

Northumbria Research Link

Citation: Horsley, Faye, James, Trevor Keith, Baker, Natasha, Broughton, Rachel, Hampton, Xanthe, Knight, Amy, Langford, Imogen, Pomfrey, Ellie and Unsworth, Laura (2022) Exploring explicit and implicit correlates of early anti-social fire exposure and everyday fire use in adulthood. *Journal of Criminological Research, Policy and Practice*, 8 (3). pp. 169-182. ISSN 2056-3841

Published by: Emerald

URL: <https://doi.org/10.1108/JCRPP-06-2021-0036> <<https://doi.org/10.1108/JCRPP-06-2021-0036>>

This version was downloaded from Northumbria Research Link: <https://nrl.northumbria.ac.uk/id/eprint/48552/>

Northumbria University has developed Northumbria Research Link (NRL) to enable users to access the University's research output. Copyright © and moral rights for items on NRL are retained by the individual author(s) and/or other copyright owners. Single copies of full items can be reproduced, displayed or performed, and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided the authors, title and full bibliographic details are given, as well as a hyperlink and/or URL to the original metadata page. The content must not be changed in any way. Full items must not be sold commercially in any format or medium without formal permission of the copyright holder. The full policy is available online: <http://nrl.northumbria.ac.uk/policies.html>

This document may differ from the final, published version of the research and has been made available online in accordance with publisher policies. To read and/or cite from the published version of the research, please visit the publisher's website (a subscription may be required.)

UN-PROOFED VERSION

Exploring explicit and implicit correlates of early anti-social fire exposure and everyday fire
use in adulthood

DRAFT

Abstract

Purpose: This study explored whether early anti-social fire exposure (ASFE) is associated with how adults engage with everyday fire use and how they view fire on explicit and implicit measures. **Methodology:** An opportunistic sample (N = 326) was recruited. Participants completed an online study exploring ASFE, fire use, strength of fire-beliefs and interest in/attitudes supportive of fire. Additionally, we measured implicit fire bias using the Affect Misattribution Procedure (AMP). **Findings:** Participants with ASFE scored higher on fire use, fire interest, and general fire beliefs, and showed an implicit dislike of fire stimuli, compared to non-exposed participants (although differences in fire use were not statistically significant when gender was accounted for). Males also had higher levels of fire interest, held stronger fire related beliefs, and were 3.4 times more likely to have been exposed to ASFE during childhood. However, there were no gender differences in fire use or on the implicit task. **Research limitations/ implications:** This is the first study to explore type of early exposure to fire and the relationship between early ASFE and adult fire use. It is also the first study to adopt the AMP as a measure of implicit fire-bias. The findings have practical application, namely in relation to early intervention and rehabilitative approaches. However, a limitation is that we did not account for participants' cultural background in this study. Additionally, we advise caution in interpreting the implicit results and call for further research.

Keywords: Firesetting, arson, fire interest, Continuum of Fire Use scale, affect misattribution procedure.

Introduction

The influence of early fire exposure on later fire behaviour and cognition (Murray et al., 2015) has received little attention in the firesetting literature to date. There are only a handful of existing studies, and methodological constraints suggest there is a need for more research. We begin with a brief review of the existing literature, focusing on the relationship between early fire exposure and adult behaviour, while noting that there is conceptual misalignment and some equivocal findings. In doing so, we allude to the absence of research that has investigated fire interest in normal populations. Finally, we end with a brief discussion of the limited research on implicit bias towards fire.

The relationship between early fire exposure and abnormal fire use.

A study by Macht and Mack (1968; as cited in Gannon and Pina, 2010) provides some of the earliest evidence for a link between early fire-experiences and later behaviour. Adolescent firesetters were found to have fathers who previously held occupations involving significant exposure to fire, such as within the fire and rescue service, albeit Macht and Macht based this on case studies of just four people. Later, Ritvo et al., (1983) drew a link between juvenile firesetting and earlier parental abuse via burning. Amongst adults, evidence that firesetters were more likely to have a family history of firesetting was found by Rice and Harris (1991). Although Ritvo et al and Rice and Harris draw a meaningful link between early exposure to fire and unsanctioned fire use, these findings were based on psychiatric samples and so are not necessarily applicable to the general population, or less specialist offending groups.

More recently, community-based research found that firesetters were more likely to have experimented with fire before the age of ten and have a family member who had also ignited a deliberate fire (Barrowcliffe and Gannon, 2015). Furthermore, offence chains for

mentally disordered firesetters (Tyler, Gannon, Lockerbie, King, Dickens and De Burca, 2014), and non-mentally disordered firesetters (Barnoux, Gannon and Ó Ciardha, 2015), highlighted early fire experiences as an important background factor. Taken together, the aforementioned findings suggest that early exposure to abnormal fire use may be a predictor of firesetting in later adulthood.

The notion that early fire exposure can influence later fire use makes theoretical sense from a social learning perspective. Pinsonneault (2002) suggests that a young child will “observe and imitate” their parents’ interactions with fire (p. 21) and Gannon and Pina (2010) state that exposure to firesetting, especially in an individual’s formative years, could place them at a greater risk of firesetting. Furthermore, Vreeland and Levin (1980; as cited in Gannon & Pina, 2010) assert that firesetting is instantly reinforcing, for example, through sensory excitement, thus suggesting how early experiences could perpetuate later behaviour. Gannon et al., (2012) build on this idea in the multi-trajectory theory of adult firesetting (M-TTAF; Gannon et al., 2012) by proposing that the fire-related experiences of a child or young adult could lead to an “inappropriately salient focus on fire” (p. 20). Gannon et al also set out the mechanisms by which this can occur, namely through the development of fire-related cognitive scripts and beliefs.

