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Authors
Chen, Jacqueline M
Banerji, Ishani
Moons, Wesley G
et al.

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Spontaneous social role inferences ☆

Jacqueline M. Chen [a,*], Ishani Banerji [b], Wesley G. Moons [a], Jeffrey W. Sherman [a]

[a] Psychology Department, University of California, Davis, One Shields Ave., Davis, CA 95616, USA
[b] McDonough School of Business, Georgetown University, Washington, DC 20057, USA

HIGHLIGHTS

- Perceivers spontaneously infer information about people from their behavior.
- We proposed that perceivers infer others' social roles from their behaviors.
- Three studies documented spontaneous role inferences (SRIs).
- SRIs were cognitively efficient, forming under cognitive load.
- SRIs had downstream consequences for trait impressions of targets.

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ABSTRACT

Past research has demonstrated that perceivers spontaneously infer individuals' goals, beliefs, and traits from their behaviors. These inferences processes are essential for predicting others' future behaviors and, thus, for smooth social interaction. Given that social roles (e.g., professor, mother) are also predictive of an individual's future behaviors, we proposed that perceivers spontaneously infer individuals' social roles from their behaviors. Across three experiments, including two different paradigms, we documented that perceivers formed spontaneous role inferences (SRIs) from single behaviors. SRIs occurred unintentionally, efficiently, and had important downstream consequences for impression formation. Namely, SRIs led perceivers to rate targets as higher on role-consistent traits. Together, these findings provide the first empirical demonstration of a novel process in impression formation.

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Spontaneous social role inferences

One of the earliest questions asked by social psychologists was: how do perceivers distill knowledge of another person from his or her behaviors? Humans have an unparalleled ability to extract valuable social information, such as intentions and dispositions, from the mere observation of another person's behavior. Given that others' social roles also provide important information about their intentions and future behaviors, we propose that perceivers also readily infer individuals' social roles from their behaviors.

It has been argued that perceivers' ability to quickly and readily infer others' mental states serves an evolutionary imperative: the ability to anticipate and predict others' future behaviors is necessary for cooperation and, consequently, survival (Humphrey, 1980; McCarthy &

Skowronski, 2011; Schaller, 2008; Whiten & Erdal, 2012). Knowing another person's traits would be particularly important for anticipating his or her future behavior (Heider, 1958). Consistent with this view, a large body of research has now demonstrated that perceivers readily extract trait information from others' behaviors, a process called *spontaneous trait inference* (STI; Winter & Uleman, 1984; see Uleman, Saribay, & Gonzalez, 2008, for a review). For instance, upon learning that Adam helped an old lady cross the street, perceivers infer that Adam is helpful. STIs occur quickly (Todd, Molden, Ham, & Vonk, 2011), without intention or awareness (Carlston & Skowronski, 1994; Todorov & Uleman, 2003) and are highly efficient (Crawford, Skowronski, Stiff, & Scherer, 2007; Todd et al., 2011; Todorov & Uleman, 2003). These findings generated a body of research documenting that perceivers also spontaneously infer targets' goals (Hassin, Aarts, & Ferguson, 2005). Thus, perceivers see in a single behavior the target's disposition and intentions.

Documentation of spontaneous inferences about others' traits and goals demonstrates some of the important social perception processes that enable smooth interaction. Yet people's actions are not solely caused by their internal states, such as goals and traits; their behaviors are multiply determined by their internal states and their situations. Indeed, social perception maps onto this reality in that, upon observing a

behavior, perceivers spontaneously infer properties of the target *and* of the situation (Duff & Newman, 1997; Ham & Vonk, 2003; Lupfer, Clark, & Hutcherson, 1990; Todd et al., 2011). For example, perceivers learning that an old lady jumped over a fence spontaneously infer that the fence is low. In the present work, we propose a novel inference process focusing on another determinant of individuals' behaviors: their social roles.

Social roles, or positions in society that are associated with specific expectations, responsibilities, and obligations, have been part of life since the earliest human societies (Massey, 2001). Social roles are a hybrid of dispositional and situational influences on human behavior. Social roles reflect disposition because people may be more or less suited to fulfill specific roles (e.g., a leader), and fulfilling a social role may lead a person to more fully develop or exhibit specific traits (e.g., assertiveness). Yet social roles are also situational because they are defined at a societal level, encompass rights and responsibilities that are mutually agreed upon by members of that society, and are likely to change over time (e.g., graduate student to professor).

Social roles are important predictors of human behavior in every society. In the U.S., adults' behaviors on an average weekday are largely determined by one type of social role: their occupation (U.S. Bureau of Labor Statistics, 2011). Moreover, people define themselves in part by the social roles that they occupy, such as *student* (McConnell, 2011). Thus, understanding the social roles of others would be extremely useful for forming impressions and being able to predict their future behaviors across a variety of situations. Given the importance of social roles in predicting behavior, we hypothesized that perceivers spontaneously infer social role information from individuals' behaviors. Spontaneous social role inferences are conceptualized as the process by which perceivers form a mental association between the individual and the inferred social role on the basis of that individual's behavior. Consistent with previous research (see Carlston & Mae, 2003; Uleman et al., 2008), we use the term *spontaneous* to indicate that the proposed inference process occurs *unintentionally* and *efficiently*. Across three experiments, we investigated the formation of spontaneous role inferences (SRIs) and its process characteristics.

