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The centrality of cognition and coping styles in driving aggressive responses

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Abstract

Objective: Despite the presence of theoretical frameworks explaining aggression, they still require refinement in the form of a specification of mechanisms that facilitate such behaviour. ***Method***: Study 1 recruited participants (N=31) from the general population (N=20) and from a forensic hospital (N=11). It was expected that aggression supportive cognitions and stress would be positively associated with aggressive behaviour. An experimental paradigm was used to induce stress and participants were subsequently given the opportunity to aggress. Study 2 was based on self-report questionnaires in community sample (N=462). It was expected that aggressive behaviour and traits would be associated with experienced stress, hostile attributions, coping styles, and attitudes to violence. Specifically, that criminal attitudes to violence will mediate the effect of hostile attribution on aggression, while coping styles will mediate the effect of perceived stress. ***Results***: An Implicit Theory "I am the law" was found to be associated with aggression. Furthermore, elevated skin conductance, but not changes in the heart rate, during the stress task was positively associated with aggression, and only among patients. Structural Equation Model confirmed the mediating role of criminal attitudes to violence and of maladaptive coping style for aggressive behaviour. ***Conclusion***: Aggression-supportive cognitions and maladaptive coping style are specific mechanisms through which external demands or subjective perception of a situation can result in aggressive behaviour.

Key words: Aggression; Violence; Aggression Supportive Cognitions; Attitudes; Stress; Coping Styles.

Fuelling Aggression: The role of aggression supportive cognitions, stress, coping styles and hostile attribution

1 Introduction

Understanding aggression increases control over it. This adds a practical value, in form of mitigating the impact on victims, communities, and aggressor, in addition to epistemological worth of such pursuit. Neurobiological models of aggression postulate aetiological differences between reactive (also referred to as affective) and proactive (or instrumental) aggression (Fabian, 2010). Reactive aggression is posited to result from a failure to appropriately control aggressive responses to a stress-evoking environment, due to increased neural activation in the threat system and poor response inhibition among both community and offender samples (Chester & DeWall, 2016; da Cunha-Bang et al., 2017; Farah et al., 2018). Meanwhile, instrumental aggression, which is the selection of aggressive conduct as a means to an end, is suggested to be rooted in poor ability to learn associations between behaviour and outcomes, decreased empathy and consequence evaluation (Blair et al., 2018; Morelli et al., 2015; Pardini & Phillips, 2010). However, this bimodal conceptualisation represents typological and artificial approximations of one behavioural concept, rather than two different phenomena. In real life, the motivation behind an act of aggression can be mixed; for instance, reactive aggression caused by a stressor can be proactively used to attack a person who is the stressor (Babcock et al., 2014; Blair, 2016).

Socio-cognitive models of aggression such as the *General Aggression Model* (GAM) (Anderson & Bushman, 2002) emphasise the role of aggression-supportive cognitive structures. According to this model, these structures reflect norms that condone or promote the use of aggression, contain associations between aggressive behaviour and valued outcomes, and outline such conduct as appropriate. Consequently, aggressive behaviour is suggested to result from a deliberate or automatic decision-making process where cognitive

structures outlining such behaviour and promising rewards are selected. The *I*^{3} *meta theory* summarises this further by postulating that the proclivity to aggress manifests as behaviour when it is evoked by external instigators, honed rather than blunted by internal and external impellents, and is not blocked by the inhibition processes (Finkel, 2014; Finkel & Hall, 2018).

The influence of cognitive structures, such as behavioural scripts or normative beliefs on aggressive conduct has been shown in previous research (Bowes & McMurran, 2013; Dunne et al., 2019; Gilbert et al., 2013; Podubinski et al., 2017). However, in it the cognitive structures facilitated aggression *as part* of wider models, suggesting that their presence might not be enough to drive aggressive behaviour. Accordingly, the GAM and I^3 state that cognitive structures favouring aggression acts as reinforcers of a proclivity to aggress that was evoked by the situational cues, perceived by an individual. This means that for a person to become aggressive, i.e. to employ cognitive structures favouring and outlining such conduct, the interaction that the person is in, needs to be interpreted as warranting aggression. Thus, specifics representation of a situation can evoke aggression-supportive cognitive structures.

An interaction that is most likely to invite aggressive conduct into consideration is that where harm is expected from others. Indeed, the tendency to perceive others' motivations as hostile even when the situation is ambiguous, referred to as Hostile Attribution Bias (HAB), has been consistently linked to aggression (Klein Tuente et al., 2019; Quan et al., 2019). With respect to the aforenoted models, the attribution of hostility to others becomes a trigger for accessing aggression-supportive cognitive structures. A person who does not deem aggressive behaviour as appropriate or rewarding is more likely to avoid an individual they consider as being hostile to them as compared to a person who has favourable stance toward

aggression. This suggests that the effect of HAB on aggressive conduct is likely to be mediated by aggression supportive cognitive structures.

The foundation for such relationship between individual's perceptions and cognitive structure are the socio-cognitive models. This is their primary value. However, while they provide a comprehensive framework for driving forces, especially internal ones, behind aggression, they often lack detailed descriptions of external modifiers that are proposed to facilitate forms of aggression (Anderson & Bushman, 2002).

One such modifier is stress. The effect of stress on aggression is acknowledged, but not consistently expanded on in aforementioned models (Anderson & Bushman, 2002). Defined as perceived threats to homeostasis activating the Sympathetic Nervous System (SNS), sympathoadrenomedullary system (SAM) and then Hypothalamic-Pituitary-Adrenal (HPA) axis (Carrasco & Van de Kar, 2003), stressors are conceptually linked to the definition of reactive aggression (Fabian, 2010). However, both hyper- and hypo-activity of the stress response systems have been shown to facilitate aggression (Bertsch et al., 2015; Murray-Close et al., 2017; Verona & Kilmer, 2007; Zhang et al., 2016). Given that coping styles are reported to mediate the relationship between emotional instability and aggression (Carlo et al., 2012; Gardner et al., 2012), it is likely that coping, and specifically maladaptive coping (Whitman & Gottdiener, 2015), will serve the same function in the stress – aggression relationship.

Since stress represents the demands of environment placed on an individual it cannot be considered the primary cause of aggressive behaviour. Within the I^3 framework stressors are instigators. Without proclivity to aggress that is *evoked* by them and aggression supportive impellants that *act on* them, stressors will not lead to aggression. This means that stress –

aggression relationship is likely to be indirect and is affected by extraneous variables that is coping styles.

There are other routes of influence for stress. The GAM places decision-making as a direct antecedent of aggressive behaviour. Stress has been shown to decrease the executive functions, including working memory capacity (Shields et al., 2016). This in turn suggests that a person with poor strategies for managing stress is likely to have less cognitive resources devoted to assessment of a situation they are in, selection of appropriate behavioural script, and evaluation of consequences.

