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# SOCIAL PROBLEMS, BIOMEDICAL ANSWERS?

## HOW CAUSES OF SOCIAL PROBLEMS AFFECT CHOICE OF SOLUTIONS

by

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Bachelor of Arts, York University, 2014

THESIS

Submitted to the Department of Psychology

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Abstract

With rapid advances in behavioural genetics, scientists are identifying an increasing array of genetic influences on human behaviour. Public misconceptions about the function of genes often lead to the oversimplification of the role of genes in behaviour (Dar-Nimrod & Heine, 2011). To date, no study has systematically investigated whether simply learning about genetic causes of behaviour affects people's preferred solutions to problematic behaviours. The present research program includes three studies that were designed to examine the psychological effects of exposure to genetic etiology for problematic behaviour, in particular aggression, and investigated how this information influences endorsement of solutions, rating of effectiveness, and support for research funding. It was predicted that compared to a psycho-social etiological emphasis, a genetic etiological emphasis would increase preference for biomedical approaches.

Participants read an article outlining the multi-determined nature of aggression, either emphasizing *a* newly-discovered *genetic* or *an environmental* cause of aggression which accounted for behavioural aggression in 30% of those with the predisposition. Across all three studies, the genetic emphasis increased preference for biomedicine compared to a psycho-social emphasis of aggression. In Studies 2 and 3 the psycho-social emphasis also increased preference for socio-behavioural approaches to aggression. These results underscore the importance of considering how media reports of genetic influences on behaviour can meaningfully affect people's beliefs about treatments and solutions to social issues. In Study 1 and 3, assigning responsibility to genetic or environmental factors for aggression mediates solution preferences and preliminary evidence from Study 3 suggests that coherence of arguments, perceptions about personal responsibility and predispositions increases the effects of the emphasis condition. The effect of emphasis was also discussed in relation to additional variables. Findings from this

program of research contribute to best practices for professionals and journalists when conveying genetic research to the public.

*Keywords:* genetic etiology, behaviour change, controllability, biomedicine

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> A scorpion and a frog sit perched on the bank of a stream. The scorpion, unable to swim but wishing to cross the stream, asks the frog to carry him across on its back.
> "How do I know you won't sting me if I agree to help you?" the frog asks apprehensively.
> "Because," reasons the scorpion, "I can't swim. If I sting you, *I* will die as well!"
> "All right, but how can I trust that you will not sting me once we reach the other side?" the frog retorts.
> "I will feel so indebted to you, I couldn't possibly consider killing you," assures the scorpion.
> The frog finally agrees to aid the scorpion. The scorpion hops on the frog's back, and the frog proceeds to paddle vigorously, keeping the scorpion well above the water to prevent him from drowning. As the frog reaches midstream, however, the scorpion suddenly and viciously stings him.
> As the two "companions" begin to submerge, the frog manages to croak, "You son of a scorpion! Why on earth would you do such a thing?"
> "I couldn't help it, my friend," replied the drowning scorpion. "It's my nature."

Dar-Nimrod and Lisandrelli (2012), use this well-known fable to illustrate the powerful constraints one's nature is perceived to have on one's ability to choose freely and the resonance that these explanations have. The true nature, or essence, of various organisms have been hypothesized to reside in different parts of the organisms' body throughout history, such as in the blood or within one's spirit. Today this "true nature" is often conceived to be located within one's genes (Dar-Nimrod & Lisandrelli, 2012; Dar-Nimrod & Heine, 2011a). The belief that illnesses and traits run in families and are sometimes inherited are well rooted in both medical literature and in lay cultural understanding (Blaxter & Paterson, 1982; Davison et al., 1989). Dar-Nimrod and Heine (2011a) argue that seeing 'genes' as determining one's nature has important implications regarding how people respond when they encounter genetic information about behaviours, illnesses and people.

Advances in genomic science, such as the Human Genome Project in the 1990s, have fascinated scientists and the public alike with the seemingly imminent capacity to identify an ever-increasing array of genes linked to diseases, health conditions, and behavioural tendencies. Advances in genomics have allowed for developments of medicine through the identification of genes related to diseases as well as genes linked to behavioural tendencies such as aggression (Moffitt & Caspi, 2001) and obesity (Boutin et al., 2003). Genetic science seems to hold much

promise for medical experts and the lay public alike. It may for example lead way to personalized medicine, which promises to tailor treatment to each individual's genetic make-up. Public funding supports this promise. President Obama, in his 2016 State of the Union Address, announced a $215 million investment in the Precision Medicine Initiative to accelerate biomedical discoveries and provide clinicians with the tools to identify which treatments will work best for which patients (The White House Office of the Press Secretary, January 30th, 2015).

Along with scientific discovery, the affordability and accessibility of personal genetic testing has increased. Personal genetic testing services used to determine one's "inherited conditions, genetic risk factors, drug responses and traits" (23andme.com) is a practice that is growing rapidly (Wolinsky, 2006) with more than 3 million tests being sold to date worldwide (Petrone, January 15th, 2015). In fact, a recent study showed that 64% of a large sample of participants was interested in the results of personal genetic tests (McGuire, Diaz, Wang, & Hilsenbeck, 2009). Genetic testing is seen as one of the "best inventions of the year 2008" (Hamilton, October 29th, 2008). This highlights that the public has a growing interest in learning about their own genetic make-up and about possible genetic links to both health and behaviour.

Given the rise of personalized genetic testing and the public's interest in learning about their genes, there is an urgent need to understand not just how genes work but also how people psychologically respond to genetic information and what processes influence peoples' responses. When a generation of individuals has access to a printout highlighting their predisposition to diabetes or coffee addiction, how do they respond? Do they increase strategies to prevent or give up on related behaviours, or do they change their approach to solutions? Further, are solution strategies based on misguided information about the function of genes? The emerging literature

is just beginning to offer some answers to these questions, but people's exposure to genetics may be outpacing our understanding of how people respond to it

Debate exists among scholars whether learning about the genetic etiology of unwanted behaviours and illnesses will lead to positive or negative outcomes. On the one hand, some argue that equipping the public with knowledge about their genes and genetic links will allow them to make more informed decisions about their own medical treatments and more well-reasoned life choices (e.g., Bloss, Schork, & Topol, 2011; Wojcicki, 2013). For example, in relation to obesity, Conradt et al. (2009) argue that "using information about the influence of genetics on the development and maintenance of obesity could encourage an obese person to develop healthier strategies concerning weight management (e.g., to set more realistic weight loss goals) or to improve emotional well-being (e.g., less self-criticism about body weight)" (p. 1-2). These arguments are in favour of the full disclosure of genetic information. On the other hand, there is reason to believe learning about genetic influences of behaviour may impede motivations to change behaviours (Dar-Nimrod & Heine, 2011a). Many researchers have argued that the general public is likely to understand genetic expression in overly simplistic terms given their lack of familiarity with genetic science and the way in which information about genes are presented to the public (Nelkin & Lindee, 1995). This introduces biases to the way the general public may interpret genetic information (Dar-Nimrod, 2012; Dar-Nimrod & Lisandrelli, 2012; Lebowitz, Ahn, & Nolen- Hoeksema, 2013). For example, staying with the example of obesity, individuals might endorse the assumption that a phenomenon with a predominantly genetic origin is uncontrollable (Marteau & Croyle, 1998), thus they might react to this genetic information by choosing to reduce strategies for weight-management. These assumptions are exacerbated by the tendency of some researchers and the media to exaggerate the impact and

utility of genetic findings while minimizing the reality of the difficulty to replicate these findings (Burke, Kuszler, Starks, Holland, & Press, 2008; Dar-Nimrod & Heine, 2011a). These issues highlight some of the concerns surrounding the disclosure of genetic information and the potential for consumers of personalized genomics, as non-experts, to misinterpret their personal genetic information. Once the general public attributes a behaviour or illness to genetic causes, it is important to evaluate how attitudes toward these conditions are affected. Learning about genetic causes affects more than just a shift in etiological perceptions. Genetic information can influence notions about the immutability or certainty of a particular outcome. Possibly more so than other pieces of scientific (Dar-Nimrod & Heine, 2011b) or biological information (Shiloh, Rashuk-Rosenthal, & Benyamini, 2002), this "genetic essentialist" way of thinking can make genes appear as the fundamental causal factor of a condition (Dar-Nimrod & Heine, 2011a).

This thesis will focus in particular on the potential effects of exposure to information about genetic influences on problems of human behavior on choice of solutions. To do so, I will build upon previous theories that have characterized people's beliefs about genetics as a form of psychological essentialism. In the following sections, I will consider several concepts and literatures related to genetic thinking and then focus specifically on the ramifications of these thoughts on people's conclusions about the solutions to problematic behaviour. Finally, I will examine what is most important to our discussion of solutions, ideas of the malleability of genetic traits, personal control and how these ideas influence attitudes towards solutions and the perceived effectiveness of solutions for conditions with a genetic etiology.

**Genetic Essentialism Framework**

Dar-Nimrod and Heine (2011a) proposed that people engage in a specific set of biased and fatalistic cognitions called "genetic essentialist" biases, when they encounter genetic

explanations of behaviour. The first cognitive bias is that behaviours perceived to have a genetic etiology are perceived to be *immutable and determined* (decreasing one's sense of self-efficacy and control). This means that an outcome perceived to occur according to unseen, genetic processes, is assumed to be beyond environmental influences or personal control. This perception in turn results in the devaluation of competing etiological accounts that focus on the environment, personal experiences, and choices individuals make (Dar-Nimrod & Lisandrelli, 2012). The second bias is that behaviours with genetic etiology are seen as *natural* (increasing the likelihood of committing the naturalistic fallacy – the tendency to conflate "ought" and "is" for occurrences deemed natural). That means behaviours that are in one's nature and devoid of personal control are more likely to be seen as permissible, 'natural', and thus deserving less blame, e.g. if homosexuality is genetic then individuals cannot be blamed as they cannot choose to be gay. Third, genetic similarity establishes groups as *homogenous and discrete* (prompting stereotypical/prototypical evaluative processes). In short, people who show genetic essentialist biases believe that genes create fundamental differences between people with outcomes that are unavoidable and often perceived as permissible or 'natural.' Lastly, and most important to this discussion is the bias that genetic traits follow a *specific etiology* (leading to a devaluation of alternative/contributing causes). This means that there is a one-to-one relationship between a specific gene and a specific trait. The presence of a certain gene necessitates the existence of the trait, whereas the absence of the gene indicates the absence of the trait. This bias invokes 'strong' genetic explanations (Turkheimer, 1998), which refers to the assumption that a gene determines the existence of a trait, illness or physical characteristic and that said characteristics would only be present if the respective gene is present (and absent otherwise). That is, a gene is presented as the mechanism, or cause of an outcome. In contrast, a 'weak' explanation recognizes that some

genetic differences among people are correlated with phenotypic differences. However, weak genetic explanations refer solely to correlations between genes and phenotypic differences, without implying causation or even a mechanism for individual differences (Turkheimer, 2016). The specific etiology bias, as does the immutability bias, leads to a significant downplay of potentially relevant external influences like the environment and choice (Dar-Nimrod & Lisandrelli, 2012).

**Function of Genes**

Strong genetic explanations (causal explanations) certainly account for some monogenetic (one-gene, one-disease) disorders such as Huntington's disease, and other disorders that involve few genes. Further, it is acceptable to say that conditions with a relatively clear biochemical causal chain have a specific etiology, are natural, and are largely determined by the individual's genetic disposition. However, when individuals generalize from rare cases such as these to other behaviours and illnesses that are multi-determined, the genetic essentialist biases neglect the biological, social, and cognitive origins of a multitude of human conditions that do not have as clear-cut a biochemical causal chain. In reality, the vast majority of traits and conditions that show genetic influences, which includes virtually every behavioural tendency, do not do so in a one-to-one completely penetrant and deterministic fashion. Given that less than a tenth of our 20,000 genes have been correlated with any condition, it is impossible to nail down exactly what component is genetic (Hamilton, October 29th, 2008). To complicate matters even further, genes do not directly ‘produce’ behaviour; rather, genes produce proteins that form complex structural and biochemical elements of the human body. Within the context of gene-mediated protein production, abnormalities, specifics of the overall genotype and interactions with an individual’s environment ultimately result in particular patterns of behaviour, the

phenotype. This means that social and health behaviours are multi-determined; experiences and behaviour play a larger role than genes in many cases and can even alter how genetic predispositions are expressed over time (Conrad, 2002).

Even the genetic testing site 23andme.com states: “Keep in mind that many conditions and traits are influenced by multiple factors. Our reports are intended for informational purposes only and do not diagnose disease” (23andme). Given this, to say that a particular behaviour is caused by or totally due to a person’s genetic make-up is almost always incorrect. It is therefore also incorrect to think that a particular genetic behavioural phenotype cannot be impacted through environmental manipulation (Simon et al., 2014). For example, it is reasonable to suggest psychotherapy to someone suffering from major depressive disorder, even if this susceptibility to the disorder has a genetic etiology. Despite the lack of evidence for strong genetic explanations, people are more likely to single out genes as etiological causes compared to other valid explanations (i.e., the environment, personal experience, etc.) for a number of human behaviours and conditions (Hinshaw & Stier, 2008). However, when the link between genes and behaviour is tenuous, as is case with all behaviours and most health conditions, an essentialist response is clearly inaccurate.

**Popular Media and Genetics**

Popular media serves as the principal means by which people receive information about scientific advances in the field of genetics (Conrad, 1997). The popular media reports an increasing number of behavioural genetics findings and typically emphasizes the role of genes in determining various social and behavioural outcomes (Bubela & Caulfield, 2004), establishing the human gene as a highly meaningful cultural icon or symbol (Nelkin & Lindee, 1995). Accordingly, social researchers have begun considering the media's role in shaping public

understanding of genetic influences on human behaviour (Conrad, 2002; Jayarantne et al., 2006). In general, public opinion surveys indicate an increase in genetic attributions for various phenomena in the past few decades. For example, Sheldon et al. (2007) compared two public opinion polls and found a recent increase in endorsement of genetic explanations for homosexuality, despite a lack of scientific evidence for or against the genetic etiology of homosexuality. Further, the increasingly firm evidence for the importance of genetic factors in several forms of mental illness (Gottesman 1991; Tsuang and Faraone 1990), have increased the salience and importance of genetic factors in mental illness in the public's mind (Phelan, Cruz-Rojas, & Reiff, 2002). In addition to these popular and highly contested issues, the endorsement of genetic explanations for a variety of behaviours and traits has increased. For example, Singer, Corning, and Lamias (1998) reported that 33% of the public at the time attributed alcoholism completely or mostly to one's genes, whereas 20% dismissed the role of genes in such addiction altogether (similar results were reported for drug abuse). A later survey indicates that from 1996 to 2006, there was a 10% increase in the American public genetic attributions for alcohol dependence (Pescosolido et al. 2010). In addition, in the 1995 Harris poll, 63% of participants endorsed the ''genes you inherit'' as the largest role in ''being substantially overweight'' (Singer et al., 1998). In that same poll, length and health of life was attributed to genes by 52%, intelligence by 45%, sexual orientation by 29%, character by 28% and criminal behavior by 14% (Singer et al., 1998).

