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The effect of the suspect-corroborator relationship and number of corroborators on alibi assessments was examined across two experiments. In both experiments, we explored the effect of relationship type and number of corroborators on believability, likelihood of guilt, and decision to retain the suspect as the primary suspect; we increased the social distance between the alibi provider and suspect and the size of difference between the number of corroborators in Experiment 2. Collectively, our results support Olson and Wells' taxonomy of alibi believability as (a) any form of person evidence mitigates pre-alibi judgments of guilt (although there is a ceiling effect), and (b) alibis corroborated by non-motivated others were judged more favourably than those corroborated by motivated others. Our results lend support toward extending the original taxonomy to include the number of corroborators. The implications for the alibi assessments are discussed.

Key words: alibi assessment; alibis; corroborator; believability; investigations; policing; wrongful convictions.

A common question posed to suspects at the beginning of a criminal investigation is 'can you account for your whereabouts during the time the crime took place?' The expectation is that innocent suspects will be able to provide an alibi: a verifiable statement that he/she was elsewhere when the crime occurred (Allison & Brimacombe, 2010; Culhane & Hosch, 2012; Olson & Wells, 2004). Investigators then have the task of assessing the veracity of the alibi. Like most investigative decisions, the alibi assessment process is consequential because an erroneous judgment can have a downstream effect on subsequent police investigative decisions (e.g. subject an innocent individual to an accusatorial interrogation; ignore other possible lines of inquiry) and on decisions made by lawyers and triers of fact further along in the truth-seeking process (e.g. judge or jurors uncritically adopting the assessments made by police officers regarding an innocent person). The nearly 400 exonerations (as determined via DNA analysis) that have occurred in Canada and the United States over the past two decades suggest that the alibi assessment process is imperfect, since the exoneree's original alibi failed to convince investigators of the accused's innocence (Innocence Canada, 2019; Innocence Project, 2019). Notwithstanding the increase in research on the various facets of decisions related to alibis (Maeder & Dempsey, 2013), there remains a shortage of knowledge on this topic relative to

other investigative processes (e.g. eyewitness identification, interrogations).

Alibi generation and assessment

A primary determinant of the believability of an alibi is the provision of corroborating evidence that can independently support the veracity of the alibi provider's account. In an attempt to guide research in the alibi field, Olson and Wells (2004) created a theoretical taxonomy of alibi believability that first divided corroborating evidence into two broad categories: (a) physical evidence (e.g. receipt, CCTV video) and (b) person evidence (e.g. sworn testimony from an alibi witness). Importantly, Olson and Wells proposed that both corroborating evidence types need to be considered in terms of ease of fabrication and/or reliability of the evidence. For example, time-stamped CCTV video footage is more difficult to fabricate and thus should be considered more believable if provided as part of an alibi claim, as compared to a paper receipt provided from a store; it is reasoned that the receipt could be recreated (i.e. fabricated using a computer), whereas inserting oneself into a CCTV video recording is much more difficult and effortful. Similarly, testimony from a motivated other (e.g. family member or close friend) as compared to a non-motivated other (e.g. complete stranger) might be regarded as less believable, because it is reasoned that people who are close to the suspect might be motivated to lie in order to protect the suspect. To summarize, an alibi is thought to be most believable when it is accompanied with difficult-to-fabricate physical evidence and testimony given by a non-motivated other.

Research shows that physical evidence is the stronger of the two evidence types in convincing assessors of the alibi's veracity. Of the two corroborating evidence types, however, alibi providers tend to rely primarily upon person evidence to support their statement. For example, Culhane, Hosch, and Kehn (2008) asked 547 American undergraduates to imagine that they were a suspect in a crime and to generate an alibi for a specified date and time. The researchers found that nearly 90% of students reported having a witness to support their whereabouts, and 30% reported having physical evidence to support their alibi. More recently, Nieuwkamp, Horselenberg, and van Koppen (2017) asked 841 Dutch adults to generate an alibi after they were falsely accused of being the perpetrator of a mock robbery. These researchers found that 90% of the participants reported having a witness to support their alibi, and 25% of participants proffered physical corroborating evidence (for similar results, see Culhane et al., 2013; Olson & Charman, 2012). Work by Dysart and Strange (2012) moved beyond the laboratory and surveyed law enforcement officers about their experiences with alibis. They discovered that officers believe that suspects tend to rely upon a particular sub-type of person evidence, namely motivated others, and only offer up physical evidence rarely (less than 25% of cases). Dysart and Strange's discovery related to physical alibi evidence is in line with the findings reported in an archival study investigating alibi-related trial outcomes from Canada and the United States, where it was found that physical evidence was provided in only 15% of cases (Turtle & Burke, 2003). The knowledge accumulated related to alibis raises a problem, whereby alibi providers offer physical evidence rarely and rely almost exclusively on person evidence, but yet alibi assessors perceive physical evidence as more convincing than personal evidence (e.g. Olson & Wells, 2004).

Given that suspects tend to rely on person evidence to support their alibis, questions remain about how such evidence is evaluated, and how alibi assessments change as a function of variations in person evidence. Legal scholars have historically argued that person evidence can vary by *quality* (i.e. the nature of the relationship to the alibi witness) and *quantity* (i.e. how many alibi witnesses are proffered), and that quality should be the more

important factor when judging alibi believability (Sullivan, 1971). With regards to qualitative differences, Olson and Wells' (2004) taxonomy of alibi believability states that the credibility of a given alibi witness is a function of motivation (i.e. how likely the witness is to lie to protect the suspect) and familiarity (i.e. how likely the witness is to misidentify the suspect). This led to the creation of three different levels of person evidence with increasing levels of presumed credibility: (a) a motivated familiar other (e.g. family member); (b) a non-motivated stranger (e.g. store clerk); and (c) a non-motivated familiar other (e.g. routinely visited healthcare provider).