Consequently, the current research aims to increase precision of aggression models by testing the interaction between aggression supportive cognitive structures and hostile attributions, as well as between the latter and working memory problems; investigate the mediating role of coping styles on stress aggression relationship. This is achieved via two studies. Study 1 used an experimental paradigm to investigate the relationship between stress cognitive structures and aggression in a small-scale study using students and patients detained in a high secure forensic hospital. The study predicted that aggression supportive cognitions will be positively associated with aggressive behaviour (Anderson & Bushman, 2002) and that an increase in the heart rate and skin conductance level will predict aggression (Verona & Kilmer, 2007). This was then followed by Study 2, which built a mediation model for the variables of value in Study 1, using a larger community sample and a cross sectional design. Thereby, it allowed to expand the investigation into the precursors of aggression, in addition to confirming presence of pathways identified for patients of secure hospital among community participants. This study had several predictions. The effect of perceived stress on aggression was expected be mediated by adaptive and maladaptive coping styles (Gardner et al., 2012; Whitman & Gottdiener, 2015). The effect of the hostile attribution bias on aggressive behaviour and traits was hypothesised to be mediated by the criminal attitudes to

violence (Klein Tuente et al., 2019). The effect of the life stressors on aggressive traits was expected to be mediated by the aggressive behaviour (Brown et al., 2017). The effect of hostile attribution bias on aggressive behaviour was hypothesised to be mediated by working memory problems (Anderson & Bushman, 2002; Klein Tuente et al., 2019). The coping styles that modulate the experienced stress were expected to be associated with working memory problems (Shields et al., 2016).

2 Study One: Effects of Stress and Implicit Theories on Aggressive Behaviour

Study 1 assesses the relationships between cognitions, stress, and aggression, exploring the presence of a positive association between implicit theories and aggressive behaviour. Additionally, it assesses whether acute stress facilitates aggressive behaviour equally among students and patients of high secure forensic hospital.

2.1 Method

Student participants were recruited using an online research platform from a University in the Northwest of England, UK. Patient participants were recruited by the researcher. Only those with good command of English language and without tinnitus were invited to participate. The ethical approval for the study was acquired from the University of Central Lancashire and the NHS ethics boards, IRAS project ID: 263017, REC reference: 19/YH/0227

2.2 Participants

The total sample for this study (N=31), consisted of male students (N=20) and patients of high secure hospital (N=11) in the United Kingdom. Since all patients of the high secure hospital were male, only students of the same sex were recruited. The student sample comprised 17 people with ages between 18 and 25 and three people aged 26 to 35. Meanwhile, the patient sample consisted of one person aged 18 to 25, four people aged 26 to

35, five people aged 36 to 45, and one person aged between 46 and 55. The ethical approval granted allowed only age as the socio-demographic descriptor.

2.3 Materials

Life history of aggression (LHA) (Coccaro et al., 1997) was used to estimate past aggressive behaviour. It was employed here as a semi-structured interview. Two subscales of the LHA were used in this research: Aggression and Antisocial Behaviour as they represent criminal behaviour directed at others, allowing to test the correspondence between implicit theories and conduct. Frequency of the target behaviour was rated on a scale ranging from 0 (no occurrence) to 5 (more than can be counted). The LHA has a good reliability (Cronbach's α for total score .88; for Aggression .87; for Antisocial Behaviour .74,) and validity indicators (Coccaro et al., 1997). With the current sample, the Cronbach's α for aggression subscale, was .66 and for antisocial - .73 indicating acceptable internal consistency (Ursachi et al., 2015; Vaske et al., 2017).

Implicit Theories Questionnaire. The presence of six Implicit Theories (ITs), identified by Polaschek et al. (2009) was explored using a semi-structured interview. During the interview participants were asked questions related to each of the ITs and encouraged to provide open ended answers.. An example, one of the questions assessing self-enhancement subtype of "Beat or be beaten" IT was: "Do you think a person can prove himself worthy by being aggressive towards others?" followed by asking participants to explain the reasoning behind their answer. Based on the participants' answers, each IT was rated as absent (0), partially present (1), or fully present (2). In the current sample, total score on Implicit theories questionnaire showed borderline acceptable reliability index, Cronbach's α = .63. Consequently, questions assessing presence or absence of the IT items were used individually.

2.3.1 Taylor Aggression Paradigm

Aggressive behaviour was assessed using competitive reaction time task (CRTT) (Copyright 2006 by Bushman & Saults) measure of aggression (Bushman & Baumeister, 1998), which represents the Taylor Aggression Paradigm (TAP) (Taylor, 1967). Previous research has demonstrated that the CRTT can be used as a measure of aggression with good validity (Giancola & Parrott, 2008). Participants were told that they would play 25 trials of CRTT against a real-life player, while in fact the outcome of each session was scripted. Before each trial, a participant was asked to set intensity using 1 to 10 slider (from 65 to 110dB with 5 dB difference) and duration, using also 1 to 10 slider (0.5 to 5.0 seconds) of an unpleasant noise. After the trial the slower responder both heard and saw the noise set for them by the faster responder, who only saw the settings of the opponent.

Only the intensity and duration selected for the first trial was used as the outcome variable. Given that it was the first trial against entirely unknown "opponent", it represented aggressive behaviour towards a "stranger".

2.3.2 STROOP task

The task was created using PsyToolkit platform. During the STROOP task a single word for a colour was presented on the screen, written in an ink of a different colour. There were four word and ink colours: red, yellow, blue, and green. Participants were instructed to respond to the colour of the ink rather than the word, by pressing a button with the first letter of the colour. For example, if the word Red was presented in yellow ink, participants needed to press button "Y". The STROOP task consisted of 50 trials, where a fixation point was presented for 200 ms, followed by the 600ms presentation of the colour word allowing participant to press corresponding button, and followed by the 500ms presentation of the feedback (right or wrong). The high speed of the word presentation was specifically designed to elicit stress-like response in the participants (Mejía-Mejía et al., 2018)

2.3.3 Physiological Measures

Participants' heart rate (HR) (measured in beat per minute (BPM)) and skin conductance level (SCL) (measured in microsiemens (μS) were obtained using Edu Loggers Heart Rate and Pulse Logger sensor and Galvanic Skin Response logger sensor. Both were used as markers of the SAM system activation (Murray-Close et al., 2017; Schwartz & Portnoy, 2017). The data was recorded using Edu Logger Software and stored in individual .csv files. Both variables were sampled at the rate of 10 per second.

2.3.4 Procedure

Participants were tested alone in a quiet laboratory or interview room. All procedures were explained to the participant and the HR and SCL receivers were placed on their non-dominant hand. First, the Edu-logger hardware was calibrated and the baseline HR and SCL were obtained. Afterwards, participants were interviewed to complete the LHA and ITQ questionnaires. A second baseline measure was taken following the interview. Participants were then informed that they would engage in the normal STROOP task. However, the task had increased speed to provoke stress response in the participants. During this task, the third measure of the HR and SCL were taken, and afterwards the fourth measure commenced. Participants were then introduced to the CRTT and told that they would be playing remotely against a real life opponent who was elsewhere. Fifth, sixth, and seventh physiological measurements were taken after first, second, and third block of the CRTT, respectively. At the end of the session participants were thanked, debriefed and were told that there was no real person playing against them. During the debrief a special attention was paid to the explanation that deception was required to maintain the validity of aggression assessment.

2.3.5 Data Analysis

All data was analysed using R software version 4.0.3 (R Core Team, 2020). First, manipulation checks were performed to assess stress induction. Then, the proposed

hypotheses were tested using linear regressions with confidence intervals obtained via bootstrapping using 1000 samples.

Owing to data corruption, HR and SCL data from a patient and 13 students were lost. Consequently, there were two datasets. A complete one (n = 31) that included LHA and IT measures and a subset (n = 17) that comprised HR and SCL measures and aggressive responses in the TAP. Although the TAP data for the whole sample was retained to ensure matched comparison for physiological measures analysis the TAP data was removed as well.