The aforementioned changes in public perception of genetic etiology have been part of growing cultural trend towards *geneticization*, the process by which people have become more likely to use genetic explanations for a range of phenomena (Lippman 1991; Richards 2010; Deister 2013). Such findings indicate an increase in causal attribution of genes for various

factors of health and behaviour. In contrast to more medicalized issues, such as mental illness and addiction, people are less likely to associate behaviour, such as criminality or character to genes; yet the endorsements are increasing. This can be partly attributed to an overemphasis on behavioural genetics (that is, research on genetic underpinnings of behaviours) in the popular media. Although the terms "behavioural genetics" and "neurogenetics" appeared in less than 1% of published scholarly articles on genetics (as of May 30, 2003), behavioural genetics and neurogenetics were the subject of 16% of the 627 newspaper articles examined (English-speaking newspaper articles from Canada, the US, the UK and Australia were included) (Bubela & Caulfield, 2004). Further, the media often oversimplifies research to make it accessible to the public, detracting from the complexity that constitutes its accuracy (Conrad, 1997, 2002; Dar-Nimrod, 2007). Scientists quoted in the media often speak of "*the* gene" that can provide definitive answers to all of our burning questions about a problematic behavior, be it drug addiction or male aggressiveness. These exaggerations are particularly evident in reports on behavioural genetics (Bubela & Caulfield, 2004), which contributes to misinformation through simplification, thus complicating an already complicated issue. For example, a recent article that appeared in the Los Angeles Times (Healy, October 29th, 2014) summarizes the findings of a prominent journal article on new genetic findings of aggression by stating that two identified "genetic signals were quite specific to violent crime", neglecting to add the researchers' cautionary note that "these findings are not specific or sensitive enough for screening purposes on an individual level, and cannot be used for crime prevention or in legal proceedings" (Sternudd (Karolinska Institute), October 29th, 2014).

However, even when reports accurately present information on genetic influences, the public is ill equipped to comprehend the complexities of genomic science. For example,

Christensen, Jayaratne, Roberts, Kardia, and Petty (2010) found that fewer than half of their participants could identify the correct answer for six of eight basic questions on knowledge about genes (e.g., “Single genes directly control specific human behaviors” and “Our genes tell us which race we belong to”, neither of which are true). Thus, the popular media can be a very effective tool in promoting public biases of genetic links to human behaviour and illnesses, either by invoking their own essentialist biases through simplification or by overemphasizing behavioural genetic findings that the public is ill equipped to understand correctly.

To summarize, learning of genetic etiology of behaviour and illness leads to cognitive biases, most notably an overemphasis on strong genetic explanations, which are in turn promoted (intentionally or unintentionally) by the public media. How do these biases in turn operate? How does genetic etiological information affect people's beliefs, attitudes, and actions regarding behaviours?

**Genetic etiology, behaviour and attitudes**

Learning about genetic influences affects more than just a shift in etiological perceptions. One way this information affects individuals is by changing the way they perceive and judge other people and other people’s behaviour. For example, if groups with genetic differences are seen as homogenous and discrete (DarNimrod & Heine, 2011a), groups with genetic similarities should be seen as more similar. In fact, Kimel et al. (2016) demonstrated that altering perceptions of genetic overlap between groups in conflict—in this case Arabs and Jews—impacts factors that are directly related to inter-ethnic hostility (e.g., aggressive behaviors, support of conflict-related policies). In four studies the authors demonstrated that participants who learned that their ethnic group was genetically related to an enemy group showed more constructive intergroup attitudes, inter-individual behaviors, and support for peaceful policies

than those who learned about genetic differences. Research has also explored several consequences of learning of a genetic etiology for the way people see the behaviour of others. For instance, people may justify immoral behaviour and even act immorally if they believe in a genetic basis for their behaviour (Dar-Nimrod & Heine, 2011a, Monterosso et al., 2005). Evidence is provided by a study (Dar-Nimrod et al., 2011) that investigated the impact of evolutionary explanations for male sexual misconduct (e.g., rape) versus social constructivist explanations, which look to social and cultural experiences to explain human behaviour. Male participants in the evolutionary condition, where genes and inheritance were emphasized, judged the perpetrator of date rape less harshly and supported less punishment in form of prison time in comparison to participants in the social constructivist condition, where the role of the environment was emphasized. There is also evidence, based on changes in public policy and new research findings, that attitudes towards individuals with mental illness (Phelan et al., 2002) and homosexuality (Petersen, 1999) became more positive with increased endorsement of genetic explanations. However, it is important to note that endorsement of genetic etiology alone does not necessarily result in improvements in attitude. Whereas behaviours seen as genetic might be considered as less controllable and blameworthy, in the case of criminal behaviour, it also increases people's tendencies to attribute the cause to internal factors and to expect the perpetrator to re-offend (Cheung & Heine, 2015), which might lead to increased prison sentences. This double-edged nature of genetic explanations cautions against the reckless endorsement of genetic explanations without further considerations for potential negative consequences.

These biases do not only influence beliefs about other people's behaviour but also influence their own beliefs and behaviours. For example, people believe they have little control

over their behaviour after learning they have a genetic susceptibility (e.g., in relation to alcoholism; Dar-Nimrod & Lisandrelli, 2012). Further, they can extend beyond beliefs to actual behaviour. For example, women who were told of men possessing a supposedly "genetic advantage" on math ability scored significantly worse on a subsequent math test than a control group that did not receive such information (Dar-Nimrod & Heine, 2006). The "genetic advantage" explanation not only had a more detrimental effect on performance than a control message of no advantage, but it also was more harmful than an explanation of "experiential advantage" (i.e., superior treatment of males in the classroom). In another study, people told of "obesity genes" (vs. social predictors of obesity such as the availability of high-fat foods) ate more cookies in a subsequent "taste test" (Dar-Nimrod & Heine, 2011a). These studies suggest that knowledge of genetically based traits and genetic links can have detrimental consequences on attitudes, discrimination, sentencing performance, self-control, moral and health behaviour, among many others.

Given that genetic theories have such high media prevalence and social relevance (Jayarantne et al., 2006), it is important that they receive more attention in social psychology, particularly with respect to socially relevant behaviour. The identification of the etiology of a problematic behaviour, such as aggression or smoking, does not only inform our thoughts about this behaviour but it also plays a crucial role in identifying interventions and policies directed at reducing this behavior. While the above section outlined the effects on behaviour and attitudes when learning of genetic etiology (versus non-genetic etiology) of a behaviour, little is known about how learning of a genetic etiology of a problematic behaviour affects the solutions people endorse for problematic social issues (except prison sentencing which has been explored extensively, see Cheung & Heine, 2015 for an example).

**Genetic etiology and controllability**

Possibly the most important implication of people's biases regarding genetics when treating or solving undesirable behaviour patterns or illnesses is for people's sense of control. Indeed, research indicates that there is a common perception that genetic risks are uncontrollable (Blaxter &Paterson, 1982; Nelkin & Lindee, 1995; Hunt et al., 2000). In the health domain, for example, people who were asked to imagine that they were genetically at risk of developing certain conditions felt that the manifestation of the condition will be less preventable than people who imagined that they were at risk for non-genetic reasons (Senior, Marteau, & Weinman, 2000). Further, genetic information for a health risk, compared to family history and medical test results, correlates with the greatest sense of reduced control over the manifestation of that health risk (Claassen et al., 2010). Smokers given a genetic explanation for their unhealthy habit cited less perceived control over smoking initiation, highlighting a reduction in their evaluation of their own choice in the behavior (Wright et al., 2007). Familial hypercholesterolaemia (FH), an inherited predisposition to heart disease, can be diagnosed using a genetic test or a test screening for cholesterol. Parents of children with FH in which a cholesterol test was used for diagnosis perceived the condition as familiar, dietary in origin, easily controlled and not very threatening. When the parents received a genetic test result, however, the condition was perceived as uncontrollable and, therefore, threatening (Senior, Marteau, & Peters, 1999). Thus, it seems that the way people think about an illness is dependent on the etiological labels given to that illness (Leventhal et al., 1980). In summary, a genetic susceptibility may be perceived as a fixed, unchangeable self-attribute, increasing the expectation for the development of a condition and sense of uncontrollability.

Thus, genetic information might trigger feelings of fatalism, the belief that little can be done to change the outcome (Alper & Beckwith, 1993). This in turn could potentially hinder engagement in behaviors aimed at solving or treating a condition, contrary to the assertion of proponents of personalized genomics (e.g., Collins, Green, Guttmacher, & Guyer, 2003; Guttmacher, McGuire, Ponder, & Stefánsson, 2010), by strengthening beliefs that a disease or behaviour is neither preventable nor controllable. In short, if providing people with genetic information leads them to become fatalistic, they may also be less likely to act in ways (such as changing their diet) that reduce their risk of developing a certain illness.

**Genetic etiology and behaviour change**

How people think about behaviours and disease, particularly the perceived controllability of the behaviour or disease, is an important determinant of what they do about it (Skinner, 1996). Cheung, Dar-Nimrod, and Gonsalkorale (2014) argue that perceived controllability is the mechanism by which the immutability/deterministic bias of genetically causes conditions is translated to behavioral (in)action. As a result of the cognitive biases associated with genetic information, perceived personal control is reduced, and given that perceived control of behavior is a key determinant of intentions and behaviour (e.g., Theory of Planned Behaviour, Ajzen, 1999) reductions in perceived behavioural control would reduce the likelihood that a behaviour will be enacted. Further, in line with the theory of planned behaviour, bias of immutability and also of one-to-one etiology should influence people's perceptions of control, and thus result in behavioural inaction. Wang and Coup (2010) confirm this notion in their survey of individuals on their view of the origin of obesity, their physical activity and healthy food intake. The majority of those surveyed endorsed individual lifestyle choices as the root of obesity (72%). The belief in obesity stemming from people making a conscious, self-perpetuated decision

correlated with greater instances of self-reported physical activity. A minority of the participants (19%) who cited genes as the primary etiological cause for obesity, in contrast, reported lower levels of physical activity and healthy food consumption. In their analysis of these findings, Dar-Nimrod and Lisandrelli (2012) conclude, "this arguably reflects a lack of perceived control over the onset of the condition, leading to more fatalistic behaviour."

However, it is not clear that a lack of personal control would necessarily result in the reduction of behaviour directed at a condition with genetic etiology. In fact, a study on alcoholism showed that people told that they had an allele associated with alcoholism believed that they had less personal control over their drinking behaviors, but they were also more likely to enroll in a "responsible drinking" workshop compared with individuals who were told they do not have such an allele (Dar-Nimrod, Zuckerman, & Duberstein, 2013). This is in direct opposition to the theory that learning about a genetic cause would reduce behaviour change. It is also important to highlight the vast array of research finding no correlation between learning of genetic etiology and behaviour change. A recent meta-analysis within the health field found no correlation between learning of genetic risk for a condition and engagement in behaviour change (Hollands et al., 2016). In a study that compared obese individuals who tested positive or negative for the β3-adrenergic receptor (β3AR) gene which was found to influence weight gain and energy expenditure, individuals who received information about their positive genetic status were not adversely affected concerning their subjective ability to lose weight or control their eating behavior (Harvey-Berino et al., 2001).

Thus, the literature on genetic etiology and behaviour change is divided and inconclusive at this point. Whereas Dar-Nimrod and Heine (2011a) and Cheung et al.(2014) argue most people believe there is little one can do to counteract the developmental trajectory of a

genetically-associated outcome – thus perceiving this association to be immutable and deterministic – there is evidence to suggest that this is not always the case. Although genetic biases exist, so does people's urge to have control of their lives (Marteau et al., 2004). A main issue contributing to the apparent inconclusive research findings around control and behaviour change might be that 'behavioural (in)action' is rarely clearly defined in gene studies. Although Wang and Coups (2010) found that learning of genetic causes to obesity lead to reductions in diet and exercise, these 'actions' specifically refer to changing behaviour personally. However, there are other responses that could be thought of as 'actions'. For example, biomedical forms of treatments or interventions (e.g., taking medication) are rarely considered as a form of 'action', and thus these responses are not typically considered by psychological research investigating genetic essentialism and control. I suggest that it is important to examine a wider range of responses that include not only actions taken to change behaviour personally but also include biomedical forms of treatment or intervention, to gain a more complete understanding of how genetic information influences behaviour.

**Genetic etiology and medication**

Learning of a genetic susceptibility might reduce people's sense of control. However, although Dar-Nimrod and Heine (2011a) and Cheung et al. (2014) have argued that this leads to behavioural inaction, they focus on a particular kind of inaction, namely behavioural habits (e.g. diet or exercising). It may be that people shift, not to inaction, but to other forms of action. Indeed, both clinical communication (Kraft et al., 2009) and direct-to-consumer advertising about genetic testing and genomic health care (McBride et al., 2008) include reference to genetic family history as beyond individual control while recommending medication as a means to address one's heredity. Thus, even if it is communicated that genes are beyond an individual's

control, medication is highlighted as a means to gain this control back. In fact, even Cheung et al. (2014) note that "once the medical establishment offers a clear way to successfully negate the disease threat, perceived control is restored, and evidently, individuals may be more likely to modify their behavior." Thus, the authors imply that once the medical establishment offers a successful treatment (one that is evidently effective in addressing the genetic issue), individuals would be more likely to choose this treatment to address their disease, thus regaining control.

I propose, along similar lines, that genetic information may increase people's openness to biomedical treatments and solutions. Moreover, I would argue that it is not necessary for the medical establishment to find 'successful' treatments for a genetic condition for the public to endorse biomedical solutions; rather medical treatments will be *perceived as more effective* (even if they are not) once genes are implicated as the cause of a condition. Thus it may not be the case that genetic information generally reduces action, but rather that it reduces a certain kind of action – personal behaviour change, at the same time increasing people's willingness to consider other actions – specifically, biomedical ones such as medications, surgery, or hormone therapy. Although this proposal has not been tested directly in past research, it is consistent with the results of prospective surveys in which many patients believe that genetic testing would encourage them to be more motivated to adhere to taking medications (Grant et al., 2009). Thus, there seems to be a greater allure of biomedical treatments (opposed to socio-behavioural treatments) once a genetic explanation for a behaviour or illness is provided.