Research has shown that qualitative differences in person evidence matter for alibi assessors. In a test of these differences, Lindsay, Lim, Marando, and Cully (1986) presented 75 mock jurors with a videotaped trial simulation wherein witnesses of different relation to the accused provided testimony, and found that guilty verdicts were 30% lower when an alibi was provided by a stranger than when provided by a relative (i.e. brother-in-law; 27% vs. 57% guilty verdicts, respectively). Similarly, Culhane and Hosch (2004) had 420 mock jurors read one of 14 vignettes that contained a crime scenario and the suspect's alibi, and found that mock jurors' conviction decisions were 10% lower when a neighbour testified on the defendant's behalf (41%) than when the defendant's girlfriend testified (51%). The finding that close-relationship corroborators (e.g. spouse, girlfriend) are viewed with greater scepticism than no-relationship corroborators has also been reported in several other studies – including Olson and Wells' (2004) initial test of their taxonomy using undergraduate students (also see Hosch, Culhane, Jolly, Chavez, & Shaw, 2011).

Although not contained within Olson and Wells' (2004) original taxonomy, more recent research in the alibi area has begun to assess the other aspect of person evidence – the quantity of alibi witnesses that are able to support a suspect's alibi. For example, Eastwood, Snook, and Au (2016) used a policy-capturing approach to model the relative impact of five person-evidence variables (i.e. number of corroborators, relationship between the corroborator and suspect, corroborator's age, corroborator's confidence in their account and the salience of the event) on alibi assessment decisions. Policy-capturing is a methodology that allows researchers to measure how people rank and combine information to make decisions in a given domain (Karren & Barringer, 2002). In doing so, the participants' decision-policy can be quantified and reveals which factors they attended to during their decision-making process (for further detail on this technique, see Aiman-Smith, Scullen, & Barr, 2002). In the Eastwood et al. study, three groups of participants (e.g. $n = 65$ university students, $n = 21$ law enforcement students and $n = 11$ police officers) were presented with 32 alibi vignettes sequentially and were asked to rate the believability of the alibi, likelihood that the alibi provider was guilty and whether or not the alibi provider should be arrested. Each alibi contained a combination of the five aforesaid variables embedded within the vignette. The results revealed that, for the majority of participants in each group, having multiple individuals (as opposed to one) corroborate a suspect's account was the primary predictor for their two attitudinal measures (i.e. alibi believability, 71−77%; likelihood of guilt, 52−75%) and, to a lesser extent, for their behavioural measure (i.e. decision to make an arrest, 55−65%). It was also discovered that having the corroboration provided by a stranger (as opposed to a family member) was the primary predictor in believability ratings, guilt ratings and arrest decisions for few participants (0−18%). Overall, Eastwood et al.'s findings suggest that the quantity of alibi witnesses may be as (or

more) important as the quality of the alibi witnesses.

The current research

Given that suspects rely heavily on person evidence when providing an alibi, it is imperative to look at the effect of variations in both quality and quantity of person evidence on alibi assessments. Specifically, it is unclear what type of people and how many people an innocent suspect needs to provide in order to generate an alibi that is viewed favourably and, thus, be perceived as innocent. The goal of the current research was to assess the protective ability of person evidence by examining the nature of the relationship between the two aforementioned person evidence factors – namely, the corroborator's relationship to the suspect and the number of corroborators (henceforth, referred to as relationship and number, respectively).

Experiment 1

The goal of Experiment 1 was to examine the effect of corroboration that came from either a brother(s) or a neighbour(s) (i.e. relationship) and from one, four or seven corroborators (i.e. number). Based on the aforementioned research, we predict that alibis corroborated by a neighbour(s) will be assessed more favourably than alibis corroborated by a brother(s). Specifically, we expect higher ratings of believability, lower ratings of the likelihood of the suspect's guilt (i.e. attitudinal measures) and fewer decisions to retain the provided suspect as the primary suspect (i.e. behavioural measure). We also predict that an alibi corroborated by seven alibi witnesses will be rated more favourably than when corroborated by four or one alibi witness(es); an alibi corroborated by four alibi witnesses will be rated as more favourable than one corroborated by a single alibi witness. We also expect a synergistic interaction whereby relationship type and number of corroborators reinforce each other's effects on alibi assessments. In other words, a higher number of alibi corroborators will enhance the effect of relationship type.

Method
Design

A 2 (relationship: brother, neighbour) × 3 (number: 1 corroborator, 4 corroborators, 7 corroborators) between-participants design was used. The dependent measures consisted of ratings of alibi believability, two ratings (pre-alibi and post-alibi) of likelihood that the suspect is guilty and a forced-choice decision regarding whether or not the alibi provider should continue to be pursued as the primary suspect. Specifically, alibi believability was measured using a 10-point scale (1 = *extremely unbelievable*, 10 = *extremely believable*); likelihood that the suspect is guilty was also measured on a 10-point scale (1 = *extremely unlikely*, 10 = *extremely likely*). The two options for the binary forced-choice decision about suspect suspicion (henceforth referred to as suspicion) were: (a) continue to pursue him as the primary suspect, or (b) begin to search for other suspects.