The intended sample size was 70 participants with 35 per group and was based on the power analysis for linear regression with medium effect size using G power (Faul, Erdfelder, Buchner, & Lang, 2009). However, due to start of the COVID-19 pandemic the face to face data collection was ended prematurely. Consequently, the existent dataset was underpowered to the extent that only large effect sizes were detectable.

2.4 Results and Discussion

<Insert Table 1>

2.4.1 Manipulation Check

Due to the heavy skewness of the SCL values and their small amount, log transformation was used to adjust the distribution's form. T-test assessing the change between the second baseline measurement (T2) and post-STROOP measurement(T4) showed no significant difference between average HR before (M = 78.84) and after (M = 81.50) the STROOP task, t(16) = -1.15, p = 0.27. However, there was a significant difference between the average SCL at T4 (M = 2.99) and T2 (M = 2.60), t(16) = -3.13, p<.01. This suggests that the STROOP task was a mild stressor and was only partially successful as it only elicited the expected increase in the SCL.

Spearman correlation analysis (n=31) between LHA aggression and antisocial subscales and the assessed ITs yielded three results. The only IT to have significant covariation with both LHA subscales was "Beat or be beaten: self-enhancement type" (r = .46, $p < .01$, and r = .53, $p < .01$, respectively). Meanwhile, "I am the law" (r = .39, $p < .05$) and "I get out of control" (r = .39, $p < .05$) had a significant correlation with aggression subscale of the LHA.

Although the model regressing ITs on aggressive behaviour did not have a significant overall fit, $F(6,24) = 2.04$, $p = .1$, "beat or be beaten self-enhancement" and "I am the law" ITs were positively associated with the aggressive behaviour. Consequently, a model with only these two ITs was constructed and had a good fit, $F(2,28) = 3.95$, $p < .05$. Despite indicated significance for the self-enhancement type of "beat or be beaten" IT, the corresponding CIs included zero suggesting that the effect is spurious (Table 2). Meanwhile, the "I am the law" IT was significantly and positively associated with the aggressive behaviour.

<Insert Table 2>

This result supports the proposition of the sociocognitive models of aggression that aggression results from enactment of aggression supportive cognitive structures (Anderson & Bushman, 2002; Huesmann, 1988; 1998; 2018) and findings of previous research (Bowes & McMurran, 2013; Dunne et al., 2019; Gilbert et al., 2013). A possible explanation why only one IT showed the association, might be because it includes both norm and responsibility. It gives the control over the situation to the aggressor as it awards the role of "*norm enforcer*" (Polaschek et al., 2009).

The model regressing HR and SCL on aggression was significant, $F(2,14)=5.4$, $p < 0.05$. While the change in the SCL was significantly positively associated with aggressive behaviour, the change in the HR did not have significant association with the outcome (Table 2). These findings were in line with previous research showing the positive association between increased SCL and anger (Zhan et al., 2017) or relational aggression (Murray-Close et al., 2017). Although, despite expectation the changes in the HR were not associated with aggressive behaviour, the manipulation check showed that the stressor did not evoke a change in it. Given that both HR and SCL reflect activation of the SAM system, the inability of the chosen stress task to elicit a HR response, suggested an overall low activation of the stress response system.

To establish whether there was a difference between students and patients in the relationship between SCL and aggression, an interaction model was run (Table 2). Although the overall model was not significant, $F(3,13) = 2.99$, $p = 0.07$, the SCL change was positively associated with aggression only among patients but not the students. This difference it is likely due to the measure of aggression. The current study used only the first "unprovoked" response in the TAP representing behaviour towards a stranger, rather than the average responses from the paradigm reflecting behaviour in an interaction. It is possible that exposure to stress on its own is not enough to provoke aggressive behaviour among students, as they require further provocation or competitive interaction with others.

Other explanations behind the partial agreement with previous research reflect the limitations of the current study. The small sample size impairs detection of minor effects. The interaction model for aggressive behaviour was not significant, while the model for the entire sample was. Consequently, it is possible that the positive stress – aggression association was significant only for the patients, due to its effect size being larger than that for the students.

Due to the small sample size this study is considered preliminary. Considering its results separately from those of the next study limits their generalisability and diminishes its value. Furthermore, due to the sample size the analysis was restricted only to that addressing the core hypotheses, as to not inflate the chances of Type I error. To support application of the findings showing the facilitators of aggressive behaviour to a wider community population a larger study was required.

3 Study 2: Pathways from Cognitions and Stress to Aggressive Acts And Traits

Study 2 builds on the earlier study by confirming outlined patterns in a larger community sample. It investigates the direct effect of aggression supportive cognitive structures on aggressive behaviour as well as their function as a mediator between hostile attribution and aggression. The study also tests the mediating role of coping styles for stress – aggression relationship and considers the effect of working memory problems.

3.1 Method

Participants were recruited online through the Prolific recruitment platform using advertising through the University of Central Lancashire psychological research participant system and Facebook platform.

3.2 Participants

The total sample (n = 462) included 172 male participants and 290 female participants. Seventy five percent identified as white British, 8% identified as Asian British, 2% identified as Black British and 15% identified as “other ethnicity. They comprised two groups; adults (n = 300), who were age 26 and above (Mage = 36.62), recruited, and the transitional age youth (TAY) group (n= 162), who were between the ages of 18 and 25 (Mage = 20.48). The resulting adult sample included 151 males and 149 females, while the TAY sample included

21 males and 141 females. The ethical approval for the study was acquired from the University of Central Lancashire[2]

The acceptability of the sample size was compared against the agreed on guide of 10 participants per hypothesised estimate (Schreiber et al., 2006). Based on predicted associations for this study this results in minimal sample size of 200 participants. However, as the structural equation models were expected to be refined and amended, the fit indices described in the "Analysis" subsection were primarily relied upon.

3.3 Materials

Short Form Buss Perry Aggression Questionnaire (BPAQ-SF) (Bryant & Smith, 2001), has 12 Likert Scale items. The reliability index by Cronbach's alpha for the total score and subscales, Physical Aggression; Verbal Aggression; Anger; Hostility, ranges from .57 to .80 (Webster et al., 2014).

Reactive Proactive Aggression Questionnaire (RPQ) (Raine et al., 2006) has 23 items ask how often something was (0 never to 2 often). It is reported to have good reliability for total scores and Reactive and Proactive subscales (Cronbach's α =from .84 to .90) and construct validity (Raine et al., 2006).

Life History of Aggression (LHA) (Coccaro et al., 1997) as described study 1 and applied here as a self-report questionnaire for screening participants to ensure range of past aggression (Coccaro et al., 2018).

Criminal Attitudes to Violence Scale (CAV) (Polaschek et al., 2004) includes 20 Likert scale items asking for agreement with statements describing criminal behaviour. It is reported to have good reliability (Cronbach's α = .95) and validity (Polaschek et al., 2004).

[2] Unique reference number Science 0023 Stage 2

Social Information Processing-Attribution and Emotional Response Questionnaire (SIP-AEQ) (Coccaro et al., 2009) assesses emotional and attributive responses to socially ambiguous situations with generally negative connotations. Only the items related to direct hostility items were included in the analysis. The subscale comprising both direct and indirect hostile attribution is reported to have good reliability (Cronbach's $\alpha = .90$) (Coccaro et al., 2009).

Perceived Stress Scale 10 (PSS) (Cohen et al., 1983), comprises 10 Likert scale items, asking participants to indicate how often they have felt or were able to do something over past month. The scale is reported to have acceptable reliability and validity with Cronbach's $\alpha > .74$ across 12 studies reviewed by Lee (2012).

List of Threatening Experiences (LTE) (Brugha & Cragg, 1990; Motrico et al., 2013) identifies whether or not participants have experienced life stress events via 12 yes or no items.. Reliability reported in previous studies ranged from .44 (Motrico et al., 2013) to .56 (Veenstra et al., 2007).

Brief COPE inventory (COPE-B) (Carver, 1997) identified coping styles that participants use when they encounter stressors. It includes 28 items, measured on a Likert scale asking whether participants engage in particular responses to stressors in their life. The inventory assesses 14 styles of coping: Self-Distraction; Active; Denial; Substance Use; Use of Emotional Support; Use of Instrumental Support; Behavioural Disengagement; Venting (e.g. "I've been expressing my negative feelings"); Positive Reframing; Planning; Humour; Acceptance; Religion; and Self-Blame. COPE-B has been shown to have acceptable reliability and validity (Monzani et al., 2015).

Working Memory Questionnaire (WMQ) (Vallat-Azouvi et al., 2012) assesses possible problems in the functioning of the working memory in daily life. It is comprised of 30 Likert

scale items that address three components: Short-Term Storage, Attention, and Executive Control. The WMQ has been shows to have good validity and reliability in both patients (Cronbach's α = .94) and healthy participants (Cronbach's α = .89) (Vallat-Azouvi et al., 2012).

3.3.1 Procedure

The Life History of Aggression questionnaire (LHA) (Coccaro et al., 1997) was initially administered to 1000 participants on Prolific . From those who participated in the screening, 300 participants were screened in (i.e. had LHA aggression scores ranging from 0 to 25) and invited to participate in the full study.

Participants from the adult group (*n*=300) were paid for their time and participants in the TAY group (*n*=162) were awarded partial course credit if they were students.

3.3.2 Analysis

All statistical analyses were performed using R software version 4.0.3 (R Core Team, 2020). Measurement models including all latent variables were constructed using the total sample. Direct and indirect pathways of mediation model fitted to adult sample were tested by model comparison.

The models were built using Structural Equation Modelling (SEM) via the Lavaan package (Rosseel, 2012). The analysis utilised bootstrapping with 1000 samples to obtain standard errors and establish the Bias Corrected and Accelerated (BCA) confidence intervals for the effects shown in the models. Comparative Fit Index (CFI) with values higher than .95, Root Mean Square Approximation (RMSEA) with values lower than .06 and the upper confidence interval lower than .08, and Standardised Root Mean Square Residual (SRMR) lower than .08 were used as indicators of good fit (Kenny, 2015; c).

There were eight missing values for the total score on the List of Threatening Experience scale. T-test establishing whether the missing values had a significant effect yielded no significance difference. Thus, they were treated as 0.

3.4 Results and Discussion

Means and standard deviations for both samples are presented in the Table 3. Bivariate correlations for the variables included in the SEM models for adult and TAY samples are presented in Supplementary Tables S.1 and S.2.

<Insert Table 3>

3.4.1 Measurement Models

The first step of the analysis was construction of the measurement model with the latent variables based on the whole sample. The first model with aggressive behaviour and traits as separate latent variables, and single working memory and coping styles latent variables was a poor fi, CFI = .7, RMSEA = .11 [.10, 11], SRMR = .12. Guided by theoretical consideration and item loadings, coping styles were split into adaptive and maladaptive coping latent variables. Although this model had significantly improved fit, (χ2 (4) = 365.80, $p < 0.001$, it was still poor, CFI =. 79, RMSEA =. 09 [.09, .10], SRMR =. 09. Consequently, a third copying style latent variable – support coping was added, based on item content and phrasing. It was a significant improvement over the second model, χ2 (5) = 499.51, $p < 0.001$, yet the overall fit was only borderline acceptable, CFI = .90, RMSEA = 06 [.06, .07], SRMR = .08. Thus, using modification indices Venting as a coping strategy was allowed to load on both maladaptive and support coping to reflect different approach to emotional release and a covariance between Humour and Positive Reframing was added, as the former often helps to

achieve the latter. This model was a significant improvement over the previous one, $\chi 2$ (2) = 96.80, $p < 0.001$. Despite the borderline acceptable fit, CFI = .92, RMSEA = .06 [.05, .06], SRMR = .06, this model was retained for mediation testing.

3.4.2 Mediation Models

Using the latent variables identified in the measurement model, an SEM model with multiple parallel mediations based on the proposed hypotheses was built for adult sample. *This model included six latent variables displayed in boxes in Figure 1. The aggression construct was separated into two, to reflect the different wording in the (sub)scales; while the BPAQ-SF asks participants to indicate the extent to which the items describe them, only the physical aggression subscale included items describing acts of aggression. Such wording made it closer to the items from the RPQ and LHA aggression subscale that asks participants to judge how often they engage in a particular behaviour. Moreover, previous research indicated that behavioural acts and trait aggression measures are not identical (Archer & Webb, 2006). Working memory latent variable was based on three subscales representing storage, attention, and executive functioning. Lastly, coping styles were divided into three latent variables. Adaptive coping reflected use of positive approaches to stress such as positive reframing of the situation. On the contrary maladaptive coping included poor responses to stressful situation, such as denial or drug use. Meanwhile, support coping was created to reflect use of social networks to alleviate pressure. Importantly, venting was included in both support and maladaptive coping constructs, to express that it can vary. In the context of aggressive behaviour, venting negative emotions through threats or using anger would represent an example of maladaptive coping, while expression of negative emotions within support networks is likely to have different consequences.*

It showed borderline fit, CFI = .91, RMSEA =.06 [.05, .06], SRMR = .07. Comparing it with the model where the indirect non-significant paths were dropped showed no significant

distinction, allowing the refined version to be retained, $\chi 2$ (6) = 8.89, p = .18. The second model had similar fit, CFI = 0.92, RMSEA = 0.06 [0.05, 0.06], SRMR = 0.07. To establish the extent of the mediation, this model was tested against the model without the non-significant direct paths, and no significant differences were found, $\chi 2$ (3) = .38, p = .95.

The resulting Model 3 had borderline acceptable fit, CFI = .92, RMSEA = .05 [0.5, .06], SRMR = .07, and it was compared to the model without the direct effect between perceived stress and aggressive behaviour (b = - .21, [-. 41, - .10], $p < .01$). The Chi-Square difference test showed significant distinction, $\chi 2$ (1) = 12.72, p < .001, suggesting that this effect cannot be removed. Consequently, the Model 3 was adopted as the final model for the adult sample (Figure 1 shows standardised path values).

Model 3 demonstrated indirect effect of perceived stress in last month on both aggressive traits (b = 0.11, [.08, .14], $p <$. 001) and behaviour (b = .31 [.18, 49], $p < .001$). For both outcomes it was positively mediated only by maladaptive coping. Given the significant non standardised total effect (b = 0.11, [0.06, 0.16], $p < .001$) and significant alteration of the model fit when the direct path was excluded, the mediation of the relationship between perceived stress and aggressive behaviour by increased maladaptive coping within this study is considered partial. However, for the aggressive traits there was a full mediation as the removal of this direct effect did not alter the model fit.

This finding is in line with previous research (Carlo et al., 2012; Gardner et al., 2012; Whitman & Gottdiener, 2015) reporting association of maladaptive coping styles and aggression. It also extends it, as coping style was shown to regulate the effect of stress. This agreed with the review by Roberton et al. (2012) highlighting the association between poor emotion regulation and aggression.