In this regard, the recent self-disclosure of Angelina Jolie's preventative mastectomy, which was widely circulated, can be seen as more than just a celebrity's unusual behaviour (Jolie, May 14th 2013). Botkin et al. (2003) studied women at high risk for developing ovarian cancer (risk was identified based on family history of cancer and other medical records). About

half of the women who were at risk due to a gene mutation had gotten an oophorectomy (removal of the ovaries) within 2 years of being genetically tested, compared with less than 5% of women who were at risk for reasons other than a gene mutation. It is important to note here that both groups of women, the genetic mutation carriers and the ones without a mutation, were at equivalent high-risk for developing ovarian cancer. Thus, learning of a genetic risk seems to increase endorsement of biomedical, rather than behavioural, solutions to the potential problem. Indeed, while learning that one is at increased genetic risk for high cholesterol has not been found to affect adherence to risk-reducing behaviors such as dieting, exercising, it has affected adherence to taking medication (Marteau et al., 2004).This assertion is also evident in popular media. A 2014 *Los Angeles Times* press release on genetics and criminality ends on a cautionary note: “The best way to reduce crime […] would be in particular making "obligatory, supervised treatment" [for released violent offenders] a condition of probation, using disulfiram (an anti-alcoholism medication also known as Antabuse) or long-acting naltrexone (a medication used to treat alcohol and opioid drug dependence)” (Healy, October 29$^{th}$, 2014). This quote highlights the emphasis that is often placed wrongly on biomedical interventions for behaviours or conditions with a genetic etiology.

These findings do not negate the biases apparent after learning of a genetic etiology, rather it seems that perceived control may be regained by perceiving certain treatments as more effective in addressing a genetic problem than others. This would also explain why perceived personal control (which should mediate the relationship between genetic information and behaviour change) is often not a significant mediator when behaviour changes include both biomedical and psycho-social actions (e.g. Wright et al., 2007). As Marteau et al. (2004) reflect, humans have a powerful motivation to perceive control over their fate (Malinowski, 1955;

DeCharms, 1968) and genetics can challenge these notions of control. Thus, when genetic information challenges the extent to which people can control their environment, people are adept at retaining control by altering their perceptions to fit their environment (Rothbaum et al., 1982). In this case, perceptions of the effectiveness of biomedical treatments (over socio-behavioural treatment options) are altered. Correlational research from the MacArthur Mental Health Module of the 1996 General Social Survey (GSS), which describe individuals with schizophrenia, major depressive disorder, alcohol dependence, or cocaine dependence supports this shift of endorsement. Kuppin and Carpiano (1996) found that genetic attributions were specifically associated with recommendations to check into a psychiatric hospital and use prescription medications but not with recommendations to go to a general physician, a psychiatrist, or a therapist. However, in this study it is unclear whether these recommendations reflect a belief in the effectiveness of biomedical treatments or other beliefs about the severity of the condition. Further, correlational studies are often limited in the casual inferences that can be drawn, necessitating experimental designs. Phelan, Yang, and Cruz-Rojas (2006), conducted an experimental follow-up study on the effect of perceived genetic causation of two major mental illnesses (depression and schizophrenia) on ratings of treatment recommendations and ratings of treatment effectiveness. The authors found that respondents who thought genetic factors contributed to the problem were no more likely to recommend that the individual described in the vignette see a psychiatrist, a therapist, or a general medical practitioner but were significantly more likely to recommend prescription medication and psychiatric hospitalization. However, belief in genetic causes was not significantly associated with the belief that the problem would improve with treatment.

It is important to note that Phelan et al. (2006) did not assess participants' beliefs in the effectiveness of biomedical and behavioural treatments separately; rather participants were simply asked to rate their overall beliefs in treatment effectiveness. This is an important area for investigation. Some evidence that investigating treatment effectiveness separately is an important avenue of research comes from a study on participants identified with a mutation of FH (compared to participants where no mutation was found). Existence of FH in study participants was either tested using a genetic test or a cholesterol test. In line with previous research, participants in whom a gene mutation for FH was found believed more strongly that their cholesterol levels were controlled by their genetic make-up than either participants in whom no gene mutation was found, or participants having the non-genetic diagnosis (Marteau et al., 2004). Thus, participants in the gene condition had a lower sense of personal control. However, although all groups believed that lowering cholesterol was an effective way of reducing the risk of a heart attack, participants in whom a gene mutation was found believed less strongly in the efficacy of diet and believed more strongly in the efficacy of cholesterol-lowering medication in reducing their cholesterol level (Marteau et al., 2004). Of course, participants in this study received self-relevant information about their own genetic risk, making it difficult to generalize the results of this study. Yet, experimental research also confirms the importance placed on biomedical interventions after receiving genetic information. Smokers who were asked to imagine that they had tested positive for a mutation that confers an inherited predisposition to nicotine addiction did not perceive themselves as having less control over smoking cessation. They were, however, more likely to select the use of a pharmacological agent as effective in assisting quitting and less likely to select the use of willpower (Wright et al., 2003). Whittle (1996) and Isselin and Addis (2003), also found that belief in biological causes was related to

belief in the importance of and likely effectiveness of more biological treatments for major mental illnesses in clinical and nonclinical samples.

As can be seen from this review of relevant literature, although perceptions of control do not produce consistent results, it is evident beliefs in the effectiveness of biomedical solutions are correlated with beliefs in biological causes and biomedical solutions are often chosen when confronted with self-relevant genetic tests. The pattern of findings leads to the novel hypothesis that although genetic information about a condition might reduce the extent to which people feel they have control over a condition, this information does not lead to limited beliefs in treatment effectiveness leading to inaction – but rather changes perceptions of *what kind of action might be most effective*. Thus, although genetic information may indeed weaken belief in the effectiveness of some forms of behavior change, such as altering diet (consistent with findings highlighting the fatalistic attitudes fostered by genetic information), it may reinforce the belief in a biologically based way of reducing the genetic susceptibility risk, such as taking medication. In addition to these effects on biomedical treatment, there is also some evidence that the bias may extend to beliefs about the value of genetic research. Etchegary et al. (2012) argues that beliefs that genes determine health enhance regard for the effectiveness of genetic research and the hope that this research affords in an otherwise seemingly unalterable situation.

**Goals and Hypotheses**

Although much previous research has focused on the importance of genetic health-risks, in light of the emphasis on behavioural genetic in the news media and the effects of genetic information on attitudes and behaviour, it is crucial to turn attention to the effect of genetic information on behaviour. The present program of research investigates psychological effects of exposure to genetic etiology for undesirable human behaviour, such as behavioural aggression

and investigates how this information influences the ratings of effectiveness and attitudes towards potential solutions.

Further, most prior studies investigating the role of biomedicine and genetic information gave participants self-relevant information, thus building upon their individual essentialist beliefs; this study uses a manipulation framework that is not self-relevant. In particular, this research uses a media story to deliver the manipulation.

**Difference between absolute and interactionist perspective**

It is also important to note that much of the previous work investigating the effect of receiving genetic information has solely focused on providing participants with strong genetic explanations to begin with. For example, participants are simply told that they "had a specific gene associated with alcoholism" (Dar-Nimrod et al., 2013, p. 133). However, the information the public receives, even from news sources is rarely that limited. Dar Nimrod and Heine (2011b) strongly endorse an emphasis on the 'interactionist perspective', which highlights the current scientific consensus that most outcomes are a function of interactions between genes and environment. They argue that providing individuals with this information would reduce biases generally associated with genes and also increase personal sense of agency. There is not much research to test this proposition. This research program will investigate whether even providing weak genetic links will lead participants to engage in an emphasis of genetic causes. Thus, the studies conducted purposefully provide an interactionist perspective to participants. This approach will provide important insight into the role of the current social rhetoric around genetics and may provide further caution to those reporting on genetic findings, such as the news media and scientists.

We were interested in examining how individuals seek to address an undesirable

behaviour, in particular behavioural aggression, mentioning both psycho-social and genetic influences, depending on which of these factors is highlighted as the 'new discovery'. We chose to focus on aggression because it is prevalent in the media and research on aggression has established both environmental and genetic links (Hedgecoe, 2009).

We conducted three experimental studies. In each study, we first presented participants with a media report on the prevalence of behavioural aggression, an elaboration of its multi-faceted causes and a report of a new study describing factors that explain behavioural aggression in some people. The reports of the new study were varied across condition to emphasize either *a genetic* (30% of the behaviour can be explained in terms of genes) or *a psycho-social cause* (30% of the behaviour can be explained by childhood experiences) of behavioural aggression. We then gave participants solution strategies and research programmes to rate, and also asked them to evaluate the causes of aggression and responsibilities of individuals displaying aggressive behaviour. In all three studies, I test the hypotheses that even when a behaviour is explained equally well by psycho-social and genetic factors (e.g., each factor accounts for the same proportion of behaviour), descriptions highlighting a genetic cause will affect people's beliefs and attitudes towards solutions for the problem behaviour and potential causes of it. In study three we also investigate potential mediators and moderators of the effects of emphasis on people's judgements. Particularly we include measures to examine the role of perceived control, fit between existing notions of causal influence and emphasis condition, fit between perceived cause of condition and solutions, knowledge, intuitive thinking and need for cognitive closure.

We hypothesized that learning about genetic influences, compared to psycho-social influences, will heighten preference for biomedical interventions and biomedical research; whereas learning about psycho-social influences, compared to genetic influences, will heighten

preference for socio-behavioural solutions and research. Given people's intuitive connections between inherited conditions and medicine, strengthened by prominent pharmaceutical advertising, we expect that participants will perceive biomedical interventions as more effective at addressing aggression with genetic etiology than aggression with psycho-social etiology.

Given the methodology of this research it is important to acknowledge that the research question and hypotheses can only be investigated in relative terms, comparing one condition relative to the other condition(s). However, because of the particular interest in the effect of genetic information, I will pay more attention to this condition and at times consider the psycho-social emphasis condition as a baseline.

We also hypothesized that participants who read the genetic emphasis article, compared to those reading the psycho-social emphasis article, will highlight genes as *the* cause of aggression when summarizing the article in a headline and consider genes to be more responsible for behavioural aggression, despite the interactionist perspective provided in the media report. This hypothesis is in line with previous research (Dar-Nimrod & Heine, 2011a; Conrad, 2002) that has investigated the widespread belief that genes provide hard evidence of causation (Cheung & Heine, 2015; Haslam, 2011), and that they can activate notions of certainty about the cause of a condition.

**Addressing versus solving a condition**

Although genetic information may increase the belief in the effectiveness of biomedical treatments it may not influence notions of the malleability of the issue itself. For example, when a mental illness is attributed to genetic factors, the public perceives the problem as more likely to persist throughout the person's life (Phelan, 2005). Thus, people might be more pessimistic about the long-term effectiveness of treatment or the treatments' ability to solve the issues if the issue

is understood in genetic terms (Phelan, Yang, & Cruz-Rojas, 2006). People may believe that the individual must try the most potent treatment possible even though this treatment probably will not be totally effective at solving the issue. Consistent with this reasoning, we hypothesize that participants in the gene emphasis condition will be less likely to believe that aggression is solvable than participants in the psycho-social emphasis condition.

We also hypothesized that individuals in the gene emphasis condition will hold individuals with aggression less personally responsible for changing their aggression compared to individuals in the psycho-social emphasis condition. This hypothesis would replicate earlier findings that genetic emphasis reduces perceptions of culpability (Cheung & Heine, 2015).

**Mediators and Moderators; Focus on process**

To explore the potential process by which learning about a genetic etiology (versus non-genetic etiology) leads to the hypothesized endorsement of biomedical solutions and research (versus socio-behavioural solutions) we explored several potential mediators and moderators. In studies 1, 2 and 3 we examine whether the extent to which genes (versus environmental factors) are considered as the cause for aggression would mediate the relationship between emphasis condition and endorsement of solutions and research. The interactionist perspective argues that genetic essentialist biases should be absent once the multi-determined nature of a condition is clearly stated. However, if despite these assertions participants consider ‘genes’ as the cause of aggression, then biases should operate nevertheless. Thus, I predict that the gene emphasis article will increase considerations of genes (versus environmental factors) as the cause for aggression, which in turn will increase endorsement of biomedical solutions and research funding. Equally I predict that the environmental emphasis article will increase endorsement of socio-behavioural

causes as a cause of aggression and thus increase endorsement of socio-behavioural solutions and research.

Further, perceptions of personal responsibility (in studies 1, 2 and 3) and perceptions of control (study 3) are investigated, given the vast amount of previous research investigating this issue (e.g. see Dar-Nimrod & Heine, 2011a). However, I do not have clear predictions regarding control, as according to Dar-Nimrod & Heine (2011a) perceived control should be reduced by invoking a genetic etiology, however, notions of biomedical treatment effectiveness might strengthen perceptions of control (Marteau & Weinman, 2006). Yet, it might be expected that perceived personal responsibility mediates the relationship between emphasis condition and preference for biomedicine and socio-behavioural approaches. I hypothesize that the gene emphasis article, relative to the psycho-social emphasis article, decreases perceived responsibility for solving the issue, which in turn increases endorsement of biomedicine and decreases endorsement for socio-behavioural approaches.

It is equally important to consider how participants' reactions towards receiving genetic information might moderate the relationship between the conditions and preference for biomedicine or socio-behavioural approaches (see Leventhal's common-sense model (CSM) of self-regulation of health and illness for a longer discussion; Leventhal et al., 1997; Leventhal, Brissette, & Leventhal, 2003). Thus, we predict that perceived novelty, difficulty understanding and explaining, and agreement with the etiological information provided in the article will moderate the relationship between emphasis condition and endorsement of solutions and research. Specifically higher perceived novelty and difficulty understanding and explaining the information will reduce endorsement of biomedical and socio-behavioural solutions and research respectively for the gene and socio-behavioural emphasis conditions, while agreement would

increase this endorsement respectively.

Further, it was investigated whether perceived similarity (or uniformity) between the cause and solution of an issue is an important moderator to consider. I predict that higher perceptions of uniformity (the belief that understanding the causes of aggression is important for treatment of aggression) will increase endorsement of biomedical and socio-behavioural solutions and research respectively for the gene and socio-behavioural emphasis conditions.

**Intuitive Thinking and Need for Closure**

These notions of similarity and uniformity of cause and solutions would also suggest that the link between genetic risk information and biomedical solutions seems intuitive to people. If this were true, we would expect the relationship between emphasis condition and endorsement of solutions and research to be moderated by intuitive thinking. Further, it is important to keep in mind the allure of the strong genetic explanation, which is characterized by clarity and lack of ambiguity and thus it is processed easily and quickly. Thus, genetic information, as opposed to more complex gene-behaviour or socio-cultural information, may be particularly attractive for individuals with high certainty needs or need for closure. And indeed, previous research has revealed that the need for certainty attenuates information seeking related to undertaking a predictive genetic test for cancer. A study (Croyle, Dutson, Tran, & Sun, 1994) found that adding a description that emphasized the existing risk for people who do not carry the susceptibility mutation resulted in less interest in the test among women who were high on need for cognitive closure (NfCC)'s measures. The opposite pattern was observed among women with low scores. We therefore also predict that need for cognitive closure and related constructs of intuitive thinking will moderate the effect of the emphasis condition on the endorsement of solutions and research.