The notion that young people may somehow learn about fire from formative experiences is supported by ethnographic research by Fessler (2006). Fessler found scant interest in fire amongst children in a Sumatran fishing village community and concluded that this was because they learnt to use fire functionally from an early age and therefore were less interested in misusing it. Murray et al (2015) built on the work of Fessler (2006) by proposing the *exposure hypothesis* as an attempt to explain the link between previous fire-related experience and later interest in fire/fire use. Predicated on the concept of habituation, they proposed that greater exposure to fire in childhood should relate to lower levels of interest in

fire in adulthood. They conducted two survey-based studies; the first based in urban Vancouver and the second in rural Alaska (a community more reliant on fire). Both samples reported largely positive affective associations with fire, but this did not appear to be “dampened” by early exposure, which is inconsistent with the exposure hypothesis. In study two, in fact, a higher frequency of early fire exposure was related to more positive affective responses. Similar equivocal findings were identified by Sherrell (2021) who surveyed community samples in New Zealand to explore the relationship between fire interest, previous fire exposure, emotional dysregulation, impulsivity and sensation seeking. Sherrell found small positive correlations between previous exposure to fire and fire interest, but previous exposure was not a significant unique predictor of fire interest. Also, firesetters reported more frequent early exposure to fire than non-firesetters, although level of fire exposure was not a unique predictor of firesetting status.

It should be apparent that research drawing a link between early fire exposure and adult fire behaviours is somewhat equivocal. Further, there is also conceptual debate, for example, Sherrell (2021) draws upon a binary perspective of participants as either firesetters or non-firesetters, a position that has prevailed in the literature (cf. Barrowcliffe and Gannon, 2015, 2016; Ducat et al., 2015). The present research takes the position that a more nuanced perspective on fire-related behaviour could be helpful, a point also alluded to by Tyler and Gannon (2021). Horsley (2020, 2021a, 2022) presents a dimensional conceptualisation of everyday fire use - the Continuum of Fire Use (CoFU)¹. At one pole of the CoFU sits *criminalised* fire use, which includes arson. At the other end sits *non-criminalised* fire use (i.e., behaviour which is considered to be legal and socially acceptable). The CoFU underpins the

¹ The term fire *use* is preferred to firesetting because it encompasses *all* interactions with fire, rather than only those which are criminal/ reckless.

current study, which is one of its unique contributions, and hereafter we will apply the terms criminalised and non-criminalised fire use where applicable.

There are two other general limitations that we observe in the literature. First is the lack of attention paid to the role of participant gender. Gannon, Tyler, Barnoux and Pina (2012) note that very little research has systematically compared men and women firesetters, a point echoed by Fritzson and Miller (2016). To date, only a small body of evidence points to gender differences in firesetting on variables such as fire interest (Dadds and Fraser, 2006) and motives (Nanayakkara, Ogloff, Davis and McEwan, 2020). A second possible limitation is the manner in which fire exposure is operationalised, which typically takes the form of *frequency* of exposure (i.e., how often participants engaged with fire), rather than *type* of exposure. Sherrell acknowledges that frequency is only one facet to previous fire experience and asserts that the type of exposure, for instance, positive or negative, should also be investigated. Lastly, previous studies have generally employed self-report questionnaires, which is a method inherently constrained by social-desirability and response bias (Demetriou et al., 2015). Such constraints can be circumvented by using indirect or implicit measures, an approach which can also provide some insight into important psychological processes. Implicit measuring of fire-related factors has been utilised in a handful of firesetting studies, which are reviewed below.

The role of unconscious bias towards fire related stimuli.

Gallagher-Duffy et al (2009) used the Emotional Stroop task – an indirect measure of how much a stimulus interferes with cognitive performance. The researchers found that adolescent firesetters were more distracted by fire-related stimuli than adolescent non-firesetters and therefore slower on the colour naming task. These findings suggest that a) firesetters differ from non-firesetters in how they process fire-related stimuli; and b), that firesetters show increased attention to fire-related stimuli compared to controls. However,

Hoerold and Trannah (2014) also employed a modified Stroop task but unlike Gallagher-Duffy et al, no significant differences in reaction times or accuracy rates were found when comparing adolescent firesetters with a control group; albeit the authors noted an association between high fire interest and decreased accuracy on fire related words.

Barrowcliffe et al (2019) used another indirect measure, the Lexical Decision Task (LDT; a task that involves creating words from word stems), to explore fire-related cognition in adults. The researchers found that (non-apprehended) firesetters were quicker to associate fire-related words as fascinating compared to controls; therefore, suggesting that firesetters are cognitively predisposed towards fire stimuli. However, it should be noted that the same firesetters were also slower in associating fire-related words with negative associations, e.g., dangerousness. Taken together, and consistent with general associative-network models of the brain and Social Learning Theory (Bandura, 1971), we can conclude that exposure to fire will likely result in an implicit bias. However, the direction of this bias remains unclear, as does whether the type of fire and its operationalisation, is relevant.

To our knowledge, the aforementioned studies are the only attempts to understand firesetting through the use of implicit measures. We propose that there is a need to test for positive and negative types of fire preference because simply being distracted by fire or differing in the speed in associating fire as fascinating (Barrowcliffe et al, 2019), does not necessarily equate to an abnormal fire preference. In order to explore this, we employ the Affect Misattribution Procedure (AMP) as a novel implicit measure of liking (Payne et al., 2005).

In sum, the present study explored whether early anti-social fire exposure (ASFE) is associated with how adults engage with fire and how they cognitively process fire-related stimuli. We hypothesise that participants exposed to anti-social fire during childhood will demonstrate a cognitive bias. Specifically, we predicted that participants who report early anti-

social fire exposure (ASFE) will score significantly higher on the following compared to controls: (*H1*) the level of criminality of their fire use; (*H2*) explicit beliefs about fire, as well as interest in, and attitudes supportive of fire; (*H3*) implicit bias toward both normal and abnormal types of fire. We also make an exploratory hypothesis with regards to gender differences (*H4*), given that this is absent from much of the existing research. Although not the primary focus of the present study, we predicted that males would differ on *Hypotheses 1-3* above, i.e., males would have engaged in more criminalised forms of fire use as adults and score higher on implicit and explicit measures.