Materials

The stimuli consisted of a seven-page online survey hosted on Qualtrics.com. The first page consisted of an informed consent form. The second page contained demographics questions about age, gender and ethnicity. The third page contained the following scenario for participants to consider:

> In this study you will be playing the role of a police detective investigating a homicide case. The victim in this case is a 34-year-old female who was found beaten and stabbed to death in her home early this morning. The coroner placed the time of death at approximately 8:00 pm last night. An initial review of her personal details revealed that she was recently divorced from her husband after two years of marriage and lived alone. Patrol officers also interviewed the victim's only close neighbour, who mentioned that the

victim and her ex-husband had several heated arguments over the past few weeks. However, the neighbour had gone to bed early the previous evening so they could not offer any information regarding the time when the crime occurred. A review of the ex-husband's file confirmed that police had been called twice in the past month to intervene in a verbal argument between the victim and her ex-husband; however, no charges were laid.

This scenario was designed to provide a rationale for why the ex-husband was the initial suspect, while also not providing any evidence that would implicate the ex-husband in the crime directly. After reading the above scenario, participants were asked to rate the likelihood that the ex-husband was guilty (i.e. pre-alibi guilt).

The fourth page contained the following alibi from the ex-husband (differences between conditions are contained in brackets):

As an initial step in your investigation, you locate the ex-husband and ask him his whereabouts during the time the crime occurred. He reported that he spent the entire evening at home, which is located across town from the victim's house. He said he was watching an NBA basketball game on television, which you verify began at 7:30 pm and ended around 10:00 pm. He also mentioned that in order to [have a visit with his family he invited his brother/4 brothers/7 brothers] [get to know some people in his neighbourhood he invited his neighbour/4 neighbours/7 neighbours] over to watch the game, and they were together at his home for the duration of the game. You subsequently question the ex-husband's [1/4/7 brother(s)] [1/4/7 neighbour(s)] and they all confirmed the ex-husband's account that they were at his home watching the basketball game on television around 8:00 pm when the crime occurred.

After reading the above scenario, participants were asked to rate the believability of the alibi and the likelihood that the suspect is guilty (i.e. post-alibi guilt), and make

the two-alternative forced-choice decision about suspicion.

The fifth page contained an open-ended question that asked participants to type as much detail as possible into a textbox about the reason(s) for their believability and guilt ratings, and suspicion decision. The sixth page consisted of two multiple-choice attention check questions (what crime type was used in the scenario; what did the ex-husband claim to be doing in his alibi statement). The seventh page consisted of a debriefing form, thanked the participants and provided them with the contact information of the primary researcher.

Procedure

Participants were recruited using the Qualtrics Panels Service. Potential participants were sent the URL link for the study via email. Once the survey was accessed, participants worked their way through each of the pages of the online survey outlined above. The survey was designed such that participants were assigned randomly to one of the six conditions. On average, participants took 5.34 min ($SD = 3.80$) to complete the survey. Participants were compensated by Qualtrics directly for completing the survey.[1]

Participants

The participants included in the final sample were 252 adults from across the United States (see Table 1 for sample size per condition). For a medium effect size ($d = 0.50$) and $\alpha = .05$, with our sample size, the power was .98 for the factor with two levels (i.e. relationship) and .95 for the factor with three levels (i.e. number), and .95 for the interaction (Cohen, 1992). The sample consisted of 185 women ($M_{age} = 45.45$ years, $SD = 16.35$) and 67 men ($M_{age} = 52.60$ years, $SD = 16.02$). In terms of ethnicity, 217 (86%) participants self-reported as White/Caucasian, 17 (7%) as Black, eight (3%) as being from multiple ethnic backgrounds, five (2%) as Asian, and four (2%) as

Table 1. The mean ratings of believability and likelihood of guilt, and the number of participants who chose to retain the ex-husband as the primary suspect as a function of relationship and number in Experiment 1.

| | Brother (n = 127) | | | | | | Neighbour (n = 125) | | | | | |
| | 1 corroborator (n = 42) | | 4 corroborators (n = 42) | | 7 corroborators (n = 43) | | 1 corroborator (n = 42) | | 4 corroborators (n = 42) | | 7 corroborators (n = 41) | |
	M (SD) [95% CI]	n (%)	M (SD) [95% CI]	n (%)	M (SD) [95% CI]	n (%)	M (SD) [95% CI]	n (%)	M (SD) [95% CI]	n (%)	M (SD) [95% CI]	n (%)
Believability	6.62 (1.96) [6.01, 7.23]		6.95 (1.90) [6.36, 7.54]		7.19 (1.74) [6.65, 7.72]		7.26 (1.84) [6.69, 7.83]		7.60 (1.71) [7.06, 8.13]		7.76 (2.23) [7.05, 8.46]	
Guilt	5.52 (2.17) [4.85, 6.20]		5.93 (2.09) [5.28, 6.58]		5.33 (2.03) [4.70, 5.95]		5.55 (2.11) [4.87, 6.22]		4.55 (2.11) [3.89, 5.21]		4.46 (2.60) [3.64, 5.28]	
Suspicion		16 (38.10)		18 (42.86)		10 (23.26)		20 (47.62)		11 (26.19)		10 (24.39)

Note: CI = confidence interval.

Latin American; one participant did not report ethnicity.

Results

There was a negative correlation between believability and post-alibi guilt ($r = -.54$), and between believability and suspicion ($r = -.40$). There was a positive correlation between post-alibi guilt and suspicion ($r = .51$). There were no statistically significant differences between the six conditions with respect to any of the demographic variables or pre-alibi ratings of guilt ($ps > .05$). The means (along with the standard deviations and 95% confidence intervals) for the three investigative decisions as a function of relationship and number are shown in Table 1.