## Study 1

In an initial study, we investigated how people seek to address aggression when aggression is described as having both psycho-social and genetic influences, depending on which of these factors is emphasized as the 'new discovery'. Participants read one of two articles, either emphasizing the genetic causes of aggression or emphasizing the psycho-social causes of aggression. We then assessed the salience of the highlighted cause, participants' endorsement of biomedical and behavioural solutions, endorsement of research funding for biomedical or social programs, and additional measures, such as perceptions of causal responsibility, personal responsibility, and solvability.

Aggression is particularly well suited to test our hypotheses, as it is considered a largely undesirable behaviour that occurs at different levels in the general population, with identified genetic and psycho-social causes. The genes implicated in aggression are primarily a common polymorphism in the MAO A (monoamine oxidase A) gene, disrupting the breakdown of monoamine neurotransmitters norepinephrine, serotonin, and dopamine (although research now indicates that these genetic vulnerabilities are triggered by severe environmental assault, e.g. maltreatment) (Alia-Klein et al., 2008). Psycho-social factors that affect aggressive behaviour are disturbed family dynamics; parental characteristics and parenting practices and the impact of exposure to violence and the influence of attachment relationships (Reebye, 2005).

Most important, the identification of etiological underpinnings for aggressive behaviour has an applied function in selecting interventions and policies directed at reducing aggressive behaviour. For example, when lack of social competencies was implicated in the instigation of

aggressive behaviour, social programs such as 'Second Step' were developed to combat aggression. Research indicated that these programs through teaching empathy, social problem solving, and anger management significantly reduced the rate of aggressive behaviours (Frey et al., 2000). Thus, the identification of psycho-social factors (such as social competencies) that affect aggressive behaviour offers a target for social programs and policies to reduce aggressive behaviour. Similarly however, incorporating knowledge of genetic factors to reduce aggressive behaviours has been considered, underscoring the involvement of MAO A enzymatic activity as a neurochemical target for the treatment of aggression. Thus, the study of the etiology of aggression has applied as well as research value.

## Method

### Participants

One hundred twenty-four American adults were recruited through the online Crowdflower service and received $2 US for completing an online questionnaire. Nine participants were excluded due to failing the attention and manipulation checks, by answering at least 3 out of 5 questions incorrectly, resulting in one hundred fifteen participants (*M* age = 37.2, *SD* age = 10.3; 65 female, 50 male).

### Procedure

To reduce demand characteristics the study was described as a "Reporting Styles and Social Issues" study. This procedure was followed in each study. The study was posted on the online Crowdflower service and participants self-selected into the study. The study was administered using an online survey (via Qualtrics survey software) that contained the experimental manipulation and measures (see Appendix A).

Participants were first randomly assigned to read one of two ostensible *The Globe and Mail News* articles, that were varied to create two emphasis conditions: (1) a genetic emphasis condition, in which participants were told that 30% of individuals with a gene-variant are behaviourally aggressive or (2) a psycho-social emphasis condition, in which participants were told that 30% of people with certain childhood experiences are behaviourally aggressive. All participants first read the following paragraph about the prevalence of behavioural aggression:

> Between the late 1980s and today, the prevalence of behavioural aggression increased significantly in both the United States and Canada. In 2007 to 2009, the prevalence of behavioural aggression in North America ranked from 24.1%- 34.4%.

All participants then read a paragraph highlighting the multi-faceted nature of behavioural aggression. This paragraph is integral to the study design because participants were told of multiple causes for behavioural aggression whereas the manipulation only emphasizes one possible cause.

> Although behavioural aggression is recorded in terms of single cases, aggressive behaviour is the complex combination of a multitude of different biological processes, from heredity to brain systems that regulate mood. Making matters even more confusing, these factors are also influenced by environmental contributors such as childhood experiences and lifestyle.
> However, new research now made an important discovery. In two separate papers, published in the journal Science and in the Journal of Clinical Investigation (JCI), researchers describe new factors that could explain aggressive behaviour in some people.

Participants randomly assigned to the gene-emphasis condition then read the following paragraph:

> Genome wide association studies, which compare genetic make-ups of individuals who behave violently to those individuals who don't, are making it easier to flesh out important genetic factors contributing to behavioural aggression. People who carry the monoamine oxidase A gene (MAOA) exhibit higher levels of behavioral aggression in response to provocation, suggesting some people have a predisposition to acting violently.

> The MAOA gene is thought to trigger extreme anger and affect a person's ability to resist impulses. Experts have shown that 30% of people who have the gene variant are behaviourally aggressive.

Participants randomly assigned to the psycho-social emphasis condition read the following paragraph:

> Population wide association studies, which compare childhood experiences of individuals who behave violently to those individuals who don't, are making it easier to flesh out important environmental factors contributing to behavioural aggression. People who have been abused as a child, witnessed abuse, or where parents often used unnecessary physical force exhibit higher levels of behavioral aggression in response to provocation, suggesting some people with certain experiences are predisposed to acting violently. These childhood experiences are thought to trigger extreme anger and affect a person's ability to resist impulses. Experts have shown that 30% of people who have these childhood experiences are behaviourally aggressive.

Both articles were nearly identical, carefully matched in terms of length and language complexity, and reported new research published in a highly ranked scientific journal with only information regarding the emphasized cause of aggression in the new study findings differing (see Appendix A for the articles).

**Dependent Measures**

After reading the article, participants completed the following dependent measures, in the order described below. A full list of all measures is in Appendix A.

**Headline.** First, participants were asked to generate a title or headline for the article they read. This qualitative measure was included to determine whether the information about new research findings in the article would be represented and described differently when the emphasis was on genetic findings rather than psycho-social findings. In particular, we examined whether the headlines referred to genetic or environmental factors as a cause of aggression. This measure provides an assessment of the salience of genetic and psycho-social information as a

fundamental cause for behavioural aggression and the importance participants place on it by mentioning it as a cause in the headline.

**Endorsement of solutions.** The primary dependent variable was participants' endorsement of biomedical and behavioural solutions. Participants first indicated what they considered to be the key solutions to aggression in an open-ended question. Next participants completed rating scales that assessed their endorsement of the two general types of solutions. Specifically, participants rated the extent to which physical or biological adjustments (e.g. medication, surgery) and psychological or environmental adjustments (e.g. therapy, education) would be good solutions to aggression (1= *not at all,* 7= *a large extent*). Next, participants were presented with a variety of specific biomedical and behavioral solutions, and were asked to rate the extent to which they agreed that each strategy was a good solution to behavioral aggression (1= not at all, 7= very much so). Biomedical strategies included *genetic therapy*, *medication to control impulses,* and *surgery to remove glands that produce "anger"-hormones*. Behavioural strategies included *self-control training*, *strict law enforcement,* and *community support groups (similar to AA)*. Participants were then asked to select and rank (from the best to worst option) their top five solutions.

**Endorsement of required solutions**. One solution item specifically focused on participants' endorsement of required biomedical solution strategies. Endorsement was rated on a 7-point scale (1= *not at all,* 7= *a large extent*).

**Endorsement of research funding**. Participants completed an open ended question that asked them to indicate where they believed further research money investigating aggression should be spent. Next they were provided with a list of possible research directions that focused on either social programs or biomedical research. Participants rated the extent to which they

believed money should be spent on each research program (1= *not at all*, 7= *a large extent*). Examples of social programs were the *development of life-skills education programs,* and *development of counselling/ psychotherapies;* examples of biomedical research were *development of drug treatments* and *detection of genetic links*.

**Resolution.** Participants were asked to rate the extent to which they thought the issue of behavioural aggression could be solved (1= *not at all*, 7= *completely)*. Participants also predicted how long it would take an individual and society at large to solve this issue, and responded in years, months, or days. Further participants were asked to write an open-ended response indicating how they think aggression could be prevented from manifesting if an individual had the predisposition to it.

**Personal responsibility.** As a measure of personal responsibility, participants rated the extent to which they believe that each individual who displays aggressive behaviour is personally responsible for changing this behaviour (1= *not at all*, 7= *completely*).

**Causal responsibility**. Two items were included to assess participants' perceptions of the fundamental cause of aggression. Participants rated the extent to which they believed that 'genes' and 'childhood experiences' are responsible for aggressive behaviour (1= *not at all*, 7= *completely*).

**Implicit theories.** To assess implicit theories of change, participants rated their agreement with three items (from Dweck, 2011) suggesting that people cannot change the type of person they are (1= *strongly disagree*, 7= *strongly agree)*.

**Genetic Essentialism.** Genetic essentialism was measured using a ten item scale developed in previous research to assess individual differences in genetic essentialism (Dreyer, xx). Participants rated their agreement with ten statements describing genetic essentialism, such

as "when personality traits or characteristics are shown to have a genetic basis, different parenting styles have no effect on these traits" (1= *strongly disagree*, 7= *strongly agree)*.

**Supplemental items**. Additional items not mentioned here were assessed for exploratory purposes and are beyond the scope of this thesis.

**Demographics and Perceived Knowledge.** The final section of the questionnaire asked participants to indicate their gender, age, ethnicity, educational level, political orientation, religiosity, and perceived knowledge of genetics and environmental influences on behaviour.

**Attention check.** Several attention check items were inserted throughout the questionnaire assessing whether people paid attention to the article, such as "What was the topic of the article you read about", as well as directed response items, such as "To respond to this question, please choose option 4".

## Results

Initially, zero-order correlations were calculated between the dependent variables and main demographic variables for the complete sample; the correlation coefficients are presented in Table 1. A Chi-Square test of independence was conducted to assess condition differences for frequency-coded headline analyses. The main analyses, testing for the effect of emphasis condition, were conducted using an independent samples t-test. These analyses are summarized in Table 2.

*Table 1. Zero-order correlations among dependent variables and main demographics (Study1)*

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Bio S | 1.00 | | | | | | | | | | | | | | | |
| 2. Psycho-social S | .02 | 1.00 | | | | | | | | | | | | | | |
| 3. Bio S (mean) | **.65**** | -.11 | 1.00 | | | | | | | | | | | | | |
| 4. P-s S (mean) | **.23*** | **.44**** | **.37**** | 1.00 | | | | | | | | | | | | |
| 5. P-s Funding | .06 | **.62**** | .03 | **.73**** | 1.00 | | | | | | | | | | | |
| 6. Bio Funding | **.60**** | -.02 | **.80**** | **.26**** | .08 | 1.00 | | | | | | | | | | |
| 7. Personal Resp | **-.19*** | .11 | **-.20*** | .34 | .12 | **-.22**** | 1.00 | | | | | | | | | |
| 8. Gene Resp | **.52**** | .05 | **.53**** | **.31**** | .11 | **.59**** | **-.22*** | 1.00 | | | | | | | | |
| 9. Childhood Resp | -.12 | **.39**** | **-.24*** | .11 | **.29**** | **-.25**** | -.04 | -.10 | 1.00 | | | | | | | |
| 10. Resolution | .07 | **.33**** | -.02 | **.17*** | **.25**** | -.06 | .11 | .11 | **.20*** | 1.00 | | | | | | |
| 11. Implicit theories | -.13 | -.01 | -.10 | .01 | .02 | -.10 | -.18 | .18 | .05 | **-.18*** | 1.00 | | | | | |
| 12. Genetic Essent. | .13 | -.03 | **.37**** | .15 | .03 | **.42**** | **-.30**** | **.29**** | -.07 | -.10 | **.34**** | 1.00 | | | | |
| 13. Conservatism | .02 | **-.30**** | .12 | -.16 | **-.30**** | .06 | **-.24**** | .02 | -.02 | -.12 | .05 | .15 | 1.00 | | | |
| 14. Religiosity | .10 | -.01 | **.20*** | .14 | -.03 | .13 | -.15 | .10 | -.04 | .15 | -.09 | **.21*** | **.45**** | 1.00 | | |
| 15. Knowl Gene | .07 | .02 | .11 | -.04 | -.04 | .11 | -.03 | -.002 | -.09 | .16 | **-.20*** | .05 | -.15 | -.07 | 1.00 | |
| 16. Knowl P-s | .09 | .04 | .09 | .07 | .03 | .04 | -.03 | .03 | .05 | .16 | -.16 | -.07 | -.14 | -.12 | .74** | 1.00 |
| 17. Gender | .02 | -.07 | .08 | **-.29**** | **-.19*** | .14 | **-.25**** | .05 | **.19*** | -.006 | .06 | .12 | .13 | -.09 | -.009 | .06 |
| *N* | 115 | 115 | 115 | 115 | 115 | 115 | 115 | 115 | 115 | 115 | 115 | 115 | 115 | 115 | 115 | 115 |
| Mean | 2.93 | 5.86 | 2.53 | 4.97 | 5.56 | 3.26 | 5.63 | 3.69 | 5.25 | 4.72 | 3.92 | 3.41 | 3.56 | 1.97 | 3.18 | 3.65 |
| Standard Deviation | 1.6 | 1.36 | 1.27 | .95 | 1.19 | 1.69 | 1.27 | 1.4 | 1.08 | 1.24 | 1.33 | .74 | 1.51 | 1.01 | 1.45 | 1.56 |

*Note*. Bio = Biomedical; S = solution(s); P-s = Psycho-social; Resp = Responsibility; Essent. = Essentialism; Knowl = Knowledge
*$p$ <.05; **$p$ < .01 (reported Spearman correlations for gender due to binary variable)

**Headline**

Participant-generated headlines were coded for mentioning the condition-specific emphasis (either genes or childhood experiences) as '*the*' cause of aggression. It is expected that conditions differed in the extent to which they mention the cause that was emphasized, however of particular interest was whether participants would mention it as *the* cause. Mentioning as *the* cause would indicate that they are not seeing aggression from the interactionist approach. Participants received a score of zero if no causal relationship was mentioned or a causal relationship with a non-emphasized factor was mentioned and a score of 1 if the emphasized factor was mentioned as the only causal factor. A second coder is currently coding headlines to establish inter-rater reliability. We conducted a chi-square test to examine whether participants were more likely to mention the emphasized cause (genes or childhood experiences) in the gene condition than in the psychosocial condition. Consistent with the hypothesis, the chi-square test of independence was significant, $X^2$ (2, 115) = 7.59, $p$ = .006. Participants in the gene condition (49%) were significantly more likely to mention the emphasized cause in their headline than participants in the psycho-social condition (24.2%), $p < .05$. Example headlines from the gene condition were: "MOAO Gene Linked To Aggressive Behavior", "Gene Causing Aggressiveness Found" and "Violence Caused by Genetic Factors". Example headlines from the psycho-social emphasis condition include: "Does Environment Affect Behavior" and "Increase of aggression in North America".

**Causal Responsibility**

Our hypothesis was that, despite providing an interactionist perspective in the article, participants in the genetic emphasis condition would perceive genes to be more responsible (i.e., the cause of) for behavioural aggression compared to participants in the psycho-social emphasis

condition. Further we hypothesized that participants in the psycho-social emphasis condition would perceive childhood experiences to be more responsible for behavioural aggression compared to participants in the genetic emphasis condition. Consistent with these hypotheses, participants believed that genes were more responsible for aggression in the gene condition ($M$ = 4.24, $SD$ = 1.41) than in the psycho-social condition ($M$ = 3.27, $SD$ = 1.25), $t(113) = 3.91$, $p < .001$. Also, participants rated childhood experiences to be more responsible for aggression in the psycho-social emphasis condition ($M$ = 5.42, $SD$ = 1.04) than in the gene emphasis condition ($M$ = 5.02, $SD$ = 1.11), $t(113) = -2.003$, $p = .048$.