Method

Participants and Design

A power analysis was conducted using G Power version 3.41. Based on a small to medium effect size of .05, an alpha of .05, and a power of .80, approximately 312 participants were required. Three hundred and twenty-six participants volunteered (254 female, 68 male, 4 non-binary) from 18 – 81 years of age ($M_{age} = 26.1$, $SD = 12.6$). Participant ethnicity was 93.6% White/Caucasian, 1.2% Black/Afro-Caribbean, 1.8% South Asian and 3.4% for other/non-disclosed categories. Participants were based in the United Kingdom and the highest education level was 0.3% Primary School, 4.6% GCSE, 40.2% A Level, 45.1% Undergraduate degree, 9.2% Postgraduate degree, and 0.3% Doctorate. One participant withheld demographic data. For the purposes of the AMP task, participants were not able to participate if they were able to read Mandarin. This study was approved by a university ethics committee (ethics approval code 6429/2020).

Materials

Childhood Exposure to Fire (based on the work of Horsley, 2020).

Participants were presented with 11 questions relating to direct or vicarious exposure to negative/ anti-social types of fire during childhood, e.g., ‘Did you ever get in trouble for setting fires/ playing with fire?’, (direct exposure); or ‘Did your parent/s and/ or care givers smoke?’, (vicarious exposure). The decision about what types of fire use to include in this measure was based on the first authors’ experience as a practitioner working with firesetters, in addition to previous research (for example Horsley, 2020; Tyler et al., 2014; Barnoux et al., 2015). Note that since children mature at different rates, the subjective definition of childhood was left to individual participants, rather than chosen artificially by the researchers. The scale was binary, and those who reported childhood exposure to anti-social fire use were give a score of 1.

The Fire Use Matrix (FUM; based on the work of Horsley, 2022).

The nature of participants’ everyday adult fire use was measured using a tool based on the work of Horsley (2022). Predicated on work by Canter and Fritzon (1998) and Horsley (2020), as well as drawing on the academic literature (c.f. Presdee, 2005; Fessler, 2006; Winder, 2009), the FUM is the first attempt to measure fire use as a dimensional construct, i.e., ranging from non-criminalised to criminalised use. The FUM measures the nature of a person’s fire use in terms of target (i.e., what is being set alight) and motive (i.e., the reason for lighting a fire). It consists of 17 types of fire, presented as individual items in the questionnaire, along with a set of motives to accompany that type (the number of possible motives differed for each of the 17 fire types). Participants were asked to indicate how they had used fire as an adult by ticking any motive which applied to them for each of the 17 fire types. There was no limit to the number of ticks allowed per item. Based on a small pilot study, a scoring template was used

UN-PROOFED VERSION

to assign scores (from 0 to 5) to each of the participant's choices. For example, if a participant indicated they had set fire to items intended to be lit (such as a candle) for relaxation purposes, this was assigned a score of 1, to reflect a non-criminalised form of fire use. If participants indicated that they had set fire to a building for an act of revenge this was assigned a score of 5 to denote a criminalised form of fire use. The minimum score on the FUM was 0 (i.e., if participants endorsed no fire type/ motive combinations) and the maximum was 829 (i.e., if they endorsed every fire type/ motive combination, each of which had scores varying from 1 to 5). The higher the total FUM score, the more criminalised a participants' adult fire use.

Fire Beliefs Scale (FBS; based on the work of Horsley, 2020, 2022).

The strength of fire-related beliefs was measured using the Fire Belief Scale (FBS). The scale consists of 13 randomly presented items such as 'fire is magical' and 'fire is mysterious'. Participants indicated how strongly they endorsed each belief ranging from 1 (not true) to 5 (very true). Responses were summed to give an overall fire belief score ranging from 13 to 65, with higher scores indicating stronger fire beliefs. The scale had acceptable reliability; $\alpha = .73$.

Four Factor Fire Scale (FFS; Ó Ciardha et al., 2015a; Ó Ciardha et al., 2015b).

The FFS includes 3 previous fire interest measurement subscales and consisted of 7 items that measured fire interest (Murphy and Clare, 1996), 15 fire attitudes items (Muckley, 1997), and 7 items that measured identification with fire (Gannon et al., 2011). Examples of the three subscales respectively include indicating excitement at, 'watching a house burn down'; agreeing that, 'if you've got problems, a small fire can help you sort them out'; and, agreeing that 'fire is almost part of my personality'. Items were measured on a 5-point scale (except for fire interest measured on a 7-point scale) and, for the purpose of this study, the total score was calculated (rather than individual sub-scale scores). Overall scores ranged from 30

to 159, with a higher score indicating greater interest in, association with, and attitudes supportive of firesetting; $\alpha = .82$.

The Affect Misattribution Procedure (AMP; Payne et al. 2005).

The AMP is an implicit measure where a prime stimulus is presented briefly, followed by a neutral target item that is ambiguous for the participant (e.g., a Chinese pictograph). Participants are asked to rate whether they like the Chinese pictograph (yes/no) by pressing a corresponding key. Participants are told to ignore the preceding prime and not let the prime influence their judgement of the neutral image. Despite these instructions, the prime can influence the subsequent rating of the pictograph, such that a negative preceding image can result in a negative rating of the pictograph and vice versa, i.e., the affect associated with the prime is misattributed to the neutral pictograph. The task provides an implicit (unconscious bias) measure of liking and has been demonstrated to have superior validity and reliability compared to other implicit tasks (Payne and Lundberg, 2014).

In the present study, an image of pro-social or anti-social fire use was presented for 75 milliseconds before being replaced by a blank screen for 125ms and then a neutral image of a Chinese pictograph for 100ms. The pictograph was then replaced by a mask before being rated as positive or negative (Figure 1). The primes consisted of 4 negative and 4 positive fire images, photographed by the researchers directly, or sourced from wiki commons image library (<https://commons.wikimedia.org>). An example pro-social fire image was candles burning, whereas an example anti-social image was a car on fire. Participants indicated whether they disliked the neutral stimuli or liked the neutral stimuli (binary choice).