Believability

The average rating of believability was 6.92 ($SD = 1.87$) for those in the brother conditions and 7.54 ($SD = 1.94$) for those in the neighbour conditions. The average ratings of believability for one-corroborator conditions was 6.94 ($SD = 1.92$), was 7.28 ($SD = 1.83$) for four-corroborators conditions, and was 7.46 ($SD = 2.00$) for seven-corroborators conditions. A two-way independent analysis of covariance (ANCOVA), with pre-alibi guilt ratings as a covariate, revealed a statistically significant main effect of relationship on alibi believability, $F(1, 245) = 7.51$, $p = .007$. Participants in the neighbour conditions rated the alibi as more believable ($d = 0.33$) than those in the brother conditions. There was no statistically significant effect of number on alibi believability, $F(2, 245) = 1.80$, $p = .168$; the effect sizes were all small ($ds < 0.30$). There was no statistically significant interaction, $F(2, 245) = 0.125$, $p = .883$.

Guilt

The average rating of post-alibi guilt was 5.59 ($SD = 2.09$) for those in the brother conditions and 4.86 ($SD = 2.33$) for those in the neighbour conditions. The average ratings of

post-alibi guilt when there were one-corroborator conditions was 5.54 ($SD = 2.15$), was 5.24 ($SD = 2.20$) for four-corroborators conditions, and was 4.90 ($SD = 2.35$) for seven-corroborators conditions. The ANCOVA revealed a statistically significant main effect of relationship on likelihood of guilt, $F(1, 245) = 9.47$, $p = .002$. Participants in the neighbour conditions rated the alibi as less likely that the suspect was guilty ($d = 0.33$) than those in the brother conditions. There was no statistically significant effect of number on likelihood of guilt, $F(2, 245) = 2.08$, $p = .128$; the effect sizes were all small ($ds < 0.30$). There was no statistically significant interaction, $F(2, 245) = 1.52$, $p = .222$.

Across all conditions, the average pre-alibi rating of guilt was 7.19 ($SD = 1.62$), suggesting that the homicide scenario was successful in generating initial suspicions of guilt toward the ex-husband. The average post-alibi rating of guilt was 5.23 ($SD = 2.24$); this difference was statistically significant, $t_{(251)} = 13.48$, $p < .01$, $r = .32$, $d = 0.85$. Moreover, 91.3% of participants indicated at the outset of the experiment that they believed the ex-husband was likely guilty (gave a rating of 6 or above on the 10-point initial guilt scale), as compared to 50.8% of participants who believed the ex-husband was guilty (gave a rating of 6 or above on the 10-point post-alibi guilt scale) after being provided with either of the six alibis. There was a statistically significant reduction in the judgments of likelihood of guilt from pre-alibi guilt ratings to post-alibi guilt ratings in all six conditions. The largest reduction was for the conditions that had four neighbours as alibi witnesses ($d = 1.23$), and the smallest reduction was for the conditions that had one family as the alibi witness ($d = 0.51$); the average effect size for all six conditions was $d = 0.87$.

Suspicion

The percentage of participants who chose to retain the ex-husband as the primary suspect when the corroborator was a brother(s) was 34.65% and was 32.80% when the corroborator was a neighbour(s). A chi-square test revealed that the binary decision on whether or not to retain the ex-husband as the primary suspect did not differ as a function of relationship, $\chi^2(1, N = 252) = 0.96$, $p = .76$. The percentage of participants who chose to retain the ex-husband as the primary suspect when there were seven corroborators was 23.81%, was 34.52% for four corroborators, and 42.86% for one corroborator. A chi-square test revealed that the binary decision on whether or not to retain the ex-husband as the primary suspect differed as a function of number, $\chi^2(2, N = 252) = 6.85$, $p = .03$. That is, there were more participants who wanted to retain the ex-husband as the primary suspect in the one-corroborator condition than you would expect by chance, and fewer in the seven-corroborator condition; the difference between the expected and actual count for the four-corroborator condition was miniscule. There was no difference in the proportion of people who retained the ex-husband as the primary suspect across six conditions, $\chi^2(5, N = 252) = 10.33$, $p = .07$.

Discussion

The goal of Experiment 1 was to examine the relative effect of quality (i.e. type of the suspect–corroborator relationship) and quantity (i.e. the number of corroborators) on judgments of alibi believability, likelihood of suspect's guilt and suspect suspicion. We manipulated quality by comparing alibis that were provided by brothers versus neighbours. In contrast to our prediction, we found that relationship type had a small effect on the two attitudinal measures and a negligible effect on the behavioural measure. In other words, the social distance between the suspect and the corroborator did not appear to matter much to our participants (see Olson & Wells, 2004). We believe that these small effects may be due to the brother and neighbour categories being viewed similarly; that is, the participants may have also viewed the neighbour(s) as a

motivated familiar person(s) who would lie for the suspect because they belong together in a small social group (e.g. neighbourhood; see Forsyth, 2014). Although participants primarily highlighted the low credibility of family members as alibi witnesses, several did explicitly mention the possibility of neighbours also lying to protect the ex-husband (e.g. 'It would be very easy for the ex-husband to ask the neighbour to cover for him.'; 'The ex-husband's alibi is not exactly rock solid. Perhaps this neighbour is a friend who agreed to corroborate with him on his story to the authorities.'). If the social distance was perceived to be greater, then it is possible that relationship may have an effect on alibi assessments.