Experiment 1

Experiment 1 investigated SRIs using the probe recognition paradigm developed by McKoon and Ratcliff (1986). This paradigm has been successfully adapted to examine two other types of spontaneous inferences: STIs (e.g., Uleman, Hon, Roman, & Moskowitz, 1996) and spontaneous situation inferences (SSIs; e.g., Ham & Vonk, 2003). In our adaptation of the probe recognition paradigm, participants read about people engaging in behaviors that afford inferences about their social roles. Immediately following each sentence is a probe word, and participants must decide whether the probe word was in the sentence. In experimental trials, the probe word is the implied social role. Control trials consist of trials in which the probe word is a role neither implied by nor contained in the sentence immediately preceding it. If the sentence led to an SRI, then it should be more difficult for participants to correctly respond "no" on experimental trials than on control trials. Therefore, evidence of SRIs is derived from longer latencies for correct responses or more false recognitions (erroneous "yes" answers) on experimental trials than on control trials. It is also important to note that SRIs impede accurate performance. Thus, to the extent that participants are motivated to do well on the task, they will not intentionally form SRIs. As such, evidence of SRIs is also consistent with the hypothesized unintentional nature of the process.

It is difficult to predict whether SRIs will produce effects on false recognitions or response latencies for any given sample of participants (Uleman et al., 1996). In addition, the likelihood of finding significant differences on both false recognitions and response latencies is reduced due to the speed-accuracy tradeoff (e.g., Wickelgren, 1977). Therefore, significant differences on either dependent measure are considered to be sufficient evidence of spontaneous inferences (Todd et al., 2011;

Uleman et al., 1996). Because we had no a priori hypotheses about whether evidence for SRIs would be exhibited in participants' false recognitions or response latencies, we analyzed both dependent measures. We hypothesized that participants would form SRIs, such that their false recognitions would be higher and/or their accurate response times would be longer for experimental trials compared to control trials.

Pretest 1: generating role-implying behaviors

Mirroring the research on STIs and SSIs, we generated a set of sentences that reliably implied social roles. For this purpose, the experimenters generated seventy-one sentences describing individuals performing different behaviors. These sentences were shown to a group of 34 undergraduates, who were asked to generate three social roles of individuals likely to perform each behavior. The social roles generated for each sentence were then collapsed across synonyms (e.g., "father" and "dad") and counted. Responses were not counted more than once if a single participant generated synonymous social roles to a sentence. Eight sentences were chosen for implying eight different social roles in at least 40% of the pretest sample (approximately the same consensus rate as the pretested materials in Ham & Vonk, 2003). Appendix A displays the eight sentences, their implied social roles, and the percentage of the sample that mentioned the implied social role.

Because our goal was to distinguish SRIs from STIs, we sought to develop stimuli that would not elicit STIs. To this end, we had also asked participants to generate three traits for each behavior. The eight role-implying behaviors did not reliably imply traits. Whereas the average sample agreement for implied roles was 68%, the average agreement for implied traits was only 16.5%. Although we cannot rule out the possibility of the role-implying stimuli eliciting STIs, the pretest established that stimuli more strongly implied roles than traits.

Method

Participants

In this and both subsequent experiments, we based sample sizes on norms in this research area. Eighty-seven undergraduates at a large public university were assigned to one of two between-subjects conditions of spontaneous inference type (role vs. trait). The STI formation condition used the same paradigm and similar materials, but it does not address our current research question and is not reported in this manuscript.

Forty-six participants (28 females) completed the SRI condition of the experiment in exchange for partial course credit. The average age was 19.67 years ($SD = 1.49$).

Materials and procedure

Upon entering the lab, participants learned that they would be participating in a reading comprehension task. They were told that they would read one sentence at a time. Following each sentence, a probe word would appear on the screen. The participants' task was to indicate as quickly and accurately as possible whether the probe word had been in the sentence immediately preceding it. To aid in the speed of their responses, participants were asked to place their index fingers on the "I" and "E" keys throughout the task. We counterbalanced whether "I" or "E" was assigned to the "yes" or "no" response option. Participants completed four practice trials with probe words unrelated to social roles prior to the experimental task.

Experimental materials consisted of sixteen sentences. Eight of the sentences had been pretested for implying unique social roles (e.g., "The person studied at the library" implying *student*; see Appendix A). Eight additional filler sentences explicitly included social role information as well as trait information (e.g., "The reporter was curious and

asked a lot of questions"). The filler sentences helped to obscure the focus of our investigation and avoid participants learning to process the experimental sentences for social role information. Each sentence was displayed twice, for a total of thirty-two randomized trials.