[Insert Figure 1]

Procedure

Details of the study, along with a link to the survey, were posted on social media sites such as Facebook. They were also circulated internally, via email, amongst the undergraduate psychology cohort at the host university; students were awarded course credit for taking part. Participants viewed and responded to an information and consent form before progressing to the survey. The study was conducted online via Qualtrics. Participants completed the AMP before answering survey items (this is standard experimental practice in many AMP studies as it avoids bias from the question items influencing task performance and also reduces the effect of participant fatigue). The AMP task was created using 'Minno' JavaScript (Zlotnick et al., 2015) and embedded in Qualtrics (Bengayev, 2020). Participants were instructed to press 'I' on their keyboard if they found Chinese pictograph pleasant, or 'E' if they found the pictograph unpleasant. Each pictograph was preceded by a positive or negative fire image. Participants undertook three practice trials using neutral images, then completed three blocks of 40 trials each (20 positive fire stimuli and 20 negative stimuli per block) for a total of 120 image ratings. Next, participants answered questions relating to childhood fire exposure (ASFE), followed by the FUM and the FBS. They then completed the FFS. All scale items were presented in randomised order. Finally, at the end of the online survey, participants answered demographic questions and rated the positive and negative fire images used in the AMP. This was used as a manipulation check to measure the valence of the images. A debrief was provided and organisations for help and support were signposted.

Data Analysis

Data for the FUM were not normally distributed so a log₁₀ transformation was applied to statistical analyses (however actual values are reported in subsequent tables). The FFS scores were normally distributed once 7 outlier responses were removed. All other scales showed acceptable distributions after inspection of histograms. A total of 12 AMP responses were

removed due to a lack of response variation, having slow responses, and/or anticipatory responses. AMP responses were recoded to -1 or +1 and totalled for overall responses as well as separately for positive and negative fire images. Total scores ranged from -120 to +120 and were summed for an overall implicit fire preference rating. Scores above 0 indicated a preference for fire (irrespective of valence), whereas scores below 0 indicated an implicit dislike. Separate scores for positive and negative fire types were also calculated, ranging from -60 to +60. Finally, in order to test *Hypotheses 1-3*, we conducted a series of univariate ANOVAs (this allowed us to also control for gender as a covariate in SPSS). For the exploratory analysis, *Hypothesis 4*, we conducted a binary logistic regression in order to test whether males were more likely to engage in anti-social fire use.

Results

A series of univariate ANOVAs were conducted to test whether participants exposed to anti-social fire use in childhood (ASFE) differed from non-exposed participants on the adult fire scales (*H1*). There was a significant difference in everyday fire use scores on the FUM, $F(1,319) = 3.8, p = .050$, partial $\eta^2 = .01$ (Table 1). There was also a significant difference on the FFS, $F(1,320) = 19.6, p < .001$, partial $\eta^2 = .06$; indicating that participants with ASFE had more interest in/attitudes supportive of fire. For *H2*, there was a significant difference on the FBS, $F(1,320) = 19.7, p < .001$, partial $\eta^2 = .06$; with ASFE participants holding stronger overall fire beliefs.

The above analyses were repeated with gender as a covariate (*H4*) in order to test whether responses on FUM, FBS, or the FFS varied as a function of being male. There were no meaningful differences in the aforementioned results, nor was gender a significant covariate, except for the following: For *H1*, there was no longer a significant difference on the FUM when

gender was included, $F(1,318) = 2.71, p = .100$, partial $\eta^2 = .008$; although gender was not a significant covariate, $p = .250$.

[Insert Table 1]

Implicit ratings of fire-related images

First, we conducted a manipulation check on the fire images used in the AMP task. A paired sample t-test was used to determine whether there was a statistically significant difference between the positive and negative fire stimuli ratings on a scale from -3 (negative) to $+3$ positive. Participants rated the positive fire stimuli ($M = 1.94, SD = .81$) as significantly more positive than the negative fire stimuli ($M = -2.83, SD = .54$), $t(325) = 83.65, p < .001$; indicating that the images were of appropriate valence.

Next, univariate ANOVAs were conducted with ASFE as the between-subjects factor. The implicit liking task revealed a significant difference in total AMP scores ($H3$), $F(1,325) = 4.1, p = .043$, partial $\eta^2 = .013$; indicating that participants exposed to early ASFE displayed a lower overall preference for fire-related stimuli, both positive and negative (Table 1). In terms of positive and negative valence, non-ASFE participants disliked negative fire images more than ASFE participants, however the difference was not significant, $F(1,325) = 3.1, p = .079$, partial $\eta^2 = .009$. There was no significant difference between ASFE and non-ASFE participants on positive fire stimuli, $F(1,322) = .057, p = .811$, partial $\eta^2 = .001$.

Exploratory analyses with gender

We conducted exploratory analyses (independent t-tests) with gender as the between-subjects factor and everyday fire use (FUM), fire beliefs (FBS), the four-factor scale (FFS) and implicit ratings (AMP task) as DVs (*Hypothesis 4*). Males were significantly more likely to hold stronger beliefs about fire, $t(123.0) = 2.76, p = .007$; and scored higher on the FFS,

$t(86.7) = 4.14, p < .001$. However, there were no significant differences in everyday fire use (FUM), nor on the implicit AMP fire scores (Table 1).

In order to test whether males were statistically more likely to be exposed to anti-social types of fire during childhood, we conducted a binary logistic regression with ASFE as the outcome variable and gender as the predictor. The logistic regression model was statistically significant, $\chi^2(1) = 18.2, p < .001$. The model explained 7% (Nagelkerke R^2) and correctly classified 59% of cases. Gender was a significant predictor of ASFE, $Wald(1) = 16.4, p < .001$; indicating that males were 3.4 times more likely to have been exposed to childhood negative/ anti-social fire use.

Discussion

We found that participants with childhood ASFE had a higher degree of criminalised fire use. Furthermore, participants with early ASFE scored higher on the explicit measure of fire interest/fire-supportive attitudes (measured by the FFS) and had stronger held beliefs about fire than those without ASFE (measured by the FBS), however they displayed lower liking for fire-related stimuli (both positive and negative) on the AMP, which was contrary to our prediction. Lastly, exploratory analysis revealed that men reported more childhood ASFE than women and that gender was a significant predictor of ASFE (although we note the low number of males that had not been exposed to anti-social fire and so suggest interpreting the results cautiously).