We manipulated quantity by comparing alibis that were provided by one, four or seven individuals. In contrast to our predictions, we found negligible to small effects of number of corroborators on judgments of believability and likelihood of guilt. However, the percentage of participants who opted to pursue the ex-husband as the primary suspect reduced as a function of the number of alibi witnesses provided. Specifically, two fifths of alibi assessors chose to pursue the ex-husband as the primary suspect when there was one corroborator, as compared to one fifth of alibi assessors who were provided with seven alibi witnesses. One potential explanation for the mixed results is methodological; the difference may be due to the variation in the type of numerical rating scale used. For the attitudinal measures, a more sensitive, 10-point scale was used (which allows for one to detect small differences), whereas an insensitive, 2-point scale was used for the behavioural measure (which can only detect large differences; Kite & Whitley, 2018). Put differently, the use of an insensitive scale lumps those who strongly want to pursue the suspect together with those who somewhat want to pursue the suspect; the disparity may be an artefact of the rating scales used in this experiment. The fact that the average believability and guilt ratings were all in the expected direction suggests that the number of

corroborators may have an effect on attitudinal measures if the manipulation was stronger.

Another potential explanation is that, unlike the judgments of believability and likelihood of guilt (which are attitudinal), the decision of whether or not to pursue the suspect is a behavioural intention that has more consequences (i.e. attitudes and behaviours are not veridical; see Eagly & Chaiken, 1993). Therefore, participants may have considered more external contextual information when making the choice regarding whether or not to continue to prioritize the ex-husband: a factor mentioned explicitly by several participants (e.g. wanting to collect more case-relevant information on him before moving on to other suspects). For example, many participants speculated about the specific role the ex-husband may have played in the event and questioned the accuracy of the investigative process thus far (e.g. 'The ex-husband could have used someone else to kill his wife and paid them off.'; 'The coroner's estimate of time is just that, an estimate. The murder could have occurred later.'). Assuming that the number of corroborators has a real effect on the suspicion decision (i.e. it is not a spurious finding), we speculate that our participants reasoned logically that the likelihood that people would lie for someone about a violent crime decreases as the number of people that has to be convinced to lie increases.

We also found that our participants became less sceptical of the ex-husband's guilt once they were provided with *any* form of person evidence. We found that nine out of every 10 participants indicated at the outset that they believed the ex-husband was likely guilty, compared to five out of every 10 participants who believed the ex-husband was guilty after being informed that there was at least one alibi witness. This finding suggests that the ability to have even just one person – who may also be perceived to be motivated – support the alibi is enough to dampen initial belief about guilt. This finding is in line with Olson and Wells' (2004) theory that some person

evidence (regardless of the type of relationship; e.g. motivated vs. non-motivated familiar other) leads to greater believability than when no evidence at all exists. Of course, our participants were not told that the ex-husband did not have an alibi; rather, they were simply unaware of any potential alibi in their initial guilt ratings. Future research may wish to explore whether or not alibi assessments change if the assessor is explicitly told that there is no alibi at all, which would be a more direct test of Olson and Wells' theory of alibi believability.

Experiment 2

Given the outcome of Experiment 1, the goal of Experiment 2 was to conduct a conceptual replication of Experiment 1 by increasing the social distance between the suspect and the non-motivated corroborator (i.e. from neighbour to nursing home staff). The purpose of changing the corroborators to nursing home staff members was to remove the potential social dynamic associated with neighbour relationships and thereby reduce the potential belief that the corroborator would lie for the suspect. We also wanted to increase the extremity of the number of corroborators (e.g. 1 vs. 7 vs. 14). Changing the maximum number of available corroborators to 14 effectively doubled the number of corroborators presented in the largest group from Experiment 1. Doing so allowed us to test the upper limits of the effect while also approximating the number of corroborators present in several real-world cases (*cf.* at least 11 alibi witnesses were proffered in the Eric Morgan case, *R. v. Morgan*, 2013; also see Canadian Broadcasting Corporation documentary, Davidson & MacIntyre, 2014, for how Morgan was in a night club celebrating his birthday with numerous more people; in the case of Richard Rosario, there were 13 alibi witnesses, see Fasick & Italiano, 2016; Slepian, 2016; in the widely known case of Steven Avery, there were 16 alibi witnesses, see Netflix

documentary, *Making a Murderer*; Ricciardi, Demos, Nishimura, & Del Deo, 2015).

We predict that alibis corroborated by a nursing home staff member(s) will be assessed more favourably than alibis corroborated by a family member(s). Specifically, we expect higher ratings of believability, lower ratings of the likelihood of the suspect's guilt (i.e. attitudinal measures) and fewer decisions to retain the provided suspect as the primary suspect (i.e. behavioural measure). We also predict that corroboration provided by by 14 alibi witnesses will be rated more favourably than when corroborated by seven or one alibi witness(es); corroboration supported by seven alibi witnesses will be more favourable than one alibi witness. We also expect a synergistic interaction whereby relationship type and number of corroborators reinforce each other's effects on alibi assessments. In other words, a higher number of alibi corroborators will enhance the effect of relationship type.

Method

Design

A 2 (relationship: family member, staff member) × 3 (number: 1 corroborator, 7 corroborators, 14 corroborators) between-participants design was used. The same dependent measures as those used for Experiment 1 were used for Experiment 2 (i.e. alibi believability, pre- and post-alibi ratings of likelihood that the suspect is guilty, and a two-alternative forced-choice suspicion decision).

Materials

Apart from the alibi and alibi corroborator information, the stimuli consisted of the same seven-page online survey hosted on Qualtrics.com that was used in Experiment 1. Given that the homicide scenario used in Experiment 1 was successful in producing relatively high initial levels of guilt without introducing inculpatory evidence, it was retained for Experiment 2.