**Ratings of Solutions**

Next, we examined whether the emphasis condition affected participants' endorsement of biomedical and socio-behavioural solutions to behavioural aggression. On the single-item measure, there was a significant effect of condition on the endorsement of biomedical, but not on socio-behavioural solutions. As hypothesized, participants in the gene emphasis condition ($M$ = 3.45, $SD$ = 1.75) endorsed biomedical solutions more strongly than participants in the psycho-social emphasis condition ($M$ = 2.55, $SD$ = 1.37), $t(113) = 3.11$, $p = .002$. Endorsement of socio-behavioural solutions did not differ between the gene emphasis condition ($M$ = 5.63, $SD$ = 1.42) and psycho-social emphasis condition ($M$ = 6.03, $SD$ = 1.30), $t(113) = -1.56$, $p = .122$, *ns*.

Participants' ratings of the effectiveness of specific strategies were averaged to create a score for the biomedical strategies ($\alpha$ = .89) and behavioural strategies ($\alpha$ = .90). See Appendix D for a factor analysis of the solution items. The t-tests performed on these aggregated scores of effectiveness replicated the findings of the single-item endorsement measure. As hypothesized, participants in the gene emphasis condition ($M$ = 2.94, $SD$ = 1.37) rated biomedical solutions as more effective than participants in the psycho-social emphasis condition ($M$ = 2.22, $SD$ = 1.11),

$t(113) = 3.15$, $p = .002$. The ratings of socio-behavioural solutions did not differ between the gene emphasis condition ($M = 4.91$, $SD = .96$) and psycho-social emphasis condition ($M = 5.00$, $SD = .95$), $t(113) = -48$, $p = .63$, *ns*.

**Ratings of Research funding**

Subsequently, we assessed whether the type of research funding participants endorsed was affected by the emphasis condition. Participants' endorsement of specific research programs were averaged to create a score for biomedical research ($\alpha = .92$) and social research ($\alpha = .86$). The t-tests performed on these aggregated scores revealed a significant condition difference for the endorsement of biomedical research but not for social research, replicating the results for the endorsement of solutions. Endorsement of research funding for biomedical programs or interventions was higher in the gene condition ($M = 4.04$, $SE = 1.66$) than in the psycho-social emphasis condition ($M = 2.69$, $SE = 1.48$), $t(113) = 4.60$, $p < .001$, whereas for social programs there was not a significant difference across the gene condition ($M = 5.42$, $SE = 1.25$) and psycho-social condition ($M = 5.66$, $SE = 1.14$), $t(113) = -1.09$, $p = .28$, *ns*.

Overall the results of multiple t-tests support our first hypothesis. Participants in the genetic emphasis condition thought that genes are more responsible for behavioural aggression, endorsed biomedical solutions more, and also wanted to focus more on biomedical research, than participants in the psycho-social emphasis condition. A summary of means table for the analyses is provided in Table 2 .

**Ratings of Requirements**

Next, we assessed whether the emphasis condition affected the extent to which participants endorsed required biomedical interventions. There was a marginally significant condition difference for endorsement of required biomedical interventions. Participants in the

gene emphasis condition ($M$ = 3.16, $SD$ = 2.03) endorsed required biomedical interventions marginally more strongly than participants in the psycho-social emphasis condition ($M$ = 2.47, $SD$ = 1.78), $t(113) = 1.94$, $p = .055$.

**Resolution and Personal responsibility,**

Next, we examined condition differences on perceptions of resolution and personal responsibility. There was no significant effect of condition on the ratings of resolution, $t$ (113) = -1.59, $p$ = .115. There was a significant effect of condition on the ratings of personal responsibility. As expected, participants in the gene condition ($M$ = 5.24, $SD$ = 1.56) believed that individuals with behavioural aggression are less personally responsible for changing their behaviour than participants in the psycho-social condition ($M$ = 5.92, $SD$ = .9), $t(113) = 2.73$, $p$ = .008 (adjusted for unequal variances). Personal responsibility was also tested as a mediator for both endorsements of biomedical solutions as well as biomedical research funding. The bootstrapping procedure revealed that it is not a significant mediator of the relationship between condition emphasis and the outcome variables.

**Perceived Knowledge**

Lastly, we investigated whether emphasis condition affected participants' perceived knowledge of genetic and environmental influences on human behaviour. Perceived knowledge of genetic influences was higher for participants in the psycho-social emphasis condition ($M$ = 3.42, $SE$ = 1.34) than for participants in the gene emphasis condition ($M$ = 2.86, $SE$ = 1.56), $t(113) = -2.10$, $p = .038$, whereas perceived knowledge of environmental influences was only marginally higher for participants in the psycho-social emphasis condition ($M$ = 5.66, $SE$ = 1.14) than the gene emphasis condition ($M$ = 5.42, $SE$ = 1.25), $t(89.9) = -1.65$, $p = .102$ (accounted for

unequal variances). Perceived knowledge of genetic or environmental influences was not significantly correlated with any other main dependent variables.

*Table 2. Primary Dependent Variables by Emphasis Condition (Study 1)*

| | Condition | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gene Emphasis | | | Psycho-social Emphasis | | | Difference | | | | | | |
| DV's | *M* | *SD* | *SE* | *M* | *SD* | *SE* | *M* | *SE* | *T* | *df* | CI | *p* | *d* |
| Gene Resp | 4.24 | 1.41 | .20 | 3.27 | 1.25 | .15 | .97 | .25 | 3.91 | 113 | .48; 1.46 | .000 | 0.74 |
| Childhood Resp | 5.02 | 1.11 | .16 | 5.42 | 1.04 | .13 | -.40 | .20 | -2.00 | 113 | -.80; -.005 | .048 | -0.38 |
| Bio S | 3.45 | 1.75 | .25 | 2.55 | 1.37 | .17 | .90 | .30 | 3.00 | 88.43 | .30; 1.50 | .003 | 0.64 |
| S-b. S | 5.63 | 1.42 | .20 | 6.03 | 1.30 | .16 | -.40 | .26 | -1.56 | 113 | -.90; .11 | .122 | -0.29 |
| Bio S (mean) | 2.94 | 1.37 | .20 | 2.22 | 1.11 | .14 | .73 | .23 | 3.15 | 113 | .27; 1.18 | .002 | 0.59 |
| S-b S (mean) | 4.92 | .96 | .14 | 5.00 | .95 | .12 | -.09 | .18 | -.48 | 113 | -.44; .27 | .63 | -0.09 |
| Bio Funding | 4.04 | 1.66 | .24 | 2.68 | 1.48 | .18 | 1.36 | .29 | 4.60 | 113 | .77; 1.94 | .000 | 0.87 |
| S-b Funding | 5.42 | 1.25 | .18 | 5.66 | 1.14 | .14 | -.24 | .22 | -1.09 | 113 | -.69; .20 | .28 | -0.21 |
| Required Bio | 3.16 | 2.03 | .29 | 2.47 | 1.78 | .22 | .69 | .36 | 1.94 | 113 | -.01; 1.40 | .055 | 0.36 |
| Resolution | 4.51 | 1.23 | .18 | 4.88 | 1.23 | .15 | -.37 | .23 | -1.59 | 113 | -.83; .09 | .115 | -0.30 |
| Personal Resp | 5.24 | 1.56 | .22 | 5.92 | .90 | .11 | -.68 | .25 | -2.73 | 71.37 | -1.18; -.18 | .008 | -0.65 |
| Knowl Gene | 2.86 | 1.56 | .22 | 3.42 | 1.34 | .17 | -.57 | .27 | -2.10 | 113 | -1.10; -.03 | .038 | -0.40 |
| Knowl P-s | 3.37 | 1.73 | .25 | 3.86 | 1.39 | .17 | -.50 | .30 | -1.65 | 89.91 | -1.09; .10 | .10 | -0.35 |

*Note*. Bio = Biomedical; S = solution(s); S-b = Socio-behavioural; Resp = Responsibility; Essent. = Essentialism; Knowl = Knowledge

N (gene condition) = 49, N (psycho-social condition) = 66

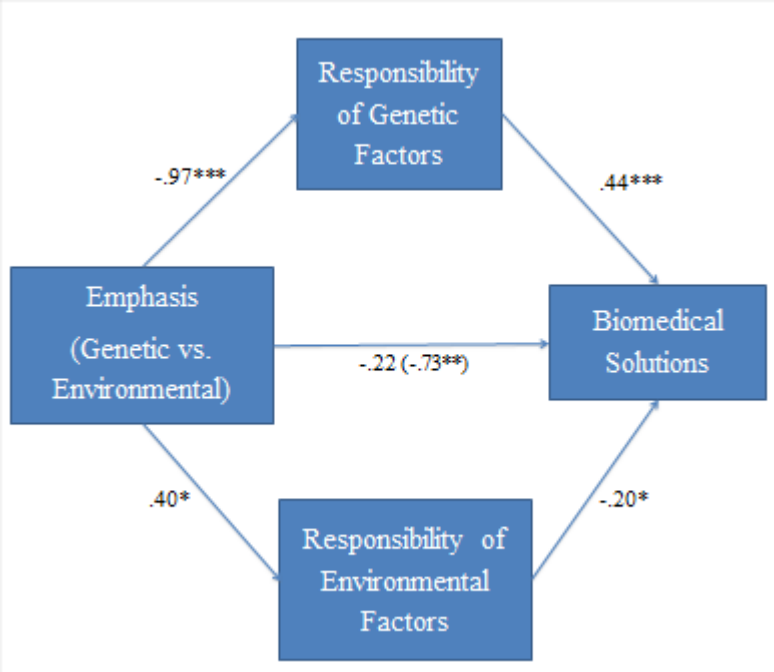
**Mediation**

To further examine the relationship of our main dependent variables to each other and test the potential mediating role of beliefs of responsibility, we conducted a mediation analysis using the PROCESS macro for SPSS (Hayes, 2013) (Model 4). Specifically we were interested in testing whether the effects of emphasis condition on the rating of effectiveness of biomedical solutions and endorsement of biomedical research were mediated by the ratings of causal responsibility of genes and environmental factors. To test this possibility we entered ratings of effectiveness of biomedical solutions (aggregated score) or biomedical research (aggregated score) as the DV, emphasis condition as the IV, and responsibility of genetic and environmental factors as the mediators.

As anticipated, the effect of the emphasis conditions on rating of effectiveness of biomedical solutions was mediated by both beliefs concerning the responsibility of genes and environmental factors for behavioural aggression. As Figure 1 illustrates, the standardized regression coefficient between emphasis condition and responsibility of genetic factors as well as responsibility of environmental factors was statistically significant, as was the standardized regression coefficient between responsibility of genetic factors and environmental factors and rating of effectiveness of biomedical solutions. Emphasis condition was no longer a significant predictor of rating of effectiveness of biomedical solutions after controlling for the two mediators (see c' in brackets), responsibility of genetic factors and responsibility of environmental factors, b = -.22 , SE = .21, *ns*, consistent with full mediation. The indirect effect was tested using a bootstrap estimation approach with 1,000 samples, and the 95% confidence interval was computed by determining the indirect effects at the 2.5th and 97.5th percentiles. The bootstrapped unstandardized indirect effect was -.51, and the 95% confidence interval ranged

from -.88 to -.25. Thus, the indirect effect was statistically significant. Being in the gene condition was associated with a .51 points higher rating of effectiveness of biomedical solutions as mediated by perceptions of responsibility of genetic and environmental factors for behavioural aggression.

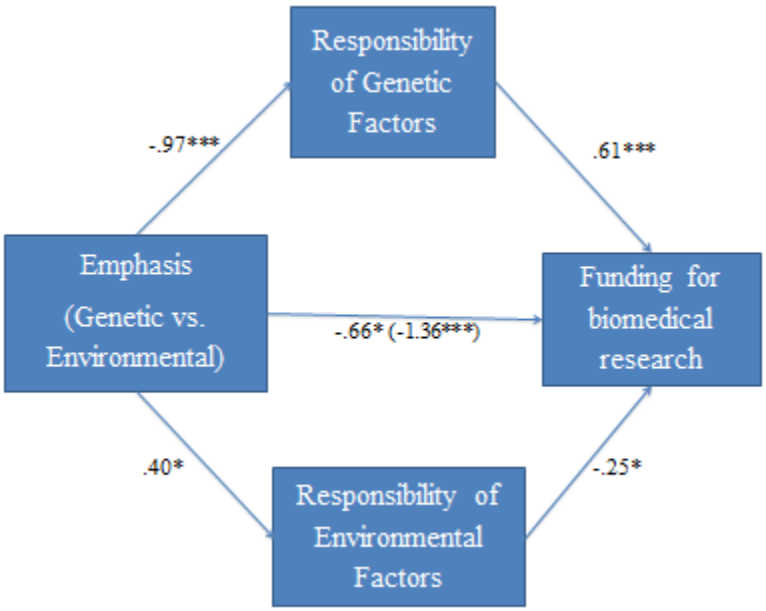
*Figure 1. Mediation Model for Emphasis condition, Responsibility and Biomedical Solutions*




Replicating the results of the first mediation analysis, condition differences in the endorsement of biomedical research were also mediated by perceptions of the responsibility of genetic and environmental factors for behavioural aggression. As Figure 2 illustrates, the standardized regression coefficient between emphasis condition and responsibility of genetic factors as well as responsibility of environmental factors was statistically significant, as was the standardized regression coefficient between responsibility of genetic factors and environmental factors and endorsement of biomedical research. Emphasis condition was a significantly weaker

predictor of endorsement of biomedical research after controlling for the two mediators (see c' in brackets), responsibility of genetic factors and responsibility of environmental factors, b = -.66 , SE = .27, *p* = .015, consistent with partial mediation. The indirect effect was tested using a bootstrap estimation approach with 1,000 samples, and the 95% confidence interval was computed by determining the indirect effects at the 2.5th and 97.5th percentiles. The bootstrapped unstandardized indirect effect was -.7, and the 95% confidence interval ranged from -1.12 to -.32. Thus, the indirect effect was statistically significant. Being in the gene condition was associated with a .7 points higher endorsement of biomedical research as mediated by perceptions of responsibility of genetic and environmental factors for behavioural aggression.

*Figure 2. Mediation Model for Emphasis condition, Responsibility and Endorsement of Biomedical Research*



To summarize, the articles participants read influenced participants' perceptions of the causal responsibility of genetic and environmental factors for aggression, which in turn influenced their endorsement of biomedical solutions and biomedical research.