The finding that participants with ASFE in childhood had a higher FUM score makes sense from a social learning theory perspective (Bandura, 1977). In accordance with the work of Vreeland and Levin (1980; as cited in Gannon & Pina, 2010), childhood exposure to the stimulating and ‘exciting’ aspects of fire are instantly reinforcing, and, thus, as an adult the individual seeks the same instant sensory stimulation. This has support from a qualitative study by Horsley (2021b) who identified that sensory stimulation (as opposed to relaxation) was

common in criminalised forms of fire use. The finding that participants with ASFE in childhood had a higher FUM score also supports contemporary firesetting theory, which highlights the relevance of early exposure to fire and how this can influence the way a person comes to view it (Gannon et al., 2012; Tyler et al., 2014; Barnoux et al., 2015).

The finding that participants with ASFE scored higher on the explicit measure of fire interest/fire-supportive attitudes (the FFS) than those without ASFE is consistent with Social Learning Theory (Bandura, 1971) and could be interpreted alongside the work of Butler and Gannon (2015). They discuss the concept of cognitive scripts in relation to firesetters. Drawing on wider psychological literature, they explain that scripts are socially learnt, and can influence how a person behaves in a given situation. Butler and Gannon suggest that scripts might guide an individual in determining when it is appropriate to use fire. They also discuss a related concept – expertise – and how it develops in firesetters as a result of repeated behaviour.

In a recent study, Butler and Gannon (2021) investigated scripts and expertise in firesetters, in comparison to other offenders, a community sample, and a sample of fire service personnel (FSP). A full review of findings from this study is beyond the scope of this paper; particularly because it raises some very interesting discussion points surrounding similarities in scripts and expertise of firesetters and FSP. Of relevance here is that a relationship was found between the FFS and scripts and expertise. More specifically, scripts were predicted by the extent to which an individual identified with fire (one of the FFS subscales), and expertise was predicted by both identification with fire and serious fire interest (another FFS subscale). Butler and Gannon suggest that these findings make sense through the lens of existing psychological theory (including social learning theory) because if an individual identifies with fire it is logical that they would develop more scripts about its use. The same logic can be applied to our findings. Specifically, given that scripts are socially learnt (Butler and Gannon, 2015), early ASFE (both direct and vicarious) might result in criminalised (i.e., anti-social) fire use scripts.

If these scripts are related to attitudes, then this might explain why ASFE participants scored more highly on the FFS. We did not measure expertise explicitly, nor did we measure frequency of past or present fire use in our study and, thus, we cannot hypothesise about the role of expertise. It is possible, however, that if those with ASFE engaged frequently in criminalised forms of fire use, then expertise may have developed and so this, too, may have influenced their scores on the FFS.

Our findings indicate that participants with ASFE had more strongly held beliefs about fire (as measured by the FBS). It is noteworthy that they did not only endorse negative beliefs, such as ‘fire is dangerous’. Rather, beliefs such as ‘fire is magical’ were also endorsed more strongly by the ASFE group. Indeed, the FBS measures *strength* of beliefs about fire, rather than nature of the beliefs. Our finding offers some support for the assertions of Horsley (2020, 2022). Horsley posits that, in western society, children receive some unhelpful messaging about fire, which thereby enshrouds fire in mystery, intrigue and excitement. According to Horsley this mystery might increase a young person’s inclination to experiment with fire and, thus, engage in criminalised use in certain instances. This discussion hints at some important cultural influences in determining the type of beliefs, and attitudes, a person develops, and, thus, how they use fire. Pyne (2019) refers to culture through the lens of the history of fire. For example, he highlights that whereas dwellings today might “shun” open fire burning, the earliest shelters, such as caves, were built to facilitate it (pp. 102 – 103). We suggest, therefore, that culture is an important direction for future international research, for instance through studying differences in fire exposure, and its consequences, between Global North and Global South countries.

The finding that ASFE participants had more strongly held beliefs about fire also aligns with social learning theory perspectives on firesetting (Vreeland and Levin, 1980, as cited in Gannon & Pina, 2010), and with Gannon et al’s (2012) discussion about the role which early

experience plays in shaping how young people come to view fire. It is possible that ASFE means that young people develop a stronger emotional connection with fire and, thus, they hold stronger fire-related beliefs. Conversely, perhaps those without ASFE are less emotionally attached to fire, which means their beliefs about it are less pronounced. This is broadly supported by research by Horsley (2021b, 2021c), although Horsley also explores positive experiences of fire (in childhood and adulthood), which we did not address in the current study. Future research could explore pro-social/ positive fire exposure in youth, alongside ASFE. Overall, our findings suggest that the FBS could be a valuable research tool and so work is needed to refine it.

Findings relating to the AMP were contrary to our prediction. Overall, participants with ASFE displayed a lower liking for fire-related stimuli, both positive and negative. This could be considered surprising given our findings (outlined above) relating to the FFS and FBS. However, perhaps this can be understood by examining the underlying constructs being measured by the two questionnaires used in our study and the AMP. Interest in, association with, and attitudes supportive of firesetting (as measured by the FFS), and strength of fire-related beliefs (as measured by the FBS) are not necessarily the same as unconscious *liking* of fire stimuli (as measured by the AMP). It is possible, for instance, that ASFE participants have been somewhat desensitised to the sight of fire-related images, whilst still being interested in, and associating with the idea of fire. Indeed, it is worth noting that non-ASFE participants disliked negative fire images more than ASFE participants. Although not quite reaching conventional significance, this is what would be expected in that, perhaps, for those with ASFE negative fire use has become more normalised. This is reminiscent of one of the firesetter ITs proposed by Ó Ciardha and Gannon (2012) – ‘firesetting as normal’. It is important to note that the AMP findings are tentative. A replication of the AMP facet of this study in laboratory

conditions would be helpful². Furthermore, it might be more meaningful to explore frequency of early fire exposure (as done by Murray et al., 2015 and Sherrell, 2021), alongside type, as a correlate of fire-liking as measured by the AMP.

We predicted that males would score higher on explicit and implicit fire interest/attitudes, strength of fire-related beliefs and fire use. The prediction was partially met. Results showed that men had more ASFE than women and that gender was a significant predictor of ASFE. This could be interpreted alongside findings that boys are more likely than girls to play with fire (c.f. Perrin-Wallqvist and Norlander, 2003; Dadds and Fraser, 2006; Del Bove et al., 2008). Furthermore, literature on parental gender-stereotyping indicates that boys are given more autonomy (Leaper and Friedman, 2007) and parents are more protective over girls (Leaper, 2002) and so this might explain how boys come to have more contact with fire in an unsupervised manner and even why they have more vicarious ASFE. In turn, this could explain our finding that men had stronger fire-related beliefs and a higher interest in, and attitudes supportive of, fire.