In the eight experimental trials, each role-implying sentence was followed by the implied role (matched). For the key control trials, the same eight sentences were followed by roles implied by other sentences (mismatched). In eight of the filler trials, each filler sentence was followed by the role explicitly contained in the sentence. In the other eight filler trials, each filler sentence was followed by one of the verbs contained in it (see Ham & Vonk, 2003). Therefore, the thirty-two trials were evenly divided in terms of the correct answer being "yes" or "no." After completing the experimental task, participants reported demographics and were debriefed.

Results

Because response key positions did not moderate the results below, our analyses collapsed across this factor.

False recognitions

False recognitions occurred when participants incorrectly identified the probe word as having been in the sentence. We conducted a paired samples *t*-test to compare false recognition rates between probe types (matched vs. mismatched probes). Although infrequent, false recognitions were significantly more likely to occur for the matched probes ($M = 0.41$ out of 8, $SD = .62$) than for the mismatched probes ($M = 0.04$ out of 8, $SD = .21$), $t(45) = 3.69$, $p < .001$, $d = 1.10$.

Response latencies

To reduce the influence of outliers on sample means, response latencies below 300 ms and above 3000 ms (1.1% of responses) were replaced with those values, respectively (e.g., Chen & Hamilton, 2012). Another paired samples *t*-test revealed that response latencies for correct responses were longer for the matched probes ($M = 1098$, $SD = 293$) than for the mismatched probes ($M = 1011$, $SD = 288$), $t(45) = 2.96$, $p = .01$, $d = 0.88$.

Discussion

The results of Experiment 1 supported our hypothesis that perceivers infer social roles from behavioral information. Accuracy was very high in Experiment 1 (on average less than one out of eight responses being inaccurate). These results are not surprising given that participants are asked about the content of a sentence that they have just read. Nonetheless, evidence from both false recognition rates and latencies of correct responses demonstrate that social roles were activated when role-implying behaviors were encoded. Namely, participants were more likely to incorrectly identify the implied role as being in the preceding sentence and, when they did answer correctly, this response took significantly longer compared to mismatched probe words. These findings are consistent with participants' unintentionally inferring social roles from role-implying behaviors.

Experiment 1 provided initial support for SRIs in demonstrating that social roles were activated when encoding role-implying behavior. However, the probe recognition paradigm that was used cannot provide conclusive evidence for SRIs, that is, that participants formed a mental association between a target and his/her inferred social role. Although our findings are consistent with SRI formation, they do not conclusively show that social roles were *inferred* from the behaviors. In order to conclusively show that SRIs are indeed inferences made about specific targets, we adopted another paradigm in Experiment 2.

Experiment 2

Experiment 2 was conducted with two goals. First, in conjunction with Experiment 1, we sought to provide converging evidence for SRIs using the savings-in-relearning paradigm (Carlston & Skowronski, 1994; Carlston, Skowronski, & Sparks, 1995). Relative to the recognition probe paradigm, the savings-in-relearning paradigm can better test whether targets' behaviors elicit actual inferences about those specific targets. Second, we directly tested whether SRIs had downstream consequences for impression formation such that targets would be perceived as having the traits consistent with their social roles. If SRIs are indeed inferences formed about targets, as opposed to mere concept activation in the presence of those targets, then SRIs should have predictable, trait-specific consequences for the perception of those targets.

The savings-in-relearning paradigm has provided strong evidence for STI formation (e.g., Carlston & Skowronski, 1994; Carlston et al., 1995). We adapted this paradigm to assess SRI formation. There are three stages to the paradigm. In the exposure stage, participants view a series of behaviors each performed by a different person displayed in a photograph. Some of the behaviors imply social roles whereas others do not. Importantly, passive instructions are given such that participants only believe that they are familiarizing themselves with study materials in order to avoid intentional or conscious impression formation during this stage (Carlston & Mae, 2003). To the extent that the instructions are followed, any inferences formed are unintentional and non-motivated. In the learning stage of the paradigm, participants are asked to learn target-role pairings and are told that their memory for the pairings will be tested later. Some of the pairings are consistent with the materials shown at exposure, such that the target is paired with the social role implied by his or her previous behavior. Other target-role pairings are unrelated to the behaviors presented in the exposure stage. After a filler task that is inserted to disrupt participants' short term memory of the pairings (Carlston & Skowronski, 1994; Carlston & Mae, 2003), there is the memory stage, in which participants are asked to recall the roles paired with each target. The key prediction is that, if SRIs are formed about specific targets during the exposure phase (i.e., participants form associations between specific targets and their implied social roles), participants' learning of those target-role pairings will be facilitated. As such, participants should exhibit a "savings" effect in the memory phase, such that they have better recall for targets' roles when the roles were implied by behavior than when they were unrelated to behavior. We hypothesized that evidence for SRIs would be obtained.