## Discussion

In line with the hypotheses, despite the emphasis on genetic and environmental influences of aggression in both conditions, genes are perceived to be more responsible for aggression in the gene-emphasis condition than in the psycho-social emphasis condition and childhood experiences are perceived to be more responsible for aggression in the psycho-social emphasis condition than in the gene condition. Thus, it seems that simply providing an interactionist perspective does not suffice in preventing differences in the extent to which different factors are held responsible for a condition. These differences in causal emphasis also emerged in participants' self-generated headlines. Considering that in reality headlines are provided with news articles and that these headlines try to be 'catchy' the emphasis of genetic causes in headlines might even be larger in actual news articles.

Thus, it seems that simply providing an interactionist perspective does not suffice in preventing lay individuals to endorse strong genetic explanations, that is to assign causation to genes for a condition that in which genes are implicated as playing a role. Interestingly, participants in the psycho-social condition likewise endorsed a 'strong' psycho-social explanation; that is they assigned causality to environmental factors. This is a previously unexplored finding and might highlight individuals' general lack of recognition of complexities, particularly in short, catchy headlines, in favor of simple, easily processed notions of cause-and-outcome. The differences in the emphasis on one type of cause over another is particularly striking in this study, as the article participants read only indicated that 30% of individuals with

the predisposition they read about develop the condition. Objectively participants were informed that less than half of all individuals with the predisposition they read about are aggressive, thus the link between the cause and outcome participants read about is very weak. Nevertheless, emphasizing one cause within the context of new research findings was enough to highlight this cause in participants' minds.

Further, in line with our primary hypothesis, participants in the gene emphasis condition endorsed biomedical solutions more than participants in the psycho-social emphasis condition. This result highlights the need to extend the conceptualization of action proposed by researchers such as Dar-Nimrod and Heine (2011) and Cheung and Dar-Nimrod (2014). Using their notion of action, one would reason that learning of a genetic etiology leads to behavioural inaction, thus the endorsement of both biomedical and socio-behavioural solutions should be lower in the gene emphasis condition compared to the psycho-social emphasis condition. However, the results indicate a different pattern. Indeed it seems that after genetic causes for a condition are made salient participants shift their notions of how effective different treatment for this condition would be. While participants' endorsement of socio-behavioural solutions does not differ between the two conditions, biomedical solutions are perceived as more effective in the gene emphasis condition than in the psycho-social emphasis condition. These results emerged despite a lack of personal relevance of the genetic information and thus highlight the general perception of increased effectiveness of biomedical solutions for problems with genetic etiology, compared to problems without genetic etiology.

One might have expected that participants in the gene condition endorse socio-behavioural solutions less, however all socio-behavioural solutions were more plausible, unobstrusive and easily implementable and might thus have been equally endorsed.

The findings regarding the endorsement of solutions were replicated with endorsement of research funding. This is the first study to show a clear extension of differences emerging after highlighting a genetic etiology (compared to psycho-social etiology) for both endorsement of biomedical solution strategies and the endorsement of biomedical research. Thus it seems that participants do not only think that current biomedical solutions will be more effective in addressing behavioural aggression with genetic causes (compared to psycho-social causes), but they further believe that future treatments should be increasingly biomedical.

It is also important to consider that participants in the gene emphasis endorsed required biomedical intervention more than participants in the psycho-social emphasis condition. One could imagine that when participants perceive aggression to be genetic, the condition seems more certain (Dar-Nimrod & Heine, 2011a) and perhaps it seems more pressing to ensure intervention in order to treat the undesirable behavioural outcome.

These findings should be seen in light of the significant mediations. Participants in both conditions increased their belief in the causal responsibility of the predisposition to aggression they read about. The belief that genes or environmental influences are responsible for aggression then influenced participants' biomedical preference. This mediation is consistent with the hypotheses and highlights that even reading an interactionist account did not prevent participants in the gene condition to increase their perception of genes as responsible for aggression (and decrease their perception of environmental factors as responsible) and in turn increase their preference for biomedicine. On the other hand, when considerations of environmental factors as responsible for aggression increased, preference for biomedicine decreased. Thus, it seems that it is not genetic information per se that influences preference for biomedicine, but the extent to which participants believed in genes (vs. environmental factors) as responsible for a condition.

Evidence that these studies did evoke genetic essentialist biases comes from the significant condition differences in beliefs of personal responsibility, replicating other studies researching genetic essentialist biases (e.g. Cheung & Dar-Nimrod, 2014). As expected from these studies, participants in the gene condition believed individuals are less personally responsible for changing their behaviour than participants in the psycho-social emphasis condition. Also, no differences were found in the belief in solvability of aggression, as expected. Though participants might consider biomedical solutions as more effective in the gene condition than in the psycho-social condition, they do not believe that aggression is more or less solvable. Interestingly, however, overall, resolution is positively correlated with belief in effectiveness of socio-behavioural solutions, endorsement of social research, and belief in responsibility of childhood experiences.

Lastly, albeit surprising, there were significant differences in perceived knowledge about influences on behaviour. Participants in the gene emphasis condition believed they knew less about both genetic and environmental influences on human behaviour than participants in the psycho-social emphasis condition. This finding rules out the possibility that participants in the gene condition simply believed they know more about genetic influences on behaviour and thus choose the biomedical solutions because they believe they know more about these solutions. Further, it highlights that the gene article did not increase perceived knowledge in the gene condition. This finding will be explored further in the next studies.

## Study 2

The main purpose of the second study was, again, to examine the effect of emphasis on participants' perceptions and attitudes towards solutions and research. Particularly we aimed to replicate the findings of Study 1 and show that simply mentioning genetic findings about a social

problem behaviour, such as aggression, in a newspaper report will lead to higher endorsement of biomedical solutions, research, and also ratings of effectiveness of biomedical solutions compared to mentioning psycho-social causes of aggression. In addition to a genetic and psycho-social emphasis condition, a control condition was added, as well as refined and additional measures. The control condition was added to assess whether the gene article indeed increased endorsement of biomedicine or whether potentially the psycho-social emphasis article decreased biomedical preferences. In Study 1, there were no condition differences on the endorsement of socio-behavioural solutions. Thus, in Study 2, the primary dependent variables, ratings of solutions and research funding were refined. Concretely, we added more severe social-behavioural solution statements in study two, because the social-behavioural solution statements in Study 1 were all relatively unobtrusive. The unobtrusive nature of these solutions might have led to a general endorsement of these solutions, independent of condition. We predict that by adding more severe socio-behavioural solution statements, participants in the psycho-social emphasis condition will be more likely to endorse these solutions than participants in the gene emphasis condition.

Further, to explore whether differences between conditions of the rating of effectiveness of solution items emerge due to properties other than the type of solution (biomedical versus socio-behavioural), participants were also asked to rate solution items on ethicality and severity. We also added additional measures to differentiate between general solutions and mandatory solutions aggressive individuals would have to engage in. We hereby build upon our findings from Study 1 that suggest that participants in the gene emphasis condition might endorse mandatory treatments more than participants in the psycho-social emphasis condition. Additional

dependent measures from Study 1 were again included to further explore the effect of condition on these variables.

## Method

### Participants

As in study one, American adults were recruited via the Crowdflower website and received $2 US as an incentive. Two-hundred and sixty-nine adults participated, and five participants failed the attention and/or manipulation check (using the same criteria as in the initial study) resulting in a final sample of two-hundred and sixty-four adults (*M* age = 35.97, *SD* age = 12.70; 104 male, 158 female, 2 unidentified).

### Procedure

After self-selecting and consenting to take part in the study, participants were directed to an online questionnaire that contained all instructions and measures (see Appendix B). Participants were randomly assigned to one of two emphasis conditions or a no-emphasis control condition. The genetic emphasis and psycho-social emphasis conditions were identical to study one. Participants were told that either that 30% of individuals with a gene-variant are behaviourally aggressive or that 30% of people with certain child-hood experiences are behaviourally aggressive. In the control condition, participants read the same prevalence and multiple cause paragraphs as in the other conditions, but did not receive the additional emphasis on a genetic or psychosocial cause.

### Dependent Measures

After reading the article, participants completed the following dependent measures, in the order described below. A full list of the items is in Appendix B. Items identical to Study 1 are light grey, whereas items that changed are in black.

**Endorsement of solutions.** As in Study 1, the primary dependent variable was participants' endorsement of biomedical and behavioural solutions. Participants completed rating scales that assessed their endorsement of the two general types of solutions. Specifically, participants rated the extent to which physical or biological adjustments (e.g. medication, surgery) and psychological or environmental adjustments (e.g. therapy, education) would be good solutions to aggression (1= *not at all,* 7= *a large extent).* Next, participants were presented with a variety of specific biomedical and social-behavioural solutions, and were asked to rate the extent to which they agreed that each strategy was an 'effective', 'ethical' and 'severe' solution to behavioral aggression (1= not at all, 7= very much so). Thus, participants rated each solution strategy on the three domains of effectiveness, ethicality and severity. Biomedical strategies included *genetic therapy to control behaviour*, *psychopharmaca (i.e. mood regulators) to alter behaviour),* and *surgery to remove glands that produce "anger"-hormones*. Social -behavioural strategies included *training sessions for impulse control (e.g. teaching effective conflict resolution skills and management of emotions), family counselling (including training for parents whose kids have the behaviour),* and *forced removal of children with behaviour from current homes*. The latter item is an example of a more obtrusive behavioural solution statement that was added.

**Endorsement of research funding**. Next, participants rated what percentage of a research budget studying behavioural aggression should be spend on a list of possible research directions that focused on either social programs or biomedical research. Examples of social programs were, *development of life-skills education programs*, and *development of counselling/ psychotherapies;* examples of biomedical research were *development of drug treatments* and *detection of genetic links*. We also included an item on the *development of early prevention*

*programs,* which could be seen as both a social or biomedical program. This item was analyzed separately.

**Headline.** As in study 1, participants were asked to generate a title or headline for the article they read.

**Resolution**. Elaborating on the findings of study 1, the measure of resolution was divided into two separate items in study 2. Participants first indicated the extent to which they believed the predisposition to behavioural aggression can be completely eliminated (1= *can never be eliminated,* 7= *can be completely eliminated).* Second, rated the extent to which the expression of aggressive behaviour can be prevented assuming the predisposition exists (1= *can never be prevented,* 7= *can be completely prevented).*

**Personal responsibility.** Participants rated the extent to which they believe that each individual who displays aggressive behaviour is personally responsible for changing this behaviour (1= *not at all*, 7= *completely*).

**Causal Responsibility**. In two items, participants rated the extent to which they believed that 'genes' and 'childhood experiences' are responsible for aggressive behaviour (1= *not at all*, 7= *completely*).

**Endorsement of mandatory solutions**. To elaborate on measures of required solutions from Study 1, items assessing mandatory solutions were included here. Participants rated their agreement with items assessing mandatory screening and mandatory prevention measures for individuals who have the predisposition to aggression (1 = I disagree completely; 7 = I agree completely). Further, participants indicted to what extent biomedical and psycho-social treatments for aggression should be mandatory (1 = *not at all*; 7 = *completely*).

**Genetic Essentialism.** Genetic essentialism was measured using a ten item scale developed in previous research to assess individual differences in genetic essentialism (Dreyer, 2014). Participants rated their agreement with ten statements describing genetic essentialism, such as "when personality traits or characteristics are shown to have a genetic basis, different parenting styles have no effect on these traits" (1= *strongly disagree*,7= *strongly agree)*.

**Implicit theories.** To assess implicit theories of change, participants rated their agreement with three items (from Dweck, 2011) suggesting that people cannot change the type of person they are (1= *strongly disagree*, 7= *strongly agree)*.

**Aggression**. Level of aggression was assessed using participants agreement with three face valid items such as '*getting back at others makes me feel better'* immersed in filler items (1= *strongly disagree* , 7= *strongly agree).*

**Agreement with article**. Participants also indicated how many examples they can think of from their own experiences that are consistent with the causes of behavioural aggression described in the article, and how many examples they can think of that are inconsistent (1= *no examples at all,* 7= *many examples)*. Next, participants also rated the extent to which they agreed with the main points of the article (1= *strongly disagree* to 7= *strongly agree).*

**Demographics and Perceived Knowledge.** The final section of the questionnaire asked participants to indicate their gender, age, ethnicity, educational level, political orientation, religiosity and their perceived knowledge of genetics and environmental influences on behaviour. Additionally an item assessing participants' actual knowledge of epigenetics was included. For this item we provided 4 potential definitions of epigenetics and participants had to select the correct one.

**Supplemental items**. Additional items not reported here were assessed for exploratory purposes and are beyond the scope of this thesis.

**Attention and manipulation checks.** We refined the manipulation check by specifically assessing whether participants could identify what factor influencing aggression was emphasized in the article. Participants responded on a scale from 1 = *environmental factors were most emphasized* to 7 = *genetic factors were most emphasized*. We again included more generic attention check items, such as "To respond to this question, please choose option 4". These items were randomly inserted throughout the questionnaire.

## Results

Initially, zero-order correlations were calculated between the main dependent variables for the complete sample; the correlation coefficients are presented in Table 3. A Chi-Square test of independence was conducted to assess condition differences for frequency-coded headline analyses. The main analyses, testing for the effect of emphasis condition, were conducted using a one-way ANOVA. Planned comparisons between the two manipulation conditions will be reported. Estimated means are reported; in addition, standard errors, confidence intervals, and effect sizes (partial $\eta^2$) for all analyses can be found in Table 4. Results are reported in the same order that they were reported in Study 1, and not in the order in which they were presented in the questionnaire. Please refer to the methods section of Appendix B for the order of presentation.