The following alibis from the ex-husband were used in Experiment 2 (differences between conditions are contained in brackets):

Staff member corroboration. As an initial step in your investigation, you locate the ex-husband and ask him his whereabouts during the time the crime occurred. He reported that he spent the entire evening having a visit with his mother, who has early-onset Alzheimer's, at her nursing home. The nursing home is located approximately 45 minutes' drive from the victim's house. Patrol officers subsequently attempted to locate individuals who could verify the ex-husband's account of being at the nursing home last evening. They were able to locate [1/7/14] nursing home staff member(s) who reported seeing the ex-husband the previous evening at the time the crime occurred. The [1/7/14] staff member(s) all confirmed that the ex-husband was present at the nursing home at the time that the crime took place, which matches the ex-husband's account.

Family member corroboration. As an initial step in your investigation, you locate the ex-husband and ask him his whereabouts during the time the crime occurred. He reported that he spent the entire evening having a visit with his mother, who has early-onset Alzheimer's, at her house. The mother's house is located approximately 45 minutes' drive from the victim's house. Patrol officers subsequently attempted to locate individuals who could verify the ex-husband's account of being at his mother's house last evening. They were able to locate [1/7/14] of the ex-husband's family members who reported seeing him the previous evening. The [1/7/14] family member(s) confirmed that the ex-husband was present at the house at the time that the crime took place, which matches the ex-husband's account.

Procedure

The same procedure as that outlined in Experiment 1 was used for Experiment 2. The average time taken for participants to complete the survey was 4.19 min ($SD = 1.77$). Participants were compensated by Qualtrics directly for completing the survey.[2]

Participants

The participants in the final sample were 247 adults from across the United States (see Table 2 for sample size per condition). For a medium effect size ($d = 0.50$) and $\alpha = .05$, with our sample size, the power is .97 for the factor with two levels (i.e. relationship), .95 for the factor with three levels (i.e. number), and .95 also for the interaction (Cohen, 1992). The sample consisted of 185 women ($M_{age} = 37.37$ years, $SD = 13.60$) and 60 men ($M_{age} = 39.32$ years, $SD = 14.19$; two individuals did not report their gender). In terms of ethnicity, 190 (77%) of participants self-reported as White/Caucasian, 15 (6%) as Asian, 13 (5%) as Black, 11 (5%) as being from multiple ethnic backgrounds, nine (4%) as Latin American, and three (1%) as Aboriginal; six participants did not report ethnicity.

Results

There was a negative correlation between ratings of believability and post-alibi guilt ($r = -.31$), and between ratings of believability and suspicion ($r = -.33$). There was a positive correlation between post-alibi guilt and suspicion ($r = .49$). There were no statistically significant differences between the six conditions with respect to any of the demographic variables or pre-alibi guilt ratings (all $ps > .05$). The means (along with the standard deviations and 95% confidence intervals) for the three investigative decisions as a function of relationship and number are shown in Table 2.

Believability

The average rating of believability was 6.30 ($SD = 1.82$) for participants in the family member conditions and was 7.08 ($SD = 2.08$) for those in the nursing staff conditions. The average ratings of believability for

Table 2. The mean ratings of believability and likelihood of guilt, and the number of participants who chose to retain the ex-husband as the primary suspect as a function of relationship and number in Experiment 2.

	Family (n = 122)						Nursing home staff (n = 125)					
	1 corroborator (n = 42)		7 corroborators (n = 44)		14 corroborators (n = 36)		1 corroborator (n = 45)		7 corroborators (n = 36)		14 corroborators (n = 44)	
	M (SD) [95% CI]	n (%)	M (SD) [95% CI]	n (%)	M (SD) [95% CI]	n (%)	M (SD) [95% CI]	n (%)	M (SD) [95% CI]	n (%)	M (SD) [95% CI]	n (%)
Believability	5.55 (1.81) [4.98, 6.11]		6.55 (1.78) [6.00, 7.09]		6.89 (1.62) [6.34, 7.44]		6.29 (1.94) [5.71, 6.87]		7.58 (1.76) [6.99, 8.18]		7.48 (2.25) [6.79, 8.16]	
Guilt	6.57 (1.93) [5.97, 7.17]		5.73 (2.01) [5.09, 6.36]		5.94 (1.39) [5.47, 6.42]		5.44 (2.18) [4.79, 6.10]		4.69 (2.12) [3.98, 5.41]		3.77 (1.74) [3.24, 4.30]	
Suspicion		25 (59.52)		14 (31.82)		10 (27.78)		24 (53.33)		12 (33.33)		8 (18.18)

Note: CI = confidence interval.

one-corroborator conditions was 5.93 (SD = 1.90), was 7.01 (SD = 1.84) for the seven-corroborators conditions, and was 7.21 (SD = 2.00) for 14-corroborators conditions. A two-way independent ANCOVA, with pre-alibi guilt ratings as a covariate, revealed a statistically significant main effect of relationship on alibi believability, $F(1, 240) = 10.54$, $p = .001$. Participants in the nursing staff member conditions rated the alibi as more believable ($d = 0.40$) than those in the family member conditions. There was also a statistically significant main effect of number on alibi believability, $F(2, 240) = 12.50$, $p < .001$. Participants in the one-corroborator conditions rated the alibi as less believable than participants in the seven-corroborators conditions ($d = 0.58$) and participants in the 14-corroborators conditions ($d = 0.66$); effect size between the seven-corroborators and 14-corroborators conditions was small ($d = 0.10$). There was no statistically significant interaction, $F(2, 240) = 0.283, p = .788$.

Guilt

The average rating of post-alibi guilt was 6.08 (SD = 1.87) for those in the family member conditions and 4.64 (SD = 2.12) for nursing staff conditions. The average ratings of post-alibi guilt for the one-corroborator conditions was 5.99 (SD = 2.13), was 5.26 (SD = 2.15) for seven-corroborators conditions, and was 4.75 (SD = 1.92) for 14-corroborators conditions. The ANCOVA revealed a statistically significant main effect of relationship on likelihood of guilt, $F(1, 240) = 45.48$, $p < .001$. Participants in the nursing staff conditions rated the ex-husband as less likely to be guilty ($d = 0.72$) than those in the family member conditions. There was also a statistically significant main effect of number on likelihood of guilt, $F(2, 240) = 8.34$, $p < .001$. Participants in the one-corroborator conditions rated the ex-husband as more likely to be guilty than participants in the seven-corroborators conditions ($d = 0.34$) and participants in the 14-corroborators conditions ($d = 0.61$);

effect size between the seven-corroborators and 14-corroborators conditions was small ($d = 0.25$). There was no statistically significant interaction, $F(2, 240) = 1.62, p = .200$.

Across all conditions, the average pre-alibi rating of guilt was 7.04 ($SD = 1.67$), thereby suggesting that the homicide scenario was also successful in generating initial suspicions of guilt toward the ex-husband. The average post-alibi rating of guilt was 5.35 ($SD = 2.13$); the difference between the two ratings of guilt was statistically significant, $t_{(246)} = 12.73$, $p < .01$, $r = .41$, $d = 0.81$. Moreover, 87.0% of participants indicated at the outset of the experiment that they believed the ex-husband was likely guilty (a rating of 6 or above on a 10-point scale), as compared to 54.7% of participants who believed the ex-husband was guilty (gave a rating of 6 or above) after being provided with either of the six alibis. There was a statistically significant reduction in the judgments of likelihood of guilt from pre-alibi guilt ratings to post-alibi guilt ratings in five of the six conditions. The largest reduction was for the conditions that had 14 nursing staff members as alibi witnesses ($d = 1.42$), and the smallest (and non-significant) reduction was for the conditions that had one family member as the alibi witness ($d = 0.22$); the average effect size for all six conditions was $d = 0.86$.

Suspicion

The percentage of participants who chose to retain the ex-husband as the primary suspect when a family member(s) was the corroborator was 40.16% and was 35.20% when the corroborator was a member of a nursing staff(s). A chi-square test revealed that the binary decision regarding the suspicion of the suspect did not differ as a function of relationship, $\chi^2(1, N = 247) = 0.65, p = .42$. The percentage of participants who chose to retain the ex-husband as the primary suspect when there were 14 corroborators was 22.50%, was 32.50% for seven corroborators, and was 56.32% for one corroborator. A chi-square test revealed that the binary decision

regarding the suspicion of the suspect differed as a function of number, $\chi^2(2, N = 247) = 21.65, p < .001$. That is, there were more participants who wanted to retain the ex-husband as the primary suspect in the one-corroborator conditions than you would expect by chance, and fewer in the seven- and 14-corroborator conditions. There also was a difference in the proportion of people who retained the ex-husband as the primary suspect across six conditions, $\chi^2(5, N = 247) = 22.80, p < .001$. In other words, there were more participants who wanted to retain the ex-husband as the primary suspect in both the one-nursing-staff and one-family-member conditions than you would expect by chance, and fewer in the 14-nursing-staff and 14-family-member conditions; the difference between the expected and actual count for both the seven-nursing-staff and seven-family-members conditions was miniscule.

Discussion

The goal of Experiment 2 was to build upon Experiment 1 by measuring the effect of person evidence on alibi assessments when an ostensibly unmotivated other (i.e. nursing staff member) was used as an alibi witness as opposed to a family member, and the maximum number of corroborators in the scenario was increased (i.e. seven to 14). In general, we found effects for both relationship and number on perceptions of the alibi provider. We also found a large reduction in belief in guilt once participants were exposed to any person evidence. These findings suggest that the quality and quantity of person evidence influences alibi assessments, but that quantity has the greatest effect on alibi assessors.

With regards to relationship (i.e. quality), we found that alibis that were supported by nursing staff members had a small effect on believability ratings, a medium effect on likelihood of guilt ratings and a small effect on the suspicion decision. Taken together, these results suggest that there is some support for Olson and Wells' (2004) taxonomy of alibi

believability, whereby having non-motivated familiar others increases the level of favourability toward the alibi because of the perception of how difficult it is to convince that person to lie for you, and the fact that they are unlikely to be mistaken because they have familiarity (see Loftus, 1979, regarding the positive effect of familiarity on recall accuracy). We suspect that our participants reasoned, with respect to their assessment of post-alibi guilt, that the staff of a nursing home are unlikely to lie for one of their clients' visitors because there is only personal risk associated to lying (e.g. obstruction of justice, loss of job), and no apparent personal gain for doing so. The credibility of the staff members was mentioned explicitly by several participants (e.g. 'I didn't rely on him so much, but seven other people who barely knew him wouldn't have a reason to cover for him'; 'I do not think that he could convince 14 unrelated and apparently only vaguely familiar persons to lie so that he could have an alibi.').

In terms of number of corroborators, we found that having more than one corroborator led to more favourable alibi assessments; however, there appears to be a ceiling effect. Specifically, we found that alibis supported by seven or 14 people were viewed as more believable and the provider being less likely to be guilty than one corroborator; the difference between seven and 14 was minimal. A similar trend was found for ratings of suspicion, whereby nearly three fifths of participants who were told about one alibi witness wanted to retain the ex-husband as the primary suspect, as compared to approximately one third and one fifth of participants who were told about seven and 14 alibi witnesses, respectively. In general, we speculate that our participants reasoned that the chance that the ex-husband would be able to convince a group of seven or 14 people to *all* vouch for an alibi in relation to a violent crime is quite low. This assumption is supported by comments provided by many participants (e.g. '14 eye witnesses to confirm his alibi; I doubt if all of if any are

lying for his benefit'; 'If he has an alibi with 14 people that confirm, there is no reason to think that him and 14 other people are lying … regardless of how many times he has been fighting with his ex-wife.').

We also found that the ratings of guilt were reduced once participants were provided with any form of person evidence. Specifically, the reduction in post-alibi guilt was large for nursing staff members and moderate for family members. Exposure to any number of corroborators led to a reduction in pre- to post-alibi guilt ratings, with the size of this effect being large for alibis that were supported by seven or 14 corroborators; it was moderate for alibis supported by one-corroborator. Granted, we did not find an interaction of the effect, but our data show that having many seemingly non-motivated alibi witnesses will have the greatest positive effect for a suspect (i.e. the 14-nursing-staff condition produced the highest ratings of believability, the lowest rating of likelihood of suspect guilt and fewest suspicion decisions to pursue the suspect). As mentioned, Olson and Wells' (2004) taxonomy predicts that it is difficult for an alibi assessor to believe that a suspect can convince a non-motivated familiar other to lie for them, or believe that the non-motivated familiar other could have been mistaken about their alibi. Thus, it seems logical that an alibi assessor who believes in such a notion would render more extreme assessments as the number of non-motivated familiar others who vouch for the suspect increases.

General discussion

Research has shown that suspects and accused persons tend to rely almost exclusively on person evidence (e.g. family and friends) to support an alibi and are often unable to provide physical evidence as a form of support (e.g. Culhane et al., 2008, 2013; Nieuwkamp et al., 2017; Olson & Charman, 2012). The ability then of an innocent suspect to convince an investigator of his/her innocence hinges

largely on the *quality* and *quantity* of person evidence provided. Across our two experiments, we found that, regardless of who and how many, having at least one person vouch for the suspect was enough to mitigate guilt judgments. In terms of quality, we found some support for Olson and Wells' (2004) theory that corroboration from non-motivated others will lead the suspect's alibi to be viewed more favourably than when provided by a motivated other. We found mixed results, however, with respect to the number of people who corroborate the suspect's alibi. In Experiment 1, we found that alibis supported by one, four or seven corroborators did not render much of an effect on believability and likelihood of guilt ratings, whereas in Experiment 2, we found that alibis that were backed up by seven or 14 corroborators were viewed more favourably than if the alibi was supported by just one other person. In general, it appears that person evidence does have an effect on alibi assessments, and that the effect is largest when provided by many people and, to a lesser extent, by those who appear to have nothing to gain from lying for the suspect.

Collectively, our research also lends to extending Olson and Wells' (2004) theory of what makes a good alibi. Specifically, our results suggest that a quantitative element may need to be added to the theory of alibi believability. On a go forward basis, however, research that tests the effect of number of corroborators at a more granular level to determine the point where the inclusion of more corroborations no longer benefits the suspect is required. In addition, it is imperative that other forms of person evidence outlined by Olson and Wells be explored, such as the use of strangers, or combinations of motivated and non-motivated others (e.g. a brother and two strangers are provided as corroborators, vs. three brothers and one nursing staff). In other words, it would be interesting to know more about the boundary conditions regarding the effect of person evidence on alibi assessments.

The temptation to generalize these findings, however, needs to be tempered. Although our sample is arguably more representative than the undergraduate samples used in previous studies, our results can possibly only be generalized to middle-aged Caucasian Americans who are motivated to participate in online studies. If replicated, we could predict with some confidence how a sample similar to ours would assess the alibi scenarios we used. We also do not claim that our sample is representative of Americans, and definitely not of police officers who are tasked with the job of assessing alibis during consequential police investigations. Consequently, replication and extension of this study with different samples and different boundary conditions are needed.

One limitation of our research paradigm pertains to the use of the initial crime scenario. In both experiments, we also used a situation of domestic violence: situations in which a pre-existing relationship typically exists between the victim and the perpetrator (Petrosky et al., 2017; United Nations Office on Drugs & Crime, 2019). It may be the case that awareness of – or even assumptions about – the prevalence rates related to intimate partner violence could have acted as an artefact (i.e. extraneous variable) on our participants' assessment decisions. Replication and extension of these experiments using different samples and different scenarios are therefore needed before firm conclusions can be drawn. In addition, including participants who are faced with such investigative decisions (e.g. police officers) would increase the ecological validity of these findings.

The number of DNA-driven exonerations that have come to light in North America over the past 20 years is concerning. Closer inspection of these exonerations reveals that many innocent people have alibis – typically supported with person evidence – that are not strong enough to convince investigators of their innocence. Thus, a very important question remains: What does it take for an alibi, supported by others, to be believed?

Researchers are just at the cusp of providing an answer to this question, but this is a question that requires as much or more attention than other investigative processes that contribute to miscarriages of justice (e.g. eyewitness identification, interrogations).

Ethical standards

Declaration of conflicts of interest

Joseph Eastwood has declared no conflicts of interest

Christopher J. Lively has declared no conflicts of interest

Brent Snook has declared no conflicts of interest

Mark D. Snow has declared no conflicts of interest

Ethical approval

Informed consent

Informed consent was obtained from all individual participants included in the study

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Notes

1. Qualtrics was responsible for administering the compensation to participants in-house. Therefore, we do not know the exact amount of monetary incentive that was provided for participation.
2. See Footnote 1 regarding same issue.

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