We also sought evidence for the downstream consequences of SRIs. Social roles are defined by societal expectations regarding one's behavior and disposition. For example, people may expect that a leader is assertive or that a mother is nurturing. Therefore, we hypothesized that SRIs would lead individuals to perceive others as having the traits consistent with their social roles. To examine this, we had participants rate the targets on carefully selected traits at the end of the experiment: one trait consistent with their role (from the learning phase) and two filler traits. The traits were selected on the basis of a pre-test that is described further below. Two comparisons were key to testing our hypothesis. First, we planned to compare participants' role-consistent trait ratings of targets who had performed role-implying behaviors to those of targets who had performed neutral behaviors. If SRIs have downstream consequences for trait judgments, then participants will rate targets higher on the role-consistent traits if they had performed role-implying behaviors than neutral behaviors. Second, among targets whose behavior implied roles, we planned to compare participants' ratings on the role-consistent trait and the two same-valence filler traits. We predicted that SRIs would have trait-specific downstream consequences as opposed to a halo effect (i.e., that targets would be rated higher on all valence-congruent traits). Thus, we hypothesized that participants would rate the SRI targets higher on the role-consistent traits than on the filler traits.

Pretest 2: generating role-consistent traits

For the explicit trait ratings task, we needed to obtain traits that were consistent with the 16 social roles we used (8 implied and 8 control). We had 86 undergraduates generate three traits to describe each of the 16 social roles. The most reliably generated traits were chosen as the role-consistent traits for the ratings task. There was substantial variation in the level of consensus. However, the average level of consensus for implied roles ($M = 55.43\%$, $SD = 18.00\%$) and control roles ($M = 41.01\%$, $SD = 18.44\%$) did not differ, $p = .18$. We also chose two filler traits matched for valence and likeability with the role-consistent trait using Anderson (1968). Refer to Appendix B for the social roles and their three traits.

Recall that participants in Pretest 1 were asked to generate social roles *and* traits implied by behaviors. Thus, we were able to confirm that the behaviors chosen for use in Experiment 1 reliably implied specific social roles but did not reliably imply the traits generated by those social roles in Pretest 2. For example, Pretest 1 determined that "brought groceries for the week" reliably implied "mother" but did not reliably imply "warm" (*warm* was generated by fewer than 40% of Pretest 1 sample), and the results of Pretest 2 confirmed that "mother" reliably implied "warm."

Method

Participants

Ninety-nine undergraduates (72 females) at a large public university participated in the experiment for partial course credit. The average age was 19.60 years ($SD = 3.05$).

Materials

For the role-implying behaviors, we used the same eight stimuli as in Experiment 1 (see Appendix A). For the control behaviors (not role-implying), we used eight behaviors from Pretest 1 that failed to reliably imply the roles paired with them (see Appendix C).

We relied on Pretest 2 to pick the traits used in the explicit ratings task. Participants rated each target on three traits, one that was consistent with the target's role and two other traits that were matched to the implied trait on valence and likeability.

Procedure

We adapted the savings-in-relearning paradigm (Carlston & Skowronski, 1994). First was the exposure phase, in which participants viewed a series of targets (photographs of individual faces) paired with one behavior each. Each trial was presented for seven seconds. Participants were told that their task was simply to familiarize themselves with the experimental materials during this stage. There were 16 trials total: eight role-implying behaviors and eight control behaviors. The trials were further divided so that the role-implying trials and control trials were evenly split between male and female targets. The specific target photograph was randomly chosen for each individual participant by the computer from sets of male faces and female faces, and trials were presented in random order determined by the computer. There was a two level between-subjects factor, "target gender," so that the gender of the target could be counterbalanced across trials (i.e., implied roles paired with males in replication 1 would be paired with females in replication 2) wherever possible (i.e., for all roles except *mother* and *father*).[1]

Next was the learning phase, in which participants viewed the same 16 targets, each paired with a social role that had either been implied by the behavior in the exposure phase (implied role) or not implied by the behavior in the exposure phase (control role). Participants were told to try and remember the target-word pairings because their memory would be tested later. Each target-role pairing was displayed for six seconds and randomized by the computer. Following the logic of the savings-in-relearning paradigm, SRI formation would facilitate memory for the implied roles over the control roles.

After a filler task (the same for all participants) involving reading four brief news excerpts and answering reading comprehension questions, the next stage of the paradigm was the memory task. Participants were shown each of the targets in random order and were asked for the word that was paired with it in the learning phase. Memory performance was the primary dependent variable, with better recall for implied roles than control roles demonstrating that SRIs had been formed in the exposure phase.

The final task was a trait ratings task. Trials consisted of participants rating each target on the trait consistent with their social role in the learning phase and two filler traits. Participants rated the targets on their three traits in random order. For each rating, the target was displayed on the screen and the participant was asked, "How [insert trait here] does this person seem?" on a scale from 1 (*not at all*) to 7 (*extremely*). Finally, participants reported demographics, were thanked, and debriefed.

Results

Memory performance: social role inference formation

We coded participants' responses to the memory task for accuracy. We required an exact match as the criterion for an accurate response, with the exception of spelling errors and abbreviations. For example, a correct response for "mother" would be "mom" or "momm." This is a more conservative test of our hypothesis because we did not accept "gist" answers as correct.[2] For example, answers such as "investigator" for "reporter" or "athlete" instead of "swimmer" were coded as inaccurate. For each participant, we computed the proportion of correctly recalled roles for implied roles and control roles separately.