***Table 3.*** Zero-order correlations among dependent variables (Study 2)

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Gene Resp | 1 | | | | | | | | | | | | | | | |
| 2. Childhood Resp | .132* | 1 | | | | | | | | | | | | | | |
| 3. Bio S | .335** | .072 | 1 | | | | | | | | | | | | | |
| 4. Psycho-social S | -.127* | .237** | -.004 | 1 | | | | | | | | | | | | |
| 5. Bio S (mean) | .398** | .096 | .622** | -.110 | 1 | | | | | | | | | | | |
| 6. S-b S (mean) | .159** | .225** | .158** | .460** | .251** | 1 | | | | | | | | | | |
| 7. Bio S (mean) ethical | .348** | .010 | .461** | -.062 | .697** | .167** | 1 | | | | | | | | | |
| 8. S-b S (mean) ethical | -.113 | .089 | -.116 | .276** | -.080 | .412** | .141* | 1 | | | | | | | | |
| 9. Bio S (mean) severe | -.189** | .013 | -.377** | .108 | -.521** | -.031 | -.633** | .063 | 1 | | | | | | | |
| 10. S-b S (mean) | .176** | .003 | .176** | -.151* | .167** | -.160** | .042 | -.500** | .188** | 1 | | | | | | |
| 11. Bio Funding | .275** | .054 | .210** | -.211** | .382** | -.027 | .364** | -.016 | -.237** | .039 | 1 | | | | | |
| 12. S-b Funding | -.378** | -.037 | -.266** | .205** | -.495** | .032 | -.466** | .111 | .296** | -.112 | -.889** | 1 | | | | |
| 13. Personal Resp | -.093 | .079 | -.077 | .279** | -.182** | .240** | -.094 | .258** | .225** | -.231** | -.157* | .195** | 1 | | | |
| 14. Eliminate | -.194** | -.030 | -.182** | .028 | -.133* | -.046 | -.116 | .184** | .091 | -.192** | -.073 | .117 | .090 | 1 | | |
| 15. Prevent | .142* | .135* | .186** | .187** | .124* | .236** | .231** | .036 | -.049 | .084 | .062 | -.073 | .091 | -.292** | 1 | |
| 16. Knowl Gene | .307** | -.028 | .260** | -.001 | .241** | .133* | .194** | -.206** | -.119 | .295** | .128* | -.194** | -.020 | -.236** | .231** | 1 |
| 17. Knowl P-s | .142* | .121* | .265** | .143* | .142* | .219** | .090 | -.086 | -.039 | .181** | .056 | -.067 | .051 | -.145* | .277** | .675 |
| *N* | 271 | 270 | 273 | 272 | 271 | 271 | 270 | 271 | 267 | 267 | 273 | 273 | 267 | 267 | 269 | 269 |
| Mean | 3.71 | 4.91 | 4.01 | 5.61 | 3.5488 | 4.7362 | 3.6472 | 5.3613 | 4.7676 | 3.0605 | 7.4711 | 11.298 | 5.15 | 7.41 | 4.32 | 3.24 |
| Standard Deviation | 1.435 | 1.210 | 1.580 | 1.047 | 1.2407 | .76726 | 1.1184 | .87210 | .98522 | 1.0131 | 3.8099 | 4.2981 | 1.270 | 4.796 | 1.172 | 1.56 |

*Note*. Bio = Biomedical; S = solution(s); S-b = Socio-behavioural; Resp = Responsibility; Essent. = Essentialism; Knowl = Knowledge
*$p$ <.05; **$p$ < .01

**Manipulation Check**

The newspaper manipulation significantly affected participants' ratings of which findings were most emphasized in the article, $F(2, 258) = 39.62$, $p < .001$. As anticipated, participants in the gene emphasis condition believed that gene were emphasized more in the article ($M = 5.71$, $SD = 1.20$) than participants in the psycho-social emphasis condition ($M = 3.92$, $SD = 1.72$), $t(155) = 8.07$, $p < .001$ (accounting for unequal variances).

**Headline**

The same coding procedure as in Study 1 was followed. Headlines for the control condition were coded as mentioning any cause as *the* cause (1) or not mentioning any cause as the cause (0). Replicating the results of the first study, a significant chi-square test of independence, $X^2$ (4, 257)= 124.17, $p$ <.001, revealed that again, participants in the gene condition were significantly more likely to mention the emphasized cause in the headline (33%), than both participants in the psycho-social (13.5%) and in the control condition (0%), $p < .05$. Further, participants in the gene condition (67%) were also significantly less likely to mention no causes or a non-emphasized cause than both participants in the psycho-social emphasis condition (80.9%) and participants in the control condition (100%), $p < .05$. The results remain the same when the control condition is omitted from the analyses. Example headlines from the gene emphasis condition were: "New Research Reveals Genetic Predisposition to Aggressive Behavior", "Possible Genetic Link Found for Aggressive Behavior" and "Anger in the Blood: What Your Genes Say About Your Temperament". Some examples from the psycho-social emphasis condition include, "Managing Today's Behavioral Problems" and "Problems that cause aggression and violence".

**Causal Responsibility**

Participants' ratings of responsibility were assessed considerably later than in Study 1. One-way ANOVA's revealed no significant condition differences of ratings of genes as responsible, $F(2, 261) = .42$, $p = .67$, *ns*. Planned comparisons between the two manipulation conditions revealed no significant differences between the gene emphasis condition ($M = 3.75$, $SD = 1.36$) and psycho-social emphasis condition ($M = 3.66$, $SD = 1.41$) on ratings of responsibility of genes, $t(261) = .41$, $p = .68$, *ns*. However, there were significant condition differences of ratings of childhood experiences as responsible, $F(2, 260) = 3.11$, $p = .046$. Planned comparisons revealed marginally significant differences on ratings of responsibility of childhood experiences between the gene emphasis condition ($M = 4.83$, $SD = 1.22$) and psycho-social emphasis condition ($M = 5.15$, $SD = 1.13$), $t(260) = -1.80$, $p = .074$.

**Ratings of Solutions**

Next, we examined whether the emphasis condition affected participants' endorsement of biomedical and psycho-social solutions to behavioural aggression. A significant effect of condition on endorsement of biomedical solutions emerged, $F(2, 260) = 7.12$, $p = .001$. Planned comparisons reveal that participants in the genetic emphasis condition endorsed biomedical solutions significantly more ($M = 4.45$, $SD = 1.39$) than participants in the psycho-social emphasis condition ($M = 3.61$, $SD = 1.76$), $t(260) = 3.6$, $p < .001$. No significant effect emerged on the endorsement of psycho-social solutions, $F(2, 260) = .76$, $p = .47$, *ns*, and planned comparisons also revealed no significant differences.

As in Study 1, participants' ratings of the effectiveness of specific strategies were averaged to create a score for the biomedical strategies ($\alpha = .90$) and socio-behavioural strategies ($\alpha = .64$). See Appendix E for a factor analysis of the effectiveness solution items. The one-way ANOVA showed a non-significant effect of condition for ratings of the effectiveness of

biomedical solutions, $F(2, 263) = 1.79$, $p = .17$, *ns*, however planned comparisons showed a marginally significant difference between the manipulation conditions. Participants in the genetic emphasis condition rated the effectiveness of biomedical solutions higher ($M = 3.69$, $SD = 1.17$) than participants in the psycho-social emphasis condition ($M = 3.35$, $SD = 1.29$), $t(263) = 1.85$, $p = .065$. Similarly, no significant condition differences emerged in the rating of the effectiveness of psycho-social solution strategies, $F(2, 263) = 2.28$, $p = .10$, *ns,* however planned comparisons revealed that participants in the psycho-social emphasis condition ($M = 4.81$, $SD = .72$) rated psycho-social solutions as more effective than participants in the gene emphasis condition ($M = 4.58$, $SD = .84$), $t(263) = 1.98$, $p = .048$.

Participants' ratings of the ethicality of specific strategies were averaged to create a score for the biomedical strategies ($\alpha = .81$) and socio-behavioural strategies ($\alpha = .76$). See Appendix E for a factor analysis of the ethicality solution items. The results of a one-way ANOVA revealed no significant main effect of emphasis condition on the ratings of the ethicality of biomedical solutions, $F(2, 260) = 1.31$, $p = .27$, *ns,* or on the ratings of socio-behavioural solutions, $F(2, 261) = .001$, $p = .99$, *ns*. Planned comparisons between the two manipulation conditions reveal no significant differences between the gene emphasis condition ($M = 3.74$, $SD = 1.14$) and psycho-social emphasis condition ($M = 3.48$, $SD = 1.11$) on ratings of the ethicality of biomedical solutions, $t(260) = 1.60$, $p = .11$, *ns,* and also no significant differences between the gene emphasis condition ($M = 5.36$, $SD = .91$) and psycho-social emphasis condition ($M = 5.36$, $SD = .86$) on ratings of the ethicality of socio-behavioural solutions, $t(261) = .-.03$, $p = .98$, *ns*.

The ratings of the severity of specific strategies were also averaged to create a score for the biomedical strategies ($\alpha = .75$) and socio-behavioural strategies ($\alpha = .74$). See Appendix E for a factor analysis of the severity solution items. Analyses revealed a non-significant effect of

condition on ratings of severity of biomedical solutions, $F(2, 257) = 2.04$, $p = .13$, *ns*. Follow-up planned comparisons however, revealed significant differences between the manipulation conditions. Participants in the gene emphasis condition ($M = 4.61$, $SD = 1.10$) rated biomedical solutions overall as significantly less severe than participants in the psycho-social emphasis condition ($M = 4.90$, $SD = .89$), $t(257) = -2.01$, $p = .046$. The one-way ANOVA of condition on ratings of severity of socio-behavioural solutions revealed no significant condition differences, $F(2, 257) = 1.17$, $p = .31$, *ns*. Planned comparisons confirmed no significant differences between the gene emphasis condition ($M = 2.96$, $SD = .99$) and psycho-social emphasis condition ($M = 3.13$, $SD = .94$) on ratings of the severity of socio-behavioural solutions, $t(257) = -1.16$, $p = .25$, *ns.*

In general the manipulation had the hypothesized effects on ratings of effectiveness, with fewer effects emerging on the ratings of ethicality and severity. As seen in Table 3, there were strong correlations between the three ratings. For biomedical solutions, effectiveness and ethicality were strongly correlated, $r = .68$; as were effectiveness and severity, $r = -.56$ and ethicality and severity, $r = -.69$. For socio-behavioural solutions, the ratings were moderately related to strongly; effectiveness and ethicality, $r = .41$; as were effectiveness and severity, $r = -.24$ and ethicality and severity, $r = -.56$. Notably the effects of the manipulation on effectiveness ratings (planned comparisons) remained significant, or marginally significant, even when the other ratings were included as covariates.

**Endorsement of Research funding**

Next, we summed participants' allocated percentages for socio-behavioural and for biomedical research programmes respectively. Unlike Study 1, in Study 2 percentage of funding allocated to each type of research programme could thus range between 0 – 100%. One-way

ANOVA's revealed no significant condition differences between funding percentages allocated to biomedical research programmes, $F(2, 261) = .27$, $p = .77$, *ns*, or socio-behavioural research programmes, $F(2, 261) = .21$, $p = .81$, *ns*. Planned comparisons between the two manipulation conditions also revealed no significant differences.

**Ratings of Requirements**

To assess participants' endorsement of required solution approaches to behavioural aggression, five separate one-way ANOVA's on participants' endorsement of mandatory screening, prevention, treatment in general and biomedical and social-behavioural treatments separately were conducted. Unlike the required items in Study 1, aside from the question about screening for the predisposition, all other items specifically mandate the existence of the predisposition before mandatory preventions or treatments are endorsed. One-way ANOVA's for all five measures were non-significant, all *p's* > .05, and follow up planned comparisons further revealed no significant differences between manipulation conditions, all *p's* > .05.

**Resolution and Personal responsibility**

Next, we examined condition differences in beliefs of the resolution of behavioural aggression and beliefs about personal responsibility. There was no significant effect of emphasis on beliefs of elimination of the predisposition to behavioural aggression, $F(2, 257) = 1.98$, $p = .14$, *ns,* and planned comparisons revealed no differences between the gene emphasis condition ($M = 8.16$, $SD = 4.76$) and psycho-social emphasis condition ($M = 7.60$, $SD = 4.84$), $t(257) = .79$, $p = .43$. There was also no significant effect of emphasis on beliefs of preventability of behavioural aggression, $F(2, 259) = 2.17$, $p = .12$, *ns*. However, follow up comparisons revealed that participants in the gene emphasis condition ($M = 4.09$, $SD = 1.11$) were marginally less likely to believe that aggressive behaviour can be prevented than participants in the psycho-

social emphasis condition ($M$ = 4.42, $SD$ = 1.21), $t(259) = -1.93$, $p = .057$. Further, there was no significant effect of emphasis on beliefs of personal responsibility, $F(2, 257) = .27$, $p = .76$, *ns*, and planned comparisons revealed no significant differences between conditions, $t(257) = -.71$, $p = .48$, *ns*.

**Perceived Knowledge**

As in Study 1, participants' perceived knowledge was examined. There was a significant effect of emphasis on perceived knowledge of genetic influences on behaviour, $F(2, 260) = 5.71$, $p = .004$. Planned contrasts revealed that being in the gene emphasis condition ($M$ = 3.10, $SD$ = 1.58) significantly decreased perceived knowledge of genetic influences compared to being in the psycho-social emphasis condition ($M$ = 3.61, $SD$ = 1.56), $t(260) = -2.26$, $p = .025$. Further, there was also a significant effect of emphasis on perceived knowledge of environmental influences on behaviour, $F(2, 260) = 5.20$, $p = .006$. Planned contrasts revealed that being in the gene emphasis condition ($M$ = 3.80, $SD$ = 1.56) also significantly decreased perceived knowledge of environmental influences compared to being in the psycho-social emphasis condition ($M$ = 4.33, $SD$ = 1.53), $t(260) = -2.26$, $p = .025$. However, there was no significant effect of emphasis on perceived knowledge of epigenetic influences on behaviour, $F(2, 260) = 1.94$, $p = .15$, *ns*, or actual knowledge of epigenetic influences, $F(2, 260) = 1.30$, $p = .27$, *ns*. However, planned contrasts revealed that again, participants in the gene emphasis condition ($M$ = 2.47, $SD$ = 1.59) perceive themselves to be marginally less knowledgeable about epigenetic influences than participants in the psycho-social emphasis condition ($M$ = 2.94, $SD$ = 1.75), $t(259) = -1.92$, $p = .056$. However, there were no differences between the gene emphasis condition ($M$ = .60, $SD$ = .49) and psycho-social emphasis condition ($M$ = .54, $SD$ = .50) on actual knowledge of epigenetics, $t(260) = .79$, $p = .43$. Thus, being in the gene emphasis

condition overall decreased perceived knowledge in genetic, epigenetic and environmental influences on behaviour but there were no actual differences in knowledge of epigenetics.

We also tested for significant mediations of the main dependent variables but no significant mediations emerged, as condition differences for important potential mediators were largely not significant. In particular, unlike Study 1, there was no evidence that perceptions of causal responsibility mediated the effects of the emphasis condition on ratings of biomedical solutions or research.