There were, however, no significant gender differences in implicit bias towards fire, as measured by the AMP, nor in fire use score. Ostensibly, the latter is inconsistent with literature suggesting men are more likely to be apprehended for firesetting (Fritzon and Miller, 2016), however Gannon et al (2012) note that little is known about gender differences in firesetting overall. Furthermore, most of the existing firesetting literature is based on the firesetter/ non-firesetter dichotomy using convicted samples. Conversely, this study was the first to measure everyday fire use dimensionally (via the FUM) and, thus, it is possible that this more nuanced approach might be less sensitive to gender differences. Furthermore, it is important to note that although we had a diverse sample in terms of age range, the sample was comprised

² The current study embedded the AMP into an online Qualtrics survey as a result of restrictions relating to the Covid-19 pandemic.

predominantly of students. Future research should utilise the FUM with a convicted sample, in addition to community-based participants, which could generate a wider distribution of everyday fire use scores (including those sitting at the highest end of the spectrum) and, thus, might be more sensitive to gender differences.

Policy and Practice Implications.

Overall, our findings, alongside the work of Horsley (2022), point to the value of early intervention as a firesetting reduction strategy. More specifically, the finding that participants with ASFE in childhood had a higher FUM score has practical implications because it illuminates the value of intervening early to prevent reckless fire use in young people. Effective screening of young people for targeted intervention programmes is also important, and this should include attention being paid to the type of the person's exposure, as well as how frequently they are exposed to it. Currently, the provision of youth firesetting interventions is inconsistent across England (Foster, 2021), and this urgently needs to be addressed (Horsley, 2020, 2022). Young people are usually identified for intervention programmes on the basis of their own actions (Foster, 2020), however our findings also highlight the relevance of parental/caregiver-fire related behaviour. Therefore, when considering which young people to prioritise for early intervention programmes, perhaps parent/ caregiver behaviour should form part of the decision making process. Moreover, there are also interesting points to consider here about the potential value of involving parents/ caregivers in early intervention. This would mean that they, too, were exposed to fire-safety messages which could, in turn, alter their own behaviour.

The finding that people with ASFE scored more highly on a measure of fire interest and attitudes, as well as having more strongly held beliefs about fire could also inform practice, in terms of early intervention, in that it endorses suggestions by Horsley (2022) about the need to support young people in developing 'healthy' fire-related beliefs, attitudes, and scripts

(Butler and Gannon, 2015, 2021) as referred to earlier. Our findings involving the new measure – the FBS – are promising and so we suggest there is now a rationale to refine it through more research. We propose that the FBS could be a useful clinical tool. For instance, it could be used as a tool for identifying young people who would benefit most from early intervention, and it could also be employed as a way of evaluating such programmes.

In summary, our findings highlight the relevance of early ASFE in understanding a person's adult fire use and the way they think about fire. We suggest that this should be afforded more consideration in screening young people for targeted firesetting intervention and also in educating parents/ caregivers on fire safety. Furthermore, our findings call for more attention to be paid to the *type* of early exposure, as well as frequency of exposure. Not only is more research required but, again, this needs to be considered when working with young people thought to be at risk of firesetting.

Conclusion

Using a cross-sectional study we explored whether ASFE in childhood is associated with how adults engage with fire and how they view fire. We found that participants with childhood ASFE self-reported a higher degree of criminalised fire use in adulthood. Furthermore, they scored more highly on measures of fire interest/ fire-supportive attitudes and fire beliefs but showed a lower liking for fire-related stimuli on an implicit computerised task, which was contrary to our prediction. Lastly, exploratory analysis revealed that men reported more childhood ASFE than women and that gender was a significant predictor of ASFE. We suggest that our findings are of relevance in firesetting prevention, and, in particular, can inform early intervention programmes for young people. We also suggest that more research into the impact of early exposure to fire is required.

References

Anwar, S., Långström, N., Grann, M., and Fazel, S. (2011). Is arson the crime most strongly associated with psychosis?—A national case-control study of arson risk in schizophrenia and other psychoses. *Schizophrenia Bulletin*, Vol. 37 No. 3, pp. 580-586.

Bandura, A. (1971). Social Learning Theory. *General Learning Corporation*.
https://web.archive.org/web/20131024214846/http://www.jku.at/org/content/e54521/e54528/e54529/e178059/Bandura_SocialLearningTheory_ger.pdf

Barrowcliffe, E. R., and Gannon, T. A. (2015). The characteristics of un-apprehended firesetters living in the UK community. *Psychology, Crime and Law*, Vol. 21 No. 9, pp.836-853. doi:10.1080/1068316X.2015.1054385.

Barrowcliffe, E. R., and Gannon, T. A. (2016). Comparing the psychological characteristics of un-apprehended firesetters and non-firesetters living in the UK. *Psychology, Crime and Law*, Vol. 22 No. 4, pp. 382-404. doi:10.1080/1068316X.2015.1111365

Barrowcliffe, E. R., Gannon, T. A., and Tyler, N. (2019). Measuring the cognition of firesetting individuals using explicit and implicit measures. *Psychiatry*, Vol. 82 No. 4, pp. 368-371.

Bengayev, E. (2020, July 27). Running Project Implicit's AMP from Qualtrics [Blog post]. Retrieved from <https://minnojs.github.io/minnojs-blog/qualtrics-amp/>

Bornstein, R. F., and D'agostino, P. R. (1992). Stimulus recognition and the mere exposure effect. *Journal of Personality and Social Psychology*, Vol. 63 No. 4, pp. 545-552.

Canter, D., and Fritzon, K. (1998). Differentiating arsonists: A model of firesetting actions and characteristics. *Legal and Criminological Psychology*, Vol. 3 No. 1, pp. 73-96.
doi:10.1111/j.2044-8333.1998.tb00352.x

Dadds, M. R., and Fraser, J. A. (2006). Fire interest, fire setting and psychopathology in Australian children: A normative study. *Australian and New Zealand Journal of Psychiatry*, Vol. 40 No. 6-7, pp. 581-586.