Evidence of SRIs would be exhibited by a main effect of role type, such that participants more accurately recalled implied roles than control roles. A paired samples *t*-test confirmed that participants exhibited better memory for the implied roles ($M = .67$, $SD = 0.23$) than the control roles ($M = .51$, $SD = 0.22$), $t(98) = 7.63$, $p < .001$, $d = 1.54$. Therefore, evidence for SRI formation was obtained.

Explicit trait ratings

Trait implications of SRIs

We also hypothesized that SRIs would have downstream consequences on participants' trait ratings of the targets. Specifically, we predicted that SRIs would lead participants to make congruent trait ratings. We tested this hypothesis in two ways. First, we conducted a paired samples *t*-test to determine whether participants rated targets higher on role-consistent traits when the roles were implied versus control. As expected, participants rated targets more highly on traits consistent with implied roles ($M = 4.42$, $SD = 0.85$) than on traits consistent with control roles ($M = 4.08$, $SD = 0.78$), $t(98) = 4.08$, $p < .001$, $d = .82$.

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[1] Target gender did not moderate the results; therefore, we collapsed across this factor in analyses.

[2] We also coded the responses for "gist." Analyses using the "gist" accuracy did not decrease the significance levels of any of the reported effects.

These findings demonstrated that SRIs facilitated trait-consistent impressions of targets.[3]

Specificity of trait implications of SRIs

Second, we tested whether participants rated the targets higher on the traits implied by their social roles than on unrelated traits matched on likeability. To test this hypothesis, we averaged participants' ratings of targets on the two unrelated traits (fillers). A paired samples *t*-test revealed that participants rated the targets as higher on their role-consistent trait ($M = 4.42, SD = 0.85$) than on the filler traits ($M = 3.96, SD = 0.58$), $t(98) = 6.91, p < .001, d = 1.40$. These results indicate that SRIs produced trait-specific explicit impressions rather than general halo effects.

Discussion

Experiment 2 provided strong evidence for SRIs as an unintentional inference process about specific, individual targets. First, the savings-in-relearning paradigm showed that SRIs facilitated learning of the implied role-target pairings compared to control role-target pairings. Second, SRIs affected perceivers' subsequent trait judgments of targets independent of participants' memory for role-target pairings. These trait judgments were tailored to the individual, inconsistent with mere activation accounts of SRI findings, and to the role, as opposed to other valence-congruent traits.

One potential critique of the trait ratings is that they were performed after the learning phase, in which targets were explicitly paired with social roles. Exposure to the target-role pairings could have influenced perceivers' subsequent trait ratings of the targets. However, it is important to note that perceivers completed ratings for targets with both types of roles—those that were implied by the behaviors presented in the exposure stage as well as those that were unrelated to the exposure phase behaviors. Further, the analysis reported in footnote 3 demonstrated that, although perceivers' trait ratings of targets were higher when they recalled those targets' roles, the rating difference between implied and control role-consistent traits was not affected by role recall. Therefore, exposure to and recall of the target-role pairings cannot explain the observed difference in ratings for implied vs. control role-consistent traits.

We have argued that SRIs are indeed spontaneous such that they occur efficiently and without intention. Thus far, we have supported the unintentional aspect of SRIs. The present experiment gave participants passive instructions to avoid their making intentional or conscious inferences about targets' role-implying behaviors and provided support for SRIs and their trait implications. To the extent that participants were following our instructions, their SRIs were not formed intentionally. In Experiment 3, we tested the efficiency of the SRI process and its downstream effects.

Experiment 3

An important aspect of spontaneous inferences is that they are cognitively efficient (Todd et al., 2011). Although there is also some

evidence that STIs are weaker when perceivers encode trait-implying behavior under cognitive load, STIs typically occur even when the perceiver has relatively few cognitive resources (Crawford et al., 2007; Todd et al., 2011; Todorov & Uleman, 2003; see Wells, Skowronski, Crawford, Scherer, & Carlston, 2011). Experiment 3 sought to determine whether SRIs are cognitively efficient as well. In this experiment, we manipulated participants' cognitive load while they encoded behavioral information to determine whether SRIs could be made with limited cognitive resources. We expected that, consistent with other spontaneous inference processes, SRIs would occur for both cognitively loaded and non-loaded participants.

Experiment 3 also used the savings-in-relearning task, and the method was nearly identical to that of Experiment 2. Because our primary goal was to understand how cognitive load at *encoding* influenced SRI formation, we had participants memorize nine-digit numbers during the exposure phase. Participants did not have a secondary task during the rest of the experiment. We hypothesized that SRIs would be formed by both cognitively loaded and non-loaded participants. Experiment 3 also provided us with the opportunity to replicate the trait ratings' findings in Experiment 2 and investigate whether they occur efficiently.

Method

Participants

Seventy-eight undergraduates (58 females) at a large public university participated in exchange for partial course credit. The average age was 19.56 years ($SD = 1.36$).

Procedure

Participants completed the savings-in-relearning paradigm. As in Experiment 2, there was a two-level between-subjects factor to counterbalance the gender of the targets presented, and this factor did not influence the results. Participants were also randomly assigned to the no load or cognitive load condition. For participants in the no load condition, the procedure was identical to that of Experiment 2. They completed the exposure phase followed by the learning phase, filler task, memory phase, and trait ratings task.