*Table 4. ANOVA Table for Analyses of Condition Differences (Study 2)*

| Dependent Variables | | Gene | Psycho-Social | Control | *F* | *p* | p (for comparison) | n2 |
|---|---|---|---|---|---|---|---|---|
| Gene Responsibility | *N* | 92 | 89 | 82 | .417 | .659 | .68 | 0.0032 |
| | *M* | 3.75 | 3.66 | 3.54 | | | | |
| | *SE* | .14 | .15 | .16 | | | | |
| | *CI* | [3.47, 4.03] | [3.37, 3.96] | [3.23, 3.88] | | | | |
| Childhood Responsibility | *N* | 92 | 89 | 82 | 3.111 | .046 | .074 | 0.023 |
| | *M* | 4.83 | 5.156 | 4.71 | | | | |
| | *SE* | .13 | .12 | .14 | | | | |
| | *CI* | [4.57, 5.08] | [4.91, 5.38] | [4.43, 4.98] | | | | |
| Biomedical Solutions | *N* | 92 | 88 | 83 | 7.116 | .001 | < .001 | 0.05 |
| | *M* | 4.45 | 3.61 | 3.81 | | | | |
| | *SE* | .14 | .19 | .16 | | | | |
| | *CI* | [4.16, 4.73] | [3.24, 3.99] | [3.48, 4.13] | | | | |
| Socio-behavioural Solutions | *N* | 92 | 87 | 83 | .758 | .470 | .28 | 0.01 |
| | *M* | 5.51 | 5.67 | 5.67 | | | | |
| | *SE* | .11 | .12 | .11 | | | | |
| | *CI* | [5.30, 5.72] | [5.44, 5.92] | [5.45, 5.90] | | | | |
| Bio S (mean) effective | *N* | 92 | 89 | 83 | 1.785 | .170 | .065 | 0.014 |
| | *M* | 3.69 | 3.35 | 3.46 | | | | |
| | *SE* | .12 | .14 | .13 | | | | |
| | *CI* | [3.44, 3.93] | [3.08, 3.62] | [3.21, 3.72] | | | | |
| S-b S (mean) effective | *N* | 92 | 89 | 83 | 2.279 | .104 | .048 | 0.017 |
| | *M* | 4.58 | 4.81 | 4.77 | | | | |
| | *SE* | .09 | .08 | .08 | | | | |
| | *CI* | [4.41, 4.76] | [4.66, 4.96] | [4.62, 4.93] | | | | |
| Bio S (mean) ethical | *N* | 91 | 89 | 83 | 1.306 | .273 | .11 | 0.0099 |
| | *M* | 3.74 | 3.48 | 3.58 | | | | |
| | *SE* | .12 | .12 | .11 | | | | |
| | *CI* | [3.51, 3.98] | [3.25, 3.72] | [3.36, 3.80] | | | | |
| S-b S (mean) ethical | *N* | 91 | 89 | 83 | .001 | .999 | .98 | 0.000005 |
| | *M* | 5.35 | 5.36 | 5.36 | | | | |
| | *SE* | .10 | .09 | .10 | | | | |
| | *CI* | [5.17, 5.55] | [5.18, 5.54] | [5.17, 5.55] | | | | |
| Bio S (mean) severe | *N* | 90 | 87 | 83 | 2.044 | .132 | .046 | 0.016 |
| | *M* | 4.61 | 4.9 | 4.79 | | | | |
| | *SE* | .12 | .10 | .10 | | | | |
| | *CI* | [4.38, 4.84] | [4.71, 5.09] | [4.58, 4.99] | | | | 0.0090 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| S-b S (mean) severe | *N* | 90 | 87 | 83 | 1.169 | .312 | .25 | |
| | *M* | 2.96 | 3.13 | 2.92 | | | | |
| | *SE* | .10 | .10 | .10 | | | | |
| | *CI* | [2.76, 3.17] | [2.93, 3.33] | [2.72, 3.12] | | | | |
| Bio Funding | *N* | 92 | 89 | 83 | .267 | .766 | .50 | 0.0020 |
| | *M* | 7.43 | 7.08 | 7.39 | | | | |
| | *SE* | 0.40 | 0.37 | 0.34 | | | | |
| | *CI* | [6.64, 8.22] | [6.33, 7.82] | [6.71, 8.07] | | | | |
| S-b Funding | *N* | 92 | 89 | 83 | .207 | .813 | .52 | 0.0016 |
| | *M* | 11.29 | 11.68 | 11.45 | | | | |
| | *SE* | 0.42 | 0.45 | 0.44 | | | | |
| | *CI* | [10.45, 12.13] | [10.78, 12.58] | [10.58, | | | | |
| Personal Resp | *N* | 90 | 89 | 81 | .271 | .763 | .48 | 0.0021 |
| | *M* | 5.1 | 5.24 | 5.14 | | | | |
| | *SE* | 0.14 | 0.12 | 0.15 | | | | |
| | *CI* | [4.82, 5.38] | [4.99, 5.48] | [4.84, 5.43] | | | | |
| Eliminate | *N* | 92 | 88 | 80 | 1.984 | .140 | .43 | 0.02 |
| | *M* | 2.99 | 3.36 | 3.28 | | | | |
| | *SE* | 0.50 | 0.52 | 0.53 | | | | |
| | *CI* | [7.18, 9.15] | [6.58, 8.63] | [5.66, 7.77] | | | | |
| Prevent | *N* | 92 | 88 | 80 | 2.168 | .117 | .057 | 0.02 |
| | *M* | 4.09 | 4.42 | 4.38 | | | | |
| | *SE* | 0.12 | 0.13 | 0.13 | | | | |
| | *CI* | [3.86, 4.32] | [4.16, 4.68] | [4.12, 4.64] | | | | |
| Knowl Gene | *N* | 92.00 | 89.00 | 82.00 | 5.712 | .004 | .025 | 0.04 |
| | *M* | 3.10 | 3.61 | 2.84 | | | | |
| | *SE* | 0.17 | 0.17 | 0.15 | | | | |
| | *CI* | [2.77, 3.43] | [3.28, 3.94] | [2.54, 3.14] | | | | |
| Knowl P-s | *N* | 92.00 | 89.00 | 82.00 | 5.204 | .006 | .025 | 0.04 |
| | *M* | 3.80 | 4.33 | 3.59 | | | | |
| | *SE* | 0.16 | 0.16 | 0.17 | | | | |
| | *CI* | [3.48, 4.13] | [4.00, 4.65] | [3.24, 3.93] | | | | |

## Discussion

Overall, although there were notable differences between the first and second study on secondary dependent variables, the pattern of results for the main variables of interest replicated. Notably, participants in the gene condition were again more likely to highlight their emphasized cause in the headline than participants in the psycho-social emphasis condition. Further, emphasis condition significantly affected preference for biomedicine. Participants in the gene condition preferred biomedicine more than participants in the psycho-social emphasis condition. Even further, in this study, participants in the psycho-social emphasis article also endorsed socio-behavioural interventions more than participants in the gene condition. These results might indicate that indeed there is a strong need for symmetry between the cause of a condition and potential solution statements. In this study, particular attention was paid to equalize solution statements across conditions in terms of severity. The inclusion of more severe psycho-social solution statements revealed that, in comparison to the previous study, participants in the gene condition were less likely to simply endorse all psycho-social solutions strongly, as not all were unobtrusive.

Another important finding of this study was that the ratings of the ethicality of solution statements did not differ across the two manipulation conditions. Participants did not simply endorse solutions they considered more or less ethical, rather, as expected, solutions items were endorsed on the bases of perceived effectiveness, as predicted. However, ratings of severity did differ across manipulation conditions. Also, additional within-subject comparisons reveal that, overall, biomedical solutions were rated as more severe than behavioral solutions ($t(259) = 22.72$, $p < .001$ by paired t-test) indicating that

I was unable to equalize the level of severity of biomedical and socio-behavioural solution statements between conditions. It might be that biomedical solutions overall are simply more severe than most socio-behavioural solutions. This is an important factor to consider for policy makers and scientists deciding on the best course of treatment for any condition. For example, most therapies are less intrusive and also show fewer side effects than psychopharmaca. However, it is problematic then that the exposure to genes as a contributor to a condition makes biomedical solutions appear less severe (compared to psycho-social etiological accounts), as the significant condition difference highlights. The finding suggests that if a person believes that biomedical solutions are effective and necessary (they are endorsed) then that person might also think that these solutions are less severe, even if they might not be.

A surprising finding was that unlike in Study 1 the effect of the emphasis condition on the endorsement and perceived effectiveness of biomedical solutions, did not generalize to ratings of research funding. One possible explanation for this finding is that the way participants had to rate research programs was more complex and less easy to follow than in the previous study. Participants were asked to conduct arithmetic in an online survey study to add a research budget up to 100%, which might have taken up cognitive resources otherwise expended to carefully consider the response options. Thus a different question format might be more suitable to get directly at participants' beliefs in the importance of biomedical research. This will be explored in Study 3.

I also aimed to more fully explore participants' beliefs in mandatory screening, prevention or treatments. However, no condition differences emerged on these ratings. Moreover, it is possible that the inclusion of these extreme items deterred participants

from further endorsing genes as a causal factor in behavioural aggression. Socially desirable responding might have deterred participants from endorsing these extreme items. American participants might be particularly attuned to notions of freedom and thus even if imposing 'mandatory' measures might be secretly endorsed, these thoughts would not be openly reported. I believe that the inclusion of these extreme items may have also influenced participants on the following measures of causal responsibility and personal responsibility. Unlike in Study 1, there were no condition differences in the ratings of genes and environmental factors as responsible for aggression. In this study, causal responsibility was assessed after inquiring about mandatory prevention, screening and treatment of aggression. All mandatory items specifically referred to the presence of the predisposition. It is possible that participants might have been discouraged from endorsing one or the other factor as responsible for aggression as the presence of the predisposition might have justified mandatory measures. I believe socially desirable responding and the extreme items that preceded questions about responsibility might have contributed to the non-significant findings. Further, the manipulation effect might have also decreased due to the ordering effect. Condition differences in participants' self-generated headlines, which were assessed earlier in the questionnaire and before the mandatory items, replicated, however, in this study these differences did not extend to participants' causal responsibility beliefs. Thus, these items will be explored further in Study 3 and reinstated at the beginning of the questionnaire. Equally, personal responsibility was assessed after inquiring about mandatory measures. This item will equally be explored at an earlier point in the questionnaire in Study 3.

Lastly, as expected, although there were no condition differences in perceived

ability to eliminate aggression, condition differences did emerge in participants' perceptions of preventability. Here the study replicated other findings suggesting that when genes are implicated in the etiology of a condition, the emergence of this condition seems more certain (Senior, Marteau, & Weinman, 2000). Also we can again conclude that condition differences did not emerge due to actual or perceived differences in participants' perceived knowledge about genetic or environmental factors of aggression. As in Study 1, participants reading the gene article perceived themselves to have less knowledge of genetic, environmental and epigenetic influences on behaviour. Perceived knowledge, however, did not mediate the relationship between condition and preference of biomedicine. These findings however, raise the question of whether there are differences among conditions in the ease of explaining the causes of aggression, and whether these differences can account for some of the differences seen across conditions (e.g., the greater likelihood of mentioning genes in the headlines). Important to highlight is that differences in perceived knowledge debunk a common perception of the genetic bias which is that genetic information is easily digestible as it offers a simple solution to the cause of a condition (Cheung et al., 2014). Yet the results of this study suggests that genetic information might in fact increases doubt about one's knowledge of influences on behaviour overall. Thus, it does not seem likely that participants in the gene condition prefer biomedicine more (i.e., endorse biomedical solutions, rate biomedical solutions as more effective and endorse biomedical research) simply because they believe they understand genetic causes; rather it seems that biomedicine is preferred more by participants in the gene condition, despite a lack of sufficient actual or perceived knowledge.

## Study 3

After replicating the results of Study 1 with a second study, the main purpose of the third study was to examine potential moderators and mediators of the effect of emphasis condition on participants' perceptions and attitudes towards solution strategies for aggression. Because no prior hypotheses exist for the control group, and results from Study 2 regarding the control group were inconclusive, the third study included only the two manipulation conditions. In an attempt to strengthen the manipulation, the articles were rewritten to resemble actual news articles more. Specifically, examples of aggressive behaviour were included, as were direct quotes by a fictitious research team. In addition, the primary dependent variables, ratings of solutions and research funding were simplified to make the two types of solution ratings more similar to each other. The purpose of these refined measures is to highlight and strengthen the finding that even learning of weak genetic etiology of a condition leads to increased endorsement of biomedical solutions and also increases perceived effectiveness of these solutions. Severe items for both solution types were omitted to equalize solutions in terms of severity ratings. Biomedical solutions items were restricted to pharmaceutical and surgical interventions, and psycho-social solution items were restricted to therapeutic and educational interventions. Significant condition differences emerged on these items in the previous two studies, which make them good candidates to test our hypotheses, compared to more extreme items such as lobotomy or forced removal of children from homes. The research-funding item of Study 1 was re-used due to the difficulties of the item format in Study 2 and a single item measure was added. In addition potential mediators and

moderators were added and measures from previous studies refined, such as perceptions of control, response efficacy of solutions, and perceived causes.

## Method

### Participants

American adults were recruited via the Mechanical Turk website and received $0.40 US as an incentive. Two hundred and thirty-eight adults participated, and one participant was removed from the final sample due to failing the attention check, resulting in a final sample of two hundred and thirty-seven adults (*M* age = 37.14, *SD* age = 12.94; 109 male, 126 female, 2 other identified).

### Procedure

After self-selecting and consenting to take part in the study, participants were directed to an online questionnaire that contained all instructions and measures (see Appendix C). Participants were randomly assigned to one of two emphasis conditions. The emphasis of either genetic or psycho-social causes of aggression was identical to study one and two. As in the first two studies, participants were told that either that 30% of individuals with a gene-variant are behaviourally aggressive or that 30% of people with certain childhood experiences are behaviourally aggressive. However, the wording of the article was slightly revised to make it resemble an actual news article more closely. All participants first read the following paragraph about examples of aggressive behaviour and the study set-up:

> When a car cuts in traffic, what makes some drivers shrug their shoulders and others fume with road rage, bashing the horn or worse? Scientists believe they may now know why some people are quicker to anger than others.
>
> At Columbia University researchers compared 110 individuals who displayed behavioural aggression to 115 individuals who do not. Study participants with the ‘anger condition’ engaged in a range of different aggressive

behaviours that lead them to be kicked out of school or cause car accidents due to road rage.

All participants then read a paragraph highlighting the multi-faceted nature of behavioural aggression. This paragraph is integral to the study design because participants were told of multiple causes for behavioural aggression whereas the manipulation only emphasizes one possible cause.

> Dr. Timothy Bickman, who led the study, explains: 'Although behavioural aggression is recorded in terms of single cases, aggressive behaviour is the complex combination of a multitude of different biological processes, from heredity to brain systems that regulate mood. Making matters even more confusing, these factors are also influenced by environmental contributors such as childhood experiences and lifestyle. We wanted to understand aggression better'.
>
> The Columbia team examined the impact of both genetics and environment on behavioural aggression. Results of the study were published yesterday in the *Journal of Clinical Investigation (JCI),* describing new factors that could explain aggressive behaviour in some people.

Participants randomly assigned to the gene-emphasis condition then read the following paragraph:

> Dr. Bickman's study is one of the few existing ***genome*** wide association studies, which compare ***genetic make-ups*** of individuals who behave violently to those individuals who don't, making it easier to flesh out important ***genetic*** factors contributing to ***behavioural aggression***. The team made an important discovery. "People who ***carry the monoamine oxidase A gene (MAOA)*** exhibit higher levels of behavioral aggression in response to provocation, suggesting some people have a **predisposition** to acting violently", said Dr. Bickman.
> "In many, many studies this predisposition appears implicated in behaviors that look like they're related to aggression or some kind of conduct disorder," Rose McDermott, a scientist at Brown and Harvard universities, told CNN news.
> ***The MAOA gene*** is thought to trigger extreme anger and affect a person's ability to resist impulses. ***These gene variants*** are thought to trigger extreme anger and affect a person's ability to resist impulses. Specifically, