception and have been used extensively in prior research (DePaulo et al., 2003).^2^ Nonverbal behaviors (“thinking hard”, cooperativeness, and frequency of false smiles) were coded by individuals who were blind to condition and hypotheses. 22.22% (n = 18) of participants were double-coded to assess inter-rater reliability, which was found to be acceptable for all variables (Crohnbach’s alphas were .86, .77, and .88 respectively). Verbal responses were transcribed and subjected to linguistic analysis using the LIWC program (Pennebaker, Booth, & Francis, 2007) to analyze word count, speech rate (word count/duration of response), proportional frequency of speech hesitations and pronoun use. In line with the baseline theory of deceptive

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^2^ These behaviors tap the same fundamental psychological constructs as those in Study 1, but were chosen for maximum likelihood of discriminating genuine versus deceptive denials of transgressions, specifically. Because behavioral signals of deception are known to differ as a function of lie type (DePaulo et al., 2003), behaviors examined in Study 1 do not map directly onto those chosen for Study 2. For example, while the lack of genuine sadness signals insincerity in public appeals, the same behavior has no relevance in the deceptive denials told here.
behavior, the difference between each behavior from baseline to relevant questions was calculated (Ewens, Vrij, Jang, & Jo, 2014). Standardized z-scores of each behavioral difference were averaged to create a composite deceptive behavior score.

**Results & Discussion**

We predicted that liars in the scarce condition would engage in the most deceptive behavior compared to all other conditions. As such, an *a priori* contrast weight sequence 3, -1, -1, -1, was used to test this hypothesis, across scarce-environment liars, scarce-environment truth-tellers, abundant-environment liars, and abundant-environment truth-teller conditions. Furthermore, a -1, 1, -1, 1, contrast sequence was used as a manipulation check to ensure that liars did indeed engage in more deceptive behavior than truth-tellers.

**Scarce Environments Increases Liars’ Deceptive Behavior**

A one-way ANOVA on condition (scarce liars, scarce truth-tellers, abundant liars, and abundant truth-teller) was conducted with contrasts testing the main effect of veracity and comparing the behavior of liars in the scarce condition to all others. As expected, the effect of condition was significant, $F(3, 77) = 1.20, p = .001$. Liars had significantly greater deceptive behavior scores than truth-tellers, $t(77) = -2.74, p = .008$, and liars under conditions of scarcity leaked more deceptive behavior than individuals in any other condition, $t(77) = 3.40, p = .001$ (see Figure 5).
In addition to deceptive behavior scores, increases of the stress hormone, cortisol, were examined. Cortisol levels are regulated by the hypothalamic–pituitary–adrenocortical (HPA) axis and can have negative implications for mental and physical health. For example, low socioeconomic status is associated with both higher basal cortisol levels and negative health outcomes including greater chance of illness and reduced longevity (McEwen & Gianaros, 2010). Prior research has found that the mock interrogation described here, among other tasks that feature motivated performance and social-evaluative threat, cause a significant increase in cortisol levels (Carney et al., 2014; Dickerson & Kemeney, 2004). Using the same statistical approach as above, a one-way ANOVA on condition was conducted with contrasts testing the main effect of veracity and comparing the cortisol reactivity of liars in the scarce condition to all others. As expected, the effect of condition was significant, $F(3, 73) = 2.97, p = .037$. Liars ($M =$
.24, SD = 1.26) showed significantly greater cortisol reactivity than truth-tellers (M = -.22, SD = .61), t(73) = -2.06, p = .043. Further, liars under conditions of scarcity evidenced greater cortisol reactivity than all other groups combined, t(73) = 2.82, p = .006.

Figure 6. Standardized difference scores indicating cortisol reactivity, from baseline to post-interrogation, for genuine and deceptive mock-crime pleaders in scarcely- and abundantly-decorated offices. Higher scores indicate greater reactivity.

Study 3

Studies 1 and 2 establish that deception under conditions of scarcity is less effective in that it is accompanied by greater signals of anxiety and cognitive load. However, for this to be practically relevant, observers should be able to pick up on these differences. Study 3 directly tests Hypothesis 2, which posits that liars in a scarce-environment will be more easily detected by the naïve observer. While research suggests that humans are poor lie detectors, performing at or only slightly above chance (54%; Bond & DePaulo, 2006), even untrained observers appear to
use accurate behavioral signals to make veracity decisions (Hartwig & Bond, 2011). Low accuracy rates then, may be attributable to the subtlety of deceptive behaviors rather than observer ineptitude and liars in scarce conditions, who engage in increased deceptive behavior, should be more accurately detected (and therefore less effective) than abundant-environment liars, or truth-tellers in either environmental condition.

**Method**

**Participants**

A separate sample of 66 subjects ($M_{age} = 20.14$; 31 females) were recruited to watch a subset of the videotaped interrogations, described above, and complete a deception detection task in exchange for $16. All subjects followed instructions and were included in subsequent analyses.

**Materials and Procedure**

Naïve participants with no training in deception detection were recruited to watch 24 videos of individuals who plead their innocence in the theft interrogations described in Study 2, including 6 liars and 6 truth-tellers from the scarcely-decorated office and 6 liars and 6 truth-tellers from the abundantly-decorated office. Videos were randomly selected and edited to a) crop out any visual signals of the environmental condition and b) include only two critical interrogation questions (specifically, “Did you steal the money from this office?” and “Ok – then please describe to me, in as much detail as possible, everything that happened since you arrived to participate in this experiment.”). After watching each video, participants completed a binary forced choice measure asking whether they thought targets were lying or telling the truth.

**Results**

**Scarce Environments Make Liars Easier to Detect**

A 2 (veracity) X 2 (environment) repeated measures ANOVA revealed a main effect of environment, $F(1, 65) = 11.73, p = .001$; observers were more accurate at detecting the veracity
of statements produced in scarce, relative to enriched, environments. Consistent with previous research, there was no significant main effect of veracity, $F(1, 65) = 1.31, p = .257$, however, as expected, veracity interacted with environment, $F(1, 65) = 4.99, p = .029$ (see Figure 7). Again, an a priori contrast supported Hypothesis 2, which postulated that liars in scare-environments ($M = 56.06, SD = 20.18$) would be detected more accurately than all others, $F(1, 65) = 4.67, p = .034$. Further, only scarce-environment liars were detected at a rate significantly greater than chance, $t(65) = 2.44, p = .017$. In contrast, the detection of liars in an enriched environment ($M = 44.44, SD = 17.86$) was significantly below chance, $t(66) = -2.53, p = .014$. The detection of truth-tellers in either environment (scarce: $M = 54.29, SD = 18.79$; abundant: $M = 52.78, SD = 20.38$) did not differ from chance, $p$s > .05.

![Figure 7](image)

**Figure 7.** Percent accuracy in detecting genuine and deceptive pleas in scarcely- and abundantly-decorated offices, by naïve observers.

**General Discussion**

Results from one observational field study and two experiments offer support for our hypotheses that telling lies under conditions of environmental scarcity is both more difficult and
less successful than telling lies under conditions of environmental abundance. Specifically, scarce environments increase the extent to which liars inadvertently betray themselves through their verbal and nonverbal behavior and allow them to be more accurately detected by naïve observers (compared to liars in enriched environments or truth-tellers). Effects of environmental scarcity on deceptive behavior were robust—affecting neuroendocrine functioning and influencing the leakage of verbal and nonverbal signals of deception even in highly uncontrolled settings and among a criminal population. Consistent with past research, these findings illustrate the psychological Catch-22 associated with experiencing scarcity (Shah et al., 2012). That is, while a successful act of deception could provide the poor with access to scarce resources, the emotional and cognitive effects of scarcity make liars more transparent to others and undermine their attempt to break free of their destitution.

In contrast, individuals in enriched environments lied with ease—experiencing minimal signs of stress or cognitive depletion, allowing them to escape detection by observers. In fact, liars in enriched environments were detected at a rate lower than would be expected by chance. These findings build on recent work by Carney et al. (2014b), which found that feeling powerful (defined as having access to and control over resources) can have a positive effect on the ability to lie. The powerful leaked fewer deceptive signals of anxiety and cognitive depletion, relative to the powerless. In fact, powerful liars did not behave differently from truth-tellers at all, and observers could not detect these liars at a rate above what would be expected by chance (Carney, et al., 2014a). Here we find that environmental scarcity operates like powerlessness. As such, it seems that those with abundant access to resources or in abundantly-decorated spaces only gain further advantage, widening the inequality gap between those with means and those without.

In addition to providing a unique illustration of the profound effect of scarcity on human behavior, results provide a practical lesson for lie detectors: when trying to detect deception, be
aware of your surroundings. Contrary to decades of research finding that deceptive behavior is subtle and can only be poorly detected (Hartwig & Bond, 2011; Bond & DePaulo, 2006), these findings suggest that cues to deception can be increased and accurately identified with a simple environmental manipulation. We add to an emerging literature which shows that cognitively challenging interviewing techniques can help more accurately identify the deceptive, without adversely affecting the innocent (Hartwig, Granhag, Stromwall, & Kronkvist, 2006; Vrij, Granhag, Mann, & Leal, 2011). Future research unraveling the manner in which environmental scarcity affects deceptive behavior will be important in understanding both how this basic evolutionary context affects human functioning and how it may serve as a novel, cheap, and simple context for enhancing lie detection.

More generally, these findings suggest that a scarce environment—in addition to previous research describing scarcity of resources, such as time or money—can dramatically affect how we feel, how we act, and how we are perceived by others. Further, this work builds on previously-reported effects of scarcity on decision-making (Shah, Mullainathan, & Shafir, 2012), and calls for investigations of the likely wide-reaching effects of scarcity on social interaction. Future research might also consider potentially adaptive outcomes of the cognitive and emotional tuning under conditions of scarcity. While this psychological state may be detrimental for the production of lies, perhaps it is better suited to other survival-relevant tasks, like the accurate identification of angry faces, anti-social personalities, or pylogenetic threats like snakes or spiders in the environment.

**Conclusion**

We find that the cognitive and emotional effects of scarcity decrease the ability to lie convincingly, leading to more behavioral “tells” in acts of deception by participants in a high-stakes theft experiment and real-world criminals. Additionally, despite decades of research
suggesting that human lie detection is surprisingly poor, our results suggest that lies told under conditions of scarcity can be accurately detected by naïve observers with no special training.

Furthermore, while scarcity might encourage the resource poor to steal food, time, or money to escape their perilous situation, the emotional and cognitive effects of a scarce environment in fact decreases the chances that they will get away with it leaving them in their state of deprivation.

Evidence suggests that, at least under conditions of scarcity, honesty really is the best policy.
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