Participants in the cognitive load condition completed a number memorization task during the exposure task (in which the role-implying behaviors were encoded). Every four trials, participants were given a new eight-digit number and were asked to keep the number in their minds. After the four trials, participants were prompted for the number and then given a new number. We adopted this cognitive load strategy (as opposed to giving one eight-digit number for the entire exposure phase) because we wanted to prevent participants from forgetting the number partway through the task and giving up, which would mean that these participants would not be under load for the exposure phase. After the exposure phase, participants in the cognitive load condition completed the learning phase, filler task, memory phase, and trait ratings task as the participants in the no load condition did.

At the end of the study, participants in the cognitive load condition were asked to rate how difficult the number memorization/reading task was on a scale from 1 (*not difficult*) to 7 (*very difficult*) and how hard they tried to remember the numbers on a scale from 1 (*not hard at all*) to 7 (*very hard*). Then participants in both conditions were asked to rate how difficult the study was on a scale from 1 (*not difficult/very easy*) to 7 (*very difficult*) and how hard they tried to do well during it from 1 (*not at all*) to 7 (*very*). Finally, participants reported their demographic information and were debriefed.

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[3] To determine whether participants' trait ratings depended on their correct recall of targets' roles, we conducted a 2(trait type: implied vs. control) × 2(recall: yes vs. no) repeated measures ANOVA on trait ratings. There was a significant effect of recall, $F(1,86) = 9.97, p = .002, \eta_p^2 = .10$, indicating that participants rated targets more highly on traits when they recalled those roles ($M = 4.31, SD = .91$) than when they did not ($M = 4.00, SD = .90$), regardless of trait type. There was an effect of trait type, $F(1,86) = 3.99, p = .049, \eta_p^2 = .04$, indicating that participants rated the targets higher on implied role-consistent traits than control role-consistent traits. Importantly, there was no interaction, $p = .41, \eta_p^2 = .01$, demonstrating that the rating difference between implied and control traits did not depend on accurate recall.

Results

Cognitive load manipulation checks

Responses from participants in the cognitive load condition were coded for accuracy by digit (from 0 to 8). On average, participants got 5.69 digits ($SD = 1.77$) correct out of eight, confirming that they were engaged in the memory task. Participants' accuracy was positively associated with their self-reported effort, $r(37) = .40$, $p = .01$, but not with their perceptions of the task's difficulty, $r(37) = .01$, $p = .93$.

Participants' perception of study difficulty in the cognitive load condition ($M = 3.72$, $SD = 1.28$) and the control condition ($M = 3.54$, $SD = 1.29$) were in the expected direction but did not differ significantly, $p = .54$. Participants' self-reported effort in the study did not differ by condition ($M_{load} = 5.54$, $SD_{load} = 1.33$; $M_{control} = 5.36$, $SD_{control} = 1.11$), $p = .52$, indicating that participants in both conditions tried equally hard to perform the tasks asked of them.

Memory performance: social role inference formation

To determine whether SRIs had been formed, we conducted a 2(condition: no load or load) × 2(role type: implied and control) mixed-model ANOVA, with the latter factor being within-subjects, on the proportion of roles recalled. There was a main effect of role type, $F(1,76) = 26.38$, $p < .001$, $\eta_p^2 = .26$. Participants recalled more implied roles ($M = .69$, $SE = .03$) than control roles ($M = .57$, $SE = .03$), $p < .001$. There were no other significant effects in the model. As expected, the main effect was not moderated by cognitive load condition, $F(1,74) = 2.78$, $p = .10$, $\eta_p^2 = .04$; however, because the p-value approached significance, we conducted follow-up pairwise comparisons to verify that SRI formation had occurred in both conditions (see Fig. 1). Indeed, participants in the no load condition ($M_{implied} = .69$, $SD = 0.24$; $M_{control} = .53$, $SD = 0.29$) and the load condition ($M_{implied} = .69$, $SD = 0.23$; $M_{control} = .61$, $SD = 0.25$) had better recall for implied roles than control roles, $ps < .02$. These results demonstrated that participants formed SRIs in both conditions.

We also computed an index of SRI formation by subtracting participants' recall of control roles from their recall of implied roles. Among participants in the cognitive load condition, there was a trend such that digit recall was negatively associated with SRI formation, $b = -.03$ (95% CI: −.06 to .01), $p = .09$, $R^2 = .08$.

Explicit trait ratings

Trait implications of SRIs

Next we tested whether SRI formation led to downstream consequences in participants' impressions of the targets. The 2(cognitive load condition) × 2(trait type: implied role-consistent and control role-consistent) mixed-model ANOVA on trait ratings revealed only a main effect of trait type, $F(1,76) = 19.63$, $p < .001$, $\eta_p^2 = .21$. Replicating Experiment 2, participants rated targets higher on implied role-consistent traits ($M = 4.34$, $SD = 0.71$) than on control role-consistent traits ($M = 4.00$, $SD = 0.80$). Cognitive load did not moderate the effect of trait type on the ratings, $p = .83$.