Meanwhile, hostile attribution tendency was shown to have an indirect effect, through criminal attitudes to violence on aggressive behaviour (b = 0.09, [.03, .16], $p < .01$), but not on aggressive traits, as removal of the indirect pathway for the latter did not alter the fit of the model. As the direct effect of hostile attribution tendency could not be removed from the model and was significant, b = .20 [.10, .30], $p < .001$, the criminal attitudes to violence were shown to be a partial mediator.

The consistent relationship between hostile attribution tendency and aggressive behaviour supports existing research (Klein Tuente et al., 2019; Martinelli et al., 2018; Quan et al., 2019). It also shows that this relationship is facilitated by engagement of aggression supportive cognitions. Expectation of hostile behaviour from others activates aggression-supportive cognitive structures, which in turn increase the likelihood of aggression.

Hostile attribution tendency was also the route through which the indirect effect of working memory problems on aggressive behaviour operated, b = .04 [.02, .06]. $p < .01$. This specifies the relationship between the HAB and aggression further (Klein Tuente et al., 2019). Poor information processing is related to aggression in cases when there already is a potential for it, in this case anticipation of hostility.

Moreover, aggressive behaviour was a full mediator of the effect that stressful life events have on aggressive traits, b = .08 [.04, .12], $p < .001$ since the direct effect was removed without affecting the overall model. This mechanism of repetitive acts informing individual traits partly corresponded to the socio-cognitive models (Anderson & Bushman, 2002) that place emphasis on learning behavioural scripts. This finding is also in line with previous research showing positive association between reactive aggression and experience of stressful events (Brown et al., 2017)

To compare the TAY and Adult sample, the saturated model was also applied to the TAY sample. The resulting fit was poor, CFI = .85, RMSEA = .07 [.06, .08], SRMR = .09. When following the same procedure as outlined above, the non-significant indirect paths were removed, Chi-square difference test indicated a significant change to the model fit, $\chi 2$ (9) = 55.10, $p < 0.001$. This suggested that the saturated model needs to be retained. However, its poor fit indicated that it is not applicable. This means that the pathways facilitating aggressive acts and forming aggressive traits in adults are different from those in the transitional aged youth. This is consistent with previous research showing that aggressive behaviour changes with age (Petersen et al., 2015) and suggests that mechanisms facilitating it do so as well.

<Insert Figure 1>

4 General Discussion

Presented studies highlight the mediating role aggression-supportive cognitive structures in facilitating aggressive behaviour among patients of high secure hospital as well as among members of the community. The results also demonstrate the importance of accounting for coping styles in the stress – aggression relationship. While a specific belief allowing a person to determine whether aggression is warranted facilitates aggression towards a complete stranger, across situations presence of different attitudes favouring such behaviour increases the chances that it will be enacted. This centrality of aggression supportive cognitive structures corresponds to the main proposition of the socio-cognitive models, which state that aggression is an enactment of cognitive structures promoting aggression as the right or suitable course of action (Anderson & Bushman, 2002). It also

clearly identifies them as impellents within I^3 meta-theory as they are personal qualities that can amplify proclivity to aggress (Finkel, 2014).

This function is was exemplified in the second study, as presence of favourable attitudes to violence facilitated the transition from expecting hostility from others to aggressive behaviour directed at them (Klein Tuente et al., 2019; Quan et al., 2019). It is also possible that in the first study aggression supportive ITs had similar effect on aggression following stress. Higher levels of stress were associated with aggression only among patients of high forensic hospital, which have reported higher endorsement of all ITs than students. This possibility needs to be addressed in future research.

Another possible explanation for the differences in the effect of stress on aggression between forensic patients and students, could be coping styles. As shown in study two maladaptive coping styles fully mediate the relationship between stress experienced in past months and aggression. Although the study was conducted with community sample, prior research have found similar role of maladaptive coping among patients with borderline personality disorder (Gardner et al., 2012). This lends ground to assuming the mediating role of maladaptive coping among forensic patients as well as community population, which in turn suggests that the effect of stress on aggression differs due to higher tendency to engage in such coping by the former as compared to the latter.

This also corresponds to further findings from the second study, specifically to the contribution of maladaptive coping styles to problems with working memory. Given that stress has been shown to decrease cognitive resources (Shields et al., 2016) and that is what maladaptive coping styles were associated with, it appears that one of their characteristics is inability to effectively decrease stress. This in turn means that employing them will keep the stress levels high, lowering working memory capacity, which in turn would facilitate reliance on hostile attribution bias in situation assessment and lead to aggressive behaviour for a

person who has cognitive structures encouraging use of aggression. Although this pathway partially agrees with the GAM (Anderson & Bushman, 2002), it has an important distinction. In this case, the working memory issues, which represent information processing capacities are suggested to influence the behaviour before the behavioural script is selected and before the situation, a person is in, is interpreted by them rather than only at the appraisal stage preceding the behaviour. In terms of the I^3 model (Finkel & Hall, 2018) the suggested pathway puts information processing capacity as an impellent rather than only as an inhibitor. Given that this is a tentative proposition future studies should address this possibility to establish whether information processing capacity has a single point of main effect on behaviour and if so determine whether it is during situation assessment of during behavioural script selection.

The current research is not without limitations. The scales used to assess aggression supportive cognitive structures in both studies lacked precision. Although ITs (Polaschek et al., 2009) were identified as present among violent offenders, the first study was the first to establish their presence through semi-structured interview, and the internal reliability of them together was low. However, the subsequent use of the ITs separately helped to uncover the specific core cognition related to aggressive behaviour at the cost of increasing the number of predictors in the regression model. Meanwhile, in regard to the CAV (Polaschek et al., 2004), Nunes et al. (2015) have questioned the type of aggression supportive cognitive structures it measures: attitudes or beliefs. While both represent cognitive structures (Anderson & Bushman, 2002), the lack of specificity hinders accurate identification of the mechanisms involved in facilitation of aggression. Nevertheless, the association of the CAV with aggressive behaviour rather than traits, supports the suggestion of Nunes et al. (2015) that this scale is related to normative beliefs about aggression.

Another arguable limitation is not addressing possible sex differences in aggressive behaviour. However, the results on the direct influence of aggression supportive cognitive structures and aggressive behaviour were comparable between the Study 1, which had an exclusively male sample, and Study 2, which used both men and women. This suggests that there is likely to be a certain degree of heterogeneity in the aggression-facilitating mechanism across sexes. This pattern is also consistent with the gender similarity hypothesis, which states that in most psychological variables the effect size of differences between men and women is small or very small (Zell et al., 2015).

4.1 Conclusion

The aim of the current studies was to understand the contribution of aggression supportive cognitive structures, stress, and information processing to aggressive behaviour. Based on the preliminary findings, these studies proposed primary route towards aggression originating in preconceived expectations for social situations and aggression supportive cognitions. Although the information processing components in form of working memory problems were also associated with aggressive behaviour, their effect was predicated on interaction with other variables. Consequently, rather than representing a route to aggression, they reflect omnipresent inhibitors and disinhibitors. Instead, the second contributor to aggression originated in stress, which broadly reflects situational demands on a person, and was suggested to affect aggressive behaviour only through other variables. One such variable was identified to be coping styles, specifically maladaptive coping style. It is, however, not the only possible mediator. Adding them is the aim of future studies.