Dalhuisen, L., Koenraadt, F., and Liem, M. (2015). Psychotic versus non-psychotic firesetters: similarities and differences in characteristics. *Journal of Forensic Psychiatry and Psychology*, Vol. 26 No 4, pp. 439-460. doi:10.1080/14789949.2015.1018927

Daykin, A., and Hamilton, L. (2012). Arson. In Winder, B., and Banyard, P. (Eds.), *A Psychologist's Casebook of Crime: From Arson to Voyeurism*. Hampshire, England: Palgrave Macmillan.

Del Bove, G., Caprara, G. V., Pastorelli, C., and Paciello, M. (2008). Juvenile firesetting in Italy: Relationship to aggression, psychopathology, personality, self-efficacy, and school functioning. *European Child and Adolescent Psychiatry*, Vol. 17 No. 4, pp. 235-244.

Demetriou, C., Essau, C. A., and Özer, B. U. (2015). Self-Report Questionnaires. In Cautin, R.

L. and Lilienfeld, S. O. (Eds.), *The Encyclopedia of Clinical Psychology*. John Wiley and Sons, Inc. <https://doi.org/10.1002/9781118625392.wbecp507>.

Ducat, L., McEwan, T., and Ogloff, J. R. (2017). A comparison of psychopathology and reoffending in female and male convicted firesetters. *Law and Human Behavior*, Vol 41 No. 6, pp. 588 – 599.

Daykin, A., and Hamilton, L. (2012). Arson. In Winder, B., and Banyard, P. (Eds.), *A Psychologist's Casebook of Crime: From Arson to Voyeurism*. Hampshire, England: Palgrave Macmillan.

Foster, J.E. (2020a). *An Exploratory Study of How Practitioners in UK Fire and Rescue Services Working with Children and Young People who Set Fires Identify Clients Requiring Psychosocial Interventions*. (Unpublished Master's dissertation). Cambridge University, Cambridge, United Kingdom.

Fessler, D. M. (2006). A burning desire: steps toward an evolutionary psychology of fire learning. *Journal of Cognition and Culture*, Vol. 6 No. 3, pp. 429-451. doi:10.1163/156853706778554986

Fritzon, K., and Miller, S. (2016). Female firesetters. In R.M. Doley, G.L. Dickens and G.A. Gannon (Eds.), *The Psychology of Arson* (pp. 41–54). Oxon, England: Routledge.

Gallagher-Duffy, J., MacKay, S., Duffy, J., Sullivan-Thomas, M., and Peterson-Badali, M. (2009). The pictorial fire Stroop: A measure of processing bias for fire-related stimuli. *Journal of Abnormal Child Psychology*, Vol. 37 No. 8, pp. 1165–1176.

Gannon, T. A., and Barrowcliffe, E. (2012). Firesetting in the general population: the development and validation of the firesetting and fire proclivity scales. *Legal and Criminological Psychology*, Vol. 17 No. 1, pp. 105-122. doi:10.1348/135532510X523203.

Gannon, T. A., Ó Ciardha, C., Doley, R. M., and Alleyne, E. (2012a). The multi-trajectory theory of adult firesetting (M-TTAF). *Aggression and Violent Behavior*, Vol. 17 No. 2, pp. 107-121. doi:10.1016/j.avb.2011.08.001.

Gannon, T.A., Tyler, N., Barnoux, M.F.L., and Pina, A. (2012b) Female arsonists and firesetters. In: Dickens, Geoffrey L. and Sugarman, Philip A. and Gannon, Theresa A., eds. *Firesetting and Mental Health: Theory, Research and Practice*. RCPsychiatrists, London, pp. 126-142.

Gannon, T. A., Ciardha, C. Ó., Barnoux, M. F., Tyler, N., Mozova, K., and Alleyne, E. K. (2013). Male imprisoned firesetters have different characteristics than other imprisoned offenders and require specialist treatment. *Psychiatry: Interpersonal and Biological Processes*, Vol. 76 No. 4, pp. 349-364.

Gannon, T. A., and Pina, A. (2010). Firesetting: Psychopathology, theory and treatment. *Aggression and Violent Behavior*, Vol. 15 No. 3, pp. 224-238. doi:10.1016/j.avb.2010.01.001

Gannon, T. A., Ó Ciardha, C., Barnoux, M. F., Tyler, N., Mozova, K., and Alleyne, E. K.

(2013). Male imprisoned firesetters have different characteristics than other imprisoned offenders and require specialist treatment. *Psychiatry: Interpersonal and Biological Processes*, Vol. 76 No. 4, pp. 349-364. doi:10.1521/psyc.2013.76.4.349.

Hoerold, D., and Trannah, T. (2014). Correlates of adolescent fire setting: examining the role of fire interest, fire-related attentional bias, impulsivity, empathy and callous–unemotional traits. *The Journal of Forensic Psychiatry and Psychology*, Vol. 25 No. 4, pp. 411-431.

Horsley, F.K. (2020). *Arson Reconceptualised: the Continuum of Fire Use*. (Unpublished doctoral dissertation). Durham University, Durham, United Kingdom.

Horsley, F.K. (2021a) Arson and firesetting: a new conceptualization. In D.A. Crighton and Towl, G.J. (eds.). *Forensic Psychology* (3rd edition). Wiley.

Horsley, F.K. (2021b) The fire – fire user relationship: a grounded theory of criminalised fire users' experiences. *The Journal of Forensic Psychiatry & Psychology*, Vol. 32 No. 6, pp. 902 – 916. doi:10.1080/14789949.2021.1942515

Horsley, F.K. (2021c) The positive aspects of fire use: a grounded theory of the experiences of non-criminalised fire users. *The Journal of Forensic Practice*, Vol. 23 No. 4, pp. 317 – 331. doi:10.1108/JFP-05-2021-0028

Horsley, F.K. (2022). *New Perspectives on Arson and Firesetting: The Human-Fire Relationship*. Routledge.

Leaper, C. (2002). Parenting girls and boys. In M. H. Bornstein (Ed.), *Handbook of Parenting: Children and Parenting*, pp. 189–225. Lawrence Erlbaum Associates Publishers.