We then computed an index of SRI-consistent trait impressions by subtracting each participant's ratings on control-role consistent traits from their ratings on implied-role consistent traits. Among participants in the cognitive load condition, there was no association between digit recall and SRI-consistent trait impressions, $p = .99$, $R^2 = .000002$.[4]

Specificity of trait implications of SRIs

We also predicted that the explicit impression implications of SRIs would be trait-specific. We conducted a 2(cognitive load condition) × 2(trait type: role-consistent and fillers) mixed-model ANOVA, with the latter factor being within-subjects, on participants' ratings of the targets. The only significant effect that emerged was the hypothesized main effect of trait type, $F(2,76) = 38.62$, $p < .001$, $\eta_p^2 = .34$. Replicating Experiment 2, participants rated the targets significantly higher on the role-consistent trait ($M = 4.34$, $SD = 0.71$) compared to the filler traits ($M = 3.98$, $SD = 0.59$). This main effect was not moderated by cognitive load, $p = .38$, and there were no other significant effects in the model.

Discussion

Experiment 3 replicated and extended the findings of Experiment 2. Both cognitively loaded and non-loaded participants exhibited evidence for SRIs. In conjunction with Experiments 1 and 2, these findings demonstrate that SRIs are indeed spontaneous; that is, they occur efficiently and without intention. Furthermore, Experiment 3 demonstrated that the trait-specific downstream consequences of SRIs did not require cognitive resources. Participants who encoded role-implying behaviors under load not only inferred the implied roles but also perceived the targets as higher on role-consistent traits.

Our conclusion about the efficiency of SRIs is based on a null finding, specifically the lack of effect of cognitive load. With null effects, it is always possible that increased power would have detected a significant effect. Nonetheless, the pattern of means in Experiment 3 revealed that cognitively loaded and non-loaded participants exhibited the same degree of recall for implied traits. The nearly marginal interaction of cognitive load and role type was driven by the fact that participants under load exhibited better recall for control roles than did non-loaded participants. These results are consistent with the argument that SRIs are formed under cognitive load. Nonetheless, additional experiments using different cognitive load manipulations and spontaneous inference paradigms (e.g., the false recognition paradigm; Todorov & Uleman, 2002) would help to corroborate our findings.

Analyses of individual variation among participants in the cognitive load condition yielded interesting results. There was a trend such that increased digit recall (a potential proxy for cognitive load) was associated with the extent of SRI formation. This result adds to the somewhat inconsistent findings regarding whether spontaneous inferences are formed under cognitive load mentioned
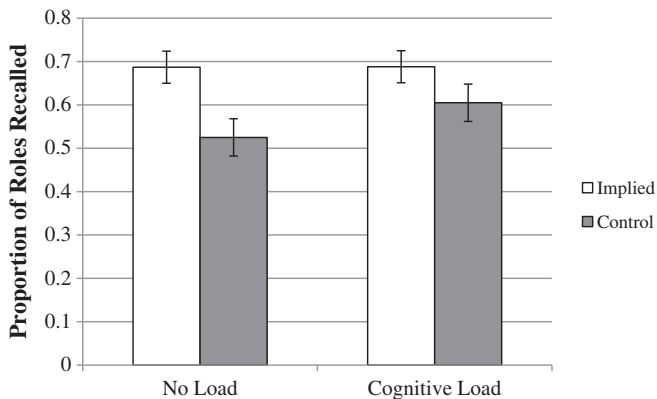

Fig. 1. Spontaneous social role formation by cognitive load condition and type of role. Error bars represent standard error.

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[4] To determine whether ratings depended on role recall or cognitive load condition, we conducted a 2(cognitive load condition) × 2(trait type: implied vs. control) × 2(role recall: yes vs. no) mixed model ANOVA on trait ratings. There was only a main effect of trait type, $F(1,60) = 14.32$, $p < .001$, $\eta_p^2 = .19$, indicating that participants rated targets higher on implied role-consistent traits ($M = 4.32$, $SD = .84$) than control role-consistent traits ($M = 3.92$, $SD = .94$). No other effects in the model were significant, $ps > .25$. Thus, consistent with Experiment 2, the rating difference between implied and control traits did not depend on role recall.

in the Experiment 3 Introduction. However, digit recall was not associated with SRI-consistent trait impressions. These supplementary analyses suggest that participants need a certain amount of cognitive resources to attend to and comprehend role-implying behaviors in order to form SRIs, but that, once formed, SRIs efficiently lead to trait-consistent impressions of the targets. These possibilities warrant follow-up investigation.

General discussion

Decades of research have documented perceivers' ability to readily infer the internal mental states of others from their behaviors (see Uleman, Rim, Saribay, & Kressel, 2012; Uleman et al., 2008). Building on this body of research, we proposed that perceivers would also spontaneously infer an individual's social roles from his or her behavior. Three experiments demonstrated that perceivers unintentionally and efficiently extract social role information from single behaviors. Further, Experiments 2 and 3 showed that SRIs led perceivers to have role-consistent trait impressions of the targets. Together these findings illustrate a novel mechanism by which perceivers form impressions of others from their behaviors.