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Table 1 Descriptive statistics

Variable name	Students M (SD)	Patients M (SD)	Total M (SD)
Past Aggression (LHA) [f]	7.9 (4.59)	11.18 (7.37)	9.06 (5.83)
Past Antisocial behaviour (LHA) [f]	3.4 (3.59)	10.64 (4.13)	5.97 (5.12)
Violence is normal (ITQ) [f]	1.25 (0.85)	1.27 (0.65)	1.26 (0.77)
Beat or be beaten (ITQ) [f]	0.25 (0.44)	0.82 (0.87)	0.45 (0.68)
Beat or be beaten self-enhancement (ITQ) [f]	0.6 (0.6)	1.36 (0.81)	0.87 (0.76)
Beat or be beaten self-preservation (ITQ) [f]	1.4 (0.5)	1.36 (0.81)	1.39 (0.62)
I am the law (ITQ) [f]	0.85 (0.67)	1.27 (0.9)	1 (0.77)
Aggressive Response (TAP) [s]	0.85 (0.67)	1.27 (0.9)	1 (0.77)
Change in Heart Rate [s]	1.5 (0.69)	1.73 (0.47)	1.58 (0.62)
Change in Skin Conductance Level [s]	-0.95 (11.16)	5.18 (7.83)	2.65 (9.53)

f – full sample (n=31), s - subset of sample (n=17)

Table 2 Summary of regression analysis for implicit theories predicting aggressive behaviour (n = 31)

F(6,24) = 2.04, p =.1, R2 = .34, adjusted R2 = .17				
	Estimate [95% CI]	SE	t	p
Intercept	7.91 [0.03,13.89]	3.33	2.37	0.03
Violence is normal	1.39 [-1.74,4.16]	1.33	1.04	0.31
Beat or be beaten	-0.63 [-3.35,2.68]	1.47	-0.43	0.67
Beat or be beaten self-enhancement	-1.24 [-4.68,2.46]	1.39	-0.89	0.38
Beat or be beaten self-preservation	-4.38 [-9.41,1.4]1	2.09	-2.1	0.046
I am the law	3.44 [-0.20,6.79]	1.64	2.1	0.047
I get out of control	2.81 [-0.37,6.98]	1.9	1.48	0.15
F(2,28) = 3.95, p < .05, R2 = .22, adjusted R2 = .16				
Intercept	11.37 [7.04,16.19]	2.33	4.88	<0.001
Beat or be beaten self-preservation	-3.82 [-7.37, 0.37]	1.86	-2.06	0.049
I am the law	4.03 [0.85, 6.48]	1.47	2.74	0.01
Regression analysis for physiological changes predicting aggressive behaviour (n = 17)				
F(2,14) = 5.4, p < 0.05, R2 = .44, adjusted R2 = .36				
Intercept	7.76 [5.11, 11.11]	1.41	5.51	<.001
HR change	0.14 [-0.22, 0.31]	0.15	0.91	0.38
SCL change	5.30 [2.52, 8.91]*	2.31	2.3	0.04
F(3,13) = 2.99, p = 0.07, R2 = .41, adjusted R2 = .27				
Intercept	7.13 [3.27, 11.24]	2.31	3.09	0.009
Student	0.96 [-5.31, 19.26]	3.04	0.32	0.76
SCL among patients	6.90 [3.22, 10.34]*	2.66	2.59	0.02
SCL among students	-1.61 [-84.64, 28.49]	6.26	-0.26	0.8

Table 3 *Means and Standard Deviation of the sample*

	Adult (n = 300)	TAY (n = 162)	Male (n = 172)	Female (n = 290)	
Variable	M(SD)	M(SD)	M(SD)	M(SD)	Scale α
1. Past Aggression (LHA)	9.91 (5.46)	8.6 (5.12)*	9.94 (5.79)	9.17 (5.1)	0.75
2. Storage domain of WM (WMQ)	18.99 (6.79)	21.51 (8.09)**	20.7 (6.95)	23 (7.64)*	0.86
3. Attention domain of WM (WMQ)	21.11 (7.15)	24.06 (7.68)***	18.23 (6.23)	19.61 (7)**	0.86
4. Executive domain of WM (WMQ)	18.27 (6.3)	20.61 (7.3)**	18.78 (6.68)	20.52 (7.67)	0.83
5. Perceived Stress (PSS-10)	18.13 (7.31)	22.44 (6.97)****	16.6 (6.96)	21.45 (7.19)****	0.77
6. Self distraction (COPE)	3.15 (1.52)	3.67 (1.46)**	3.04 (1.62)	3.51 (1.43)**	-
7. Active coping (COPE)	3.53 (1.46)	3.14 (1.64)	3.53 (1.44)	3.31 (1.58)	-
8. Denial (COPE)	0.85 (1.29)	1.09 (1.46)	0.84 (1.31)	1 (1.38)	-
9. Substance use (COPE)	1.25 (1.83)	1.02 (1.65)	1.31 (1.81)	1.09 (1.75)	-
10. Use of emotional support (COPE)	2.8 (1.79)	2.93 (1.75)	2.51 (1.76)	3.04 (1.76)**	-
11. Use of instrumental support (COPE)	2.46 (1.78)	2.77 (1.74)	2.13 (1.71)	2.82 (1.76)**	-
12.Behavioural disengagement (COPE)	1.08 (1.39)	1.83 (1.76)****	1.06 (1.46)	1.52 (1.61)**	-
13. Venting (COPE)	2.23 (1.45)	2.44 (1.56)	1.87 (1.23)	2.56 (1.57)****	-
14. Positive reframing	2.98 (1.53)	2.87 (1.65)	2.95 (1.53)	2.94 (1.6)	-

(COPE)					
15. Planning (COPE)	3.53 (1.5)	3.11 (1.57)*	3.41 (1.47)	3.37 (1.58)	-
16. Humour (COPE)	2.77 (1.84)	3.22 (2.05)*	2.89 (1.91)	2.95 (1.94)	-
17. Acceptance (COPE)	3.59 (1.38)	3.57 (1.4)*	3.68 (1.38)	3.52 (1.39)	-
18. Religion (COPE)	0.84 (1.52)	1.22 (1.81)*	0.95 (1.67)	0.99 (1.62)	-
19. Self-blame (COPE)	2.83 (1.84)	3.57 (1.92)****	2.66 (1.73)	3.34 (1.95)***	-
20.Criminal Attitudes to Violence (CAV)	35.03 (14.35)	35.2 (13.26)	38.96 (15.82)	32.79 (12.2)****	0.93
21. Physical Aggression (BPAQ)	8.19 (3.64)	8.22 (3.62)	8.49 (3.86)	8.03 (3.48)	0.76
22. Verbal Aggression (BPAQ)	7.79 (2.9)	8.17 (3.04)	7.78 (3.01)	8.01 (2.92)	0.79
23. Anger (BPAQ)	4.37 (2.27)	4.49 (2.35)	4.1 (2.23)	4.6 (2.32)*	0.76
24. Hostility (BPAQ)	8.39 (3.32)	8.35 (2.88)	8.16 (3.27)	8.51 (3.11)	0.77
25.Proactive Aggression (RPQ)	1.78 (3.04)	1.39 (2.86)	2.15 (3.73)	1.34 (2.38)*	0.88
26. Reactive Aggression (RPQ)	7.38 (4.22)	7.58 (3.94)	7.21 (4.53)	7.6 (3.86)	0.85
27. List of Threatening Experiences (LTE)	4.16 (2.56)	3.3 (2.09)***	4.08 (2.67)	3.73 (2.29)	0.69
28. Hostile Attribution Bias (SIP-AEQ)	9.83 (3.52)	9.27 (3.78)	9.18 (3.75)	9.9 (3.52)	0.73