Leaper, C., and Friedman, C.K. (2007). The socialization of gender. In J. Grusec and P. Hastings (Eds), *Handbook of Socialization: Theory and Research*, pp. 561–587. Guildford Press.

Long, C. G., Fitzgerald, K. A., and Hollin, C. R. (2015). Women firesetters admitted to secure psychiatric services: Characteristics and treatment needs. *Victims and Offenders*, Vol. 10 No. 3, pp.341-353.

Macht, L. B., and Mack, J. E. (1968). The firesetter syndrome. *Psychiatry*, Vol. 31 No. 3, pp. 277-288.

Murray, D. R., Fessler, D. M., and Lupfer, G. (2015). Young flames: The effects of childhood exposure to fire on adult attitudes. *Evolutionary Behavioral Sciences*, Vol. 9 No. 3, pp. 204 – 213.

Vindya Nanayakkara, V., Ogloff, J.R.P., Davis, M.R., and McEwan, T.E. (2020). Gender-based types of firesetting: clinical, behavioural and motivational differences among female and male firesetters, *The Journal of Forensic Psychiatry and Psychology*, Vol. 31No. 2, pp. 273-291. doi: 10.1080/14789949.2020.1720266.

Ó Ciardha, C., and Gannon, T. A. (2012). The implicit theories of firesetters: A preliminary conceptualization. *Aggression and Violent Behavior*, Vol. 17 No. 2, pp. 122-128.

Ó Ciardha, C., Barnoux, M. F., Alleyne, E. K., Tyler, N., Mozova, K., and Gannon, T. A. (2015a). Multiple factors in the assessment of firesetters' fire interest and attitudes. *Legal and Criminological Psychology*, Vol. 20 No. 1, pp. 37-47. doi: 10.1111/lcrp.12065

Ó Ciardha, C., Tyler, N., and Gannon, T. A. (2015b). A practical guide to assessing adult firesetters' fire-specific treatment needs using the Four Factor Fire Scales. *Psychiatry*, Vol. 78 No. 4, pp. 293-304.

Payne, B. K., Cheng, C. M., Govorun, O., and Stewart, B. D. (2005). An inkblot for attitudes: affect misattribution as implicit measurement. *Journal of Personality and Social Psychology*, Vol. 89 No. 3, pp. 277–293.

Payne, K., and Lundberg, K. (2014). The affect misattribution procedure: Ten years of evidence on reliability, validity, and mechanisms. *Social and Personality Psychology compass*, Vol. 8 no. 12, pp. 672-686.

Perrin-Wallqvist, R., and Norlander, T. (2003). Firesetting and playing with fire during childhood and adolescence: Interview studies of 18-year-old male draftees and 18– 19-year-old female pupils. *Legal and Criminological Psychology*, No. 8 Vol. 2, pp.151-157.

Pinsonneault, I. (2002) Developmental perspective on children and fire. In D.J. Kolko (ed.) *Handbook of Firesetting in Children and Youth*, pp. 15 - 32. Academic Press.

Presdee, M. (2005) Burning issues: fire, carnival and crime. In M. Peelo and K. Soothill (Eds.) *Questioning Crime and Criminology*, pp. 69-82. Routledge.

Rice, M. E., and Harris, G. T. (1991). Firesetters admitted to a maximum security psychiatric institution: Offenders and offenses. *Journal of Interpersonal Violence*, Vol. 6 No. 4, pp. 461-475. doi:10.1177/088626091006004005.

Ritvo, E., Shanok, S. S., and Lewis, D. O. (1983). Firesetting and nonfiresetting delinquents: A comparison of neuropsychiatric, psychoeducational, experiential and behavioral characteristics. *Child Psychiatry and Human Development*, Vol. 13 No. 4, pp. 259–267.

Sambrooks, K., and Tyler, N. F. (2019). What works with adult deliberate firesetters. *Forensic Update*, Vol. 130, pp. 17-21.

Seligman, M. E., and Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychological Association*, Vol. 55 No. 1, pp. 5 – 14. doi:10.1037/0003-066X.55.1.5.

Sherrell, R. (2021). *Examining the Relationship between Fire Interest and Firesetting: Contributions of Previous Experience with Fire and Self and Emotional Regulation* (Master's Dissertation, Open Access Victoria University of Wellington| Te Herenga Waka).

Tyler, N., Gannon, T. A., Ciardha, C. Ó., Ogloff, J. R., and Stadolnik, R. (2019). Deliberate firesetting: an international public health issue. *The Lancet Public Health*, Vol. 4 No. 8, pp. 371-372.

Winder, B. (2009). Positive aspects of fire: Fire in ritual and religion. *E-Journal of the Irish Journal of Psychology*, No. 30 Vol. 1-2, pp. 5-19. Retrieved from <https://www.tandfonline.com/loi/riri20>.

Wrangham, R., (2010) *How Cooking Made us Human*. Profile Books.

Zlotnick, E., Dzikiewicz, A. J., and Bar-Anan, Y. (2015). Minno.js (Version 0.3) [Computer software].

Table 1
Mean scores for anti-social fire exposure (ASFE)

	ASFE Yes (n = 166)		ASFE No (n = 160)		Male (n = 68)		Female (n = 254)	
	M	SD	M	SD	M	SD	M	SD
1.Fire Use Matrix	45.3	(49.9)	32.7	(43.3)	48.3	(52.8)	36.7	(45.6)
2.Fire Beliefs	42.4	(7.1)	38.9	(6.7)	42.6	(6.1)	40.1	(7.3)
3.Four Factor Scale	33.1	(5.8)	30.3	(5.5)	34.8	(7.2)	30.9	(5.2)
4.AMP Total	1.0	(27.3)	7.2	(27.6)	2.9	(23.6)	4.7	(28.7)
5.AMP Negative Total	-8.4	(25.0)	-13.5	(27.3)	-11.9	(25.6)	-10.5	(26.5)
6.AMP Positive Total	15.6	(20.1)	14.5	(20.5)	14.9	(20.8)	15.3	(20.3)

^{a b} indicates a significant difference, $p < .05$.

DRAFT