Our findings generate many interesting questions for follow-up research. One question concerns the relation of social role inferences to other inferences from an individual's behavior. Are SRIs and STIs more likely to be made simultaneously, or does the formation of one type of inference reduce the likelihood of another type? For instance, consider a perceiver who observes John run into a burning building to save a child. The perceiver might infer that John is courageous, and she could also infer that John is the child's father or a firefighter. In some cases, the SRI might reduce the likelihood of an STI (e.g., all fathers would rescue their child) or magnify one (e.g., firefighters are really brave). On the other hand, the findings of Todd et al. (2011), who found that STIs and SSIs were activated simultaneously, suggest that SRIs and STIs would be simultaneously activated, and that perceivers' goals and cognitive capacity would influence their reliance on either inference type for their deliberative attributions of the behavior (see also Rim, Min, Uleman, Chartrand, & Carlston, 2013). The interplay between SRIs and STIs may be a rich topic for follow-up research.

Another unanswered question is when SRIs versus STIs will be more useful to the perceiver. There may be some contexts in which SRIs are more informative than STIs and vice versa. For example, individuals' social roles may be more predictive of others' behavior in collectivistic cultures, whereas individuals' dispositions may be more predictive of their behavior in individualistic cultures (e.g., Menon, Morris, Chiu, & Hong, 1999). Consequently, people from collectivistic cultures may be more likely to make SRIs than STIs, whereas people from individualistic cultures may form STIs more frequently than SRIs because dispositions are more predictive of behavior than roles. In addition, there may be situations in which a perceiver is more prone to make an STI or SRI. For example, a salesperson who is meeting potential clients for the first time may form SRIs that provide useful information about the hierarchical structure of the client group (e.g., leader vs. followers). The same salesperson may form STIs of the leader (e.g., thrifty, competitive, or ostentatious) that inform her persuasive appeals in subsequent meetings. Therefore, the social perceiver's goals may, in part, determine whether SRIs or STIs are more useful and informative, and it may be the co-occurrence of these inference processes that optimizes perceivers' ability to engage in smooth social interaction and successfully fulfill their goals.

Furthermore, it remains to be determined if perceivers may readily infer social role information from thin slices of visual and non-verbal information. It seems reasonable to predict that perceivers are able to spontaneously infer whether two people are mother-son, romantic partners, friends, or colleagues after brief exposure to the dyad. These possibilities highlight interesting avenues for future research.

The ability to form spontaneous impressions of others is essential for having smooth social interactions and may be rooted in evolutionary adaptations (e.g., Schaller, 2008; Whiten & Erdal, 2012). Similar to trait inferences, social role information provides perceivers with insights into the people in their social environments. Our research builds on past research by identifying a novel way in which perceivers extract valuable social information from others' behaviors.

Appendix A

Behavior descriptions with the implied social role and percentage of Pretest 1 participants who mentioned it.

Behavior description	Social role	%
Motivated the group to tackle the problem.	Leader	41.2
Assigned homework to the class.	Professor	91.1
Investigated the violent crime.	Policeman	73.5
Bought groceries for the week.	Mother	70.6
Grilled burgers in the yard.	Father	64.7
Swam across the entire lake.	Swimmer	64.7
Supported the team even with their five year losing streak.	Coach	44.1
Studied in the library.	Student	94.1

Appendix B

Social roles with their implied traits. Percentage represents the number of times the implied trait was generated by participants in Pretest 2. Control traits were matched on likeability using Anderson (1968) and valence (positive vs. negative).

Social role	Implied trait (%)	Filler traits
Artist	Creative (72.3)	Sensible, generous
Banker	Intelligent (34)	Truthful, dependable
Coach	Demanding (38.6)	Clumsy, insecure
Doctor	Helpful (17.18)	Self-disciplined, courteous
Father	Caring (85.5)	Thoughtful, happy
Friend	Fun (54.2)	Independent, logical
Leader	Confident (38.6)	Scientific, hopeful
Mother	Warm (77.1)	Reliable, caring
Neighbor	Friendly (56.6)	Mature, humorous
Policeman	Tough (38.6)	Argumentative, forgetful
Professor	Intelligent (60.2)	Trustworthy, considerate
Reporter	Talkative (24)	Sensitive, proud
Student	Hardworking (50.6)	Practical, outgoing
Swimmer	Athletic (54.2)	Sympathetic, tolerant
Therapist	Helpful (33.7)	Trusting, polite
Volunteer	Compassionate (36.1)	Tactful, cheerful

Appendix C

Control behavior-social role pairings used in Experiment 2. Pretest 1 confirmed that these social roles were not implied by the behaviors.

Behavior description	Social role
Brainstormed about blueprints for a futuristic car competition.	Reporter
Started their meetings exactly at 9 o'clock in the morning.	Therapist
Was unable to choose a place to eat for lunch.	Volunteer
Although only a block away, had pizza delivered.	Artist
Didn't listen to outcome criticism of their plans.	Doctor
Talked loudly during the movie in the theater.	Friend
Tripped over their partner's feet while learning the new dance step.	Banker
Set the agenda for the group.	Neighbor

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