*p <0.05, **p <0.01, ***p <0.001, ****p < 0.0001

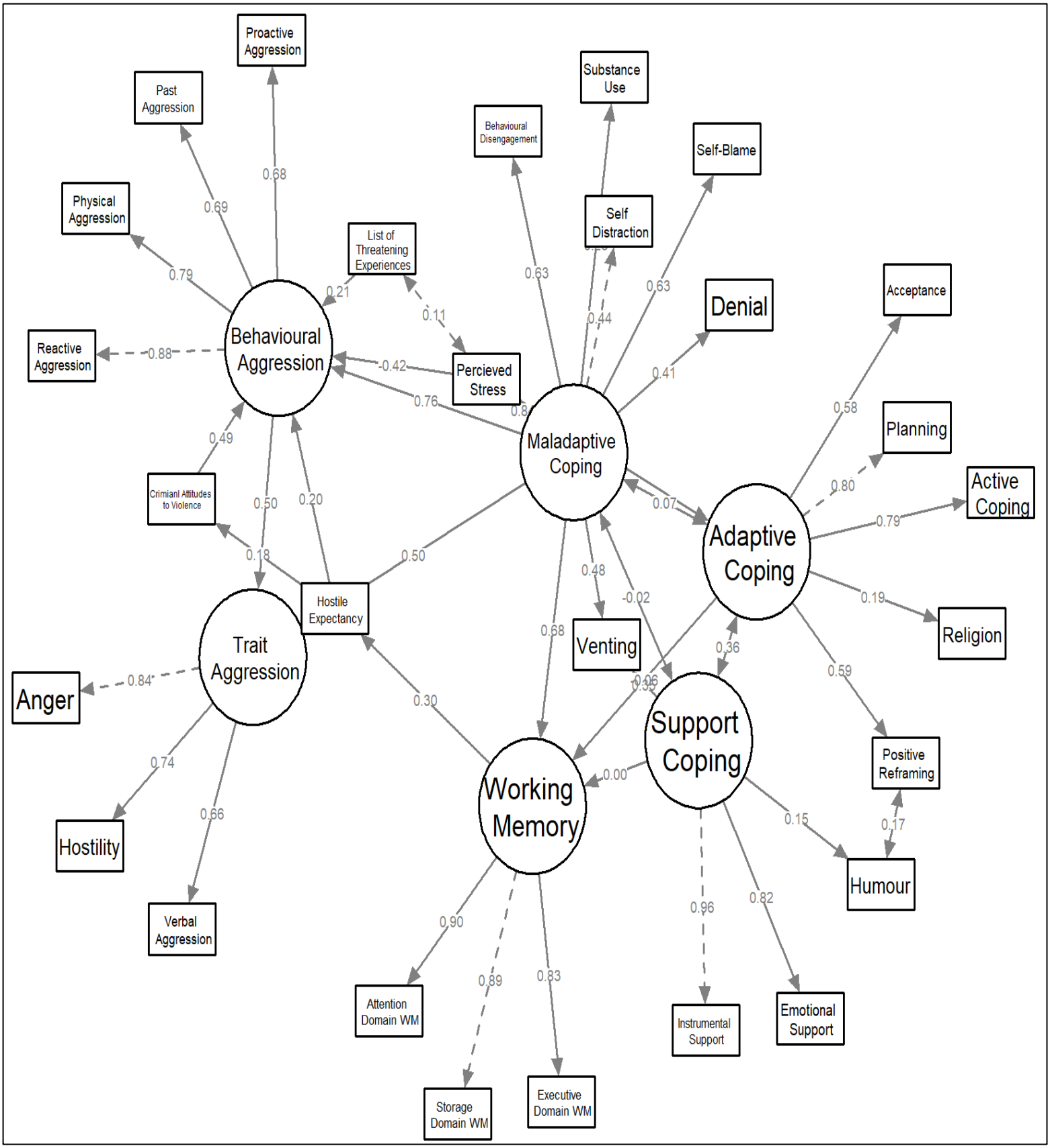

Figure 1. Model 3: Total direct and indirect effects of the model for adults (n = 300)

Supplemental Material

Table S1. 1. Correlations between past behaviour and Implicit Theories (n = 31)

	Aggressive behaviour	Past Aggression	Past Antisocial behaviour	Violence is normal	Beat or be beaten	Beat or be beaten self-enhancement	Beat or be beaten self-preservation	I am the law	I get out of control
Aggressive behaviour	1								
Past Aggression	0.24	1							
Past Antisocial behaviour	0.32	0.63***	1						
Violence is normal	0.31	0.17	0.18	1					
Beat or be beaten	-0.03	0.15	0.34	0.09	1				
Beat or be beaten self-enhancement	0.03	0.46**	0.53**	0.28	0.25	1			
Beat or be beaten self-preservation	-0.11	0.16	-0.04	-0.15	0.13	0.11	1		
I am the law	0.32	0.39*	0.24	0.17	0.13	0.34	0.56**	1	
I get out of control	0.26	0.39*	0.27	0.09	0.23	0.16	0.53**	0.49**	1

*<0.05, **<0.01, ***<0.001

Table S1. 1. Bivariate Correlations between variables included in the model for adults (n=300)

1[3]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	27
2	.23**																										
3	.21**	.81**																									
4	.23**	.74**	.73**																								
5	.17**	.49**	.53**	.51**																							
6	.23**	.26**	.32**	.26**	.37**																						
7	0.07	-.18**	-.21**	-.22**	-.33**	0.05																					
8	.18**	.30**	.29**	.32**	.29**	.21**	-0.08																				
9	.15**	.19**	.22**	.26**	.21**	.15**	-.18**	.19**																			
10	-0.04	-0.07	0.04	0.02	-0.07	0.02	.20**	-0.09	-0.02																		
11	0.01	-0.05	-0.01	-0.03	-0.01	0.06	.23**	-0.05	-0.06	.79**																	
12	.15*	.37**	.41**	.43**	.58**	.20**	-.30**	.40**	.20**	-.12*	-0.05																
13	.22**	.26**	.30**	.25**	.39**	.27**	0.07	.13*	0	.26**	.32**	.18**															
14	-.13*	-0.09	-.16**	-.12*	-.32**	0	.43**	0	-0.1	.29**	.30**	-.23**	0.01														
15	0.02	-0.11	-.13*	-.17**	-.21**	0.05	.67**	0	-.17**	.17**	.26**	-.16**	0.07	.46**													

[3] 1. Past Aggression; 2. Storage domain of WM (WMQ); 3. Attention domain of WM (WMQ); 4. Executive domain of WM (WMQ); 5. Perceived Stress (PSS-10); 6. Self distraction (COPE); 7. Active coping (COPE); 8. Denial (COPE); 9. Substance use (COPE); 10. Use of emotional support (COPE); 11. Use of instrumental support (COPE); 12. Behavioural disengagement (COPE); 13. Venting (COPE); 14. Positive reframing (COPE); 15. Planning (COPE); 16. Humour (COPE); 17. Acceptance (COPE); 18. Religion (COPE); 19. Self-blame (COPE); 20. Criminal Attitudes to Violence (CAV); 21. Physical Aggression (BPAQ); 22. Verbal Aggression (BPAQ); 23. Anger (BPAQ); 24. Hostility (BPAQ); 25. Proactive Aggression (RPQ); 26. Reactive Aggression (RPQ); 27. Life Traumatic Experiences (LTE); 28. Hostile Attribution Bias (SIP-AEQ)

16	0.03	-0.01	-0.02	0.03	-.11*	.11*	.16**	-0.04	0.05	.12*	.17**	-0.07	.12*	.26**	.13*												
17	0	-.18**	-.25**	-.24**	-.29**	0.01	.43**	-.14*	-0.05	.14*	.15**	-.17**	-0.06	.44**	.46**	.28**											
18	0.03	-0.02	-0.04	-0.01	-0.03	0.01	.14*	0.1	-0.09	0.09	.13*	0.02	0.11	.17**	.14*	-0.02	0.08										
19	.20**	.35**	.43**	.36**	.54**	.29**	-.17**	.25**	.14*	-0.06	0.02	.43**	.31**	-.11*	-0.04	0.01	-0.08	-0.08									
20	.43**	.18**	.17**	.14*	.15**	.16**	-0.04	.22**	.17**	-.14*	-0.11	.15**	0.11	-.21**	0.04	-0.06	-0.05	.12*	0.09								
21	.56**	.30**	.30**	.31**	.27**	.25**	-0.07	.30**	.20**	-0.08	-0.08	.22**	.28**	-.18**	0.03	-0.11	-0.07	0.05	.25**	.53**							
22	.39**	.28**	.30**	.35**	.34**	.24**	-0.03	.17**	.18**	0.02	0.02	.20**	.29**	-.17**	-0.01	0.05	-0.08	0.05	.25**	.27**	.50**						
23	.46**	.42**	.41**	.41**	.48**	.30**	-.13*	.32**	.17**	-.13*	-0.08	.36**	.38**	-.24**	-0.06	-0.08	-.15**	-0.01	.38**	.32**	.61**	.60**					
24	.36**	.47**	.43**	.42**	.57**	.33**	-.22**	.28**	.18**	-.17**	-.12*	.41**	.25**	-.21**	-0.09	-0.08	-.15**	-0.05	.44**	.29**	.48**	.49**	.63**				
25	.49**	.33**	.28**	.39**	.22**	.17**	-0.11	.24**	.27**	-0.03	-0.02	.22**	.19**	-.14*	-0.05	-0.02	-0.07	0.05	.16**	.48**	.57**	.38**	.36**	.33**			
26	.66**	.36**	.37**	.39**	.35**	.32**	-0.08	.23**	.20**	-0.07	0.01	.24**	.32**	-.22**	0.03	-0.03	-.12*	0	.32**	.51**	.69**	.54**	.65**	.51**	.65**		
27	.25**	.17**	.13*	.18**	0.11	.21**	-0.01	0.03	.20**	-0.03	-0.06	0.01	0.01	-0.06	0.06	0.03	0.08	0	0.11	.16**	.27**	.23**	.14*	.23**	.23**	.32**	
28	.26**	.26**	.26**	.25**	.28**	.17**	-0.07	0.11	0.03	-0.11	-0.06	0.11	.16**	-.12*	-0.03	-0.08	-.15**	0.03	.15**	.18**	.28**	.25**	.36**	.29**	.33**	.33**	0.11

*<0.05, **<0.01, ***<0.001

Table S1. 2. Bivariate Correlations between variables included in the model for TAY (n=162)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
2	-0.02																										
3	0.04	.80**																									
4	0.1	.73**	.79**																								
5	0.06	.51**	.52**	.58**																							
6	0.08	.25**	.17*	0.14	.21**																						
7	0.15	-.31**	-.36**	-.38**	-.51**	0.01																					
8	-0.01	.23**	.26**	.30**	.20**	-0.07	-.20*																				
9	.23**	0.12	.17*	.30**	.26**	0.07	-.16*	.27**																			
10	-0.03	-0.11	-.17*	-.20**	-0.11	.16*	.17*	-0.09	-0.06																		
11	-0.07	-0.11	-.19*	-.19*	-.19*	.19*	.24**	-0.08	-0.11	.81**																	
12	0.07	.36**	.40**	.43**	.57**	0.14	-.47**	.41**	.23**	-0.13	-0.15																
13	0.07	0.09	0.09	0.13	.15*	.25**	0.02	0.15	0.11	.38**	.42**	.18*															
14	0.06	-0.07	-0.07	-0.11	-.28**	-0.01	.42**	0.01	-0.08	0.13	0.14	-0.13	-0.05														
15	0.07	-.23**	-.26**	-.29**	-.34**	0.14	.61**	-.20**	-.20*	.26**	.28**	-.34**	0.15	.38**													

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27

16	0.03	.22**	.21**	.21**	0.15	.16*	-.19*	0.14	0.14	-0.04	0.01	.25**	0.13	.20*	-0.11													
17	.22**	-0.03	0	-0.07	-0.11	.28**	.32**	-.24**	-0.1	.16*	.20*	-0.09	0.11	.16*	.37**	0.14												
18	0.06	-0.1	-0.13	-0.15	-0.04	-0.08	.21**	0.11	-0.1	-0.01	0.1	-0.06	-0.01	.21**	.20*	-0.12	0.1											
19	0.09	.31**	.34**	.35**	.53**	.27**	-.22**	.27**	.20*	0.02	-0.02	.53**	.22**	-.20**	-0.15	.21**	0.01	-0.07										
20	.28**	-0.14	-0.08	-0.04	-.16*	0.02	0.02	.25**	.21**	-0.01	0.05	0.12	0.13	0.07	0.01	0.03	.19*	.21**	-0.07									
21	.50**	0.08	0.12	0.14	0.09	0.02	0	.28**	.37**	-0.09	-0.06	.28**	0.14	-0.04	-0.05	0.11	0.14	0.09	0.12	.47**								
22	.27**	0.03	0.14	0.11	0.07	0.11	-0.14	0.1	.19*	-0.01	-0.04	0.15	.17*	-0.13	-0.09	0.14	.17*	-0.08	0.12	.32**	.44**							
23	.37**	.18*	.32**	.34**	.34**	0.03	-.17*	.29**	.42**	-0.1	-0.15	.39**	0.14	-0.06	-.26**	0.13	0.01	0.06	.26**	.36**	.70**	.43**						
24	.21**	.23**	.29**	.34**	.42**	0.14	-.31**	.24**	.32**	-0.14	-.19*	.38**	0.15	-.20**	-.24**	0.15	-0.06	-0.09	.37**	.23**	.49**	.33**	.63**					
25	.27**	0.03	0	0.05	-0.09	0.04	0	.18*	.28**	-0.01	-0.01	0.05	0.02	0.1	-0.09	0.04	0.01	0.14	-0.01	.52**	.36**	.16*	.30**	.18*				
26	.56**	.16*	.23**	.24**	.22**	0.12	-0.13	0.12	.32**	-0.06	-0.12	.22**	0.15	-0.06	-0.14	0.04	0.13	-0.06	.23**	.34**	.56**	.40**	.56**	.38**	.44**			
27	.33**	0.09	0.12	.23**	.15*	0.06	-0.12	0.1	.32**	-0.1	-.16*	0.14	0.1	-0.05	-0.13	.16*	0.01	-.27**	0.11	0.03	.28**	.23**	.33**	.32**	.26**	.35**		
28	-0.1	.31**	.31**	.25**	.31**	0.1	-.34**	0.11	0.14	0.01	-0.04	.20*	0	-.21**	-.26**	0.12	-0.03	-0.12	0.15	0	0	0.02	0.13	.18*	0.04	0.13	0.07	

*<0.05, **<0.01, ***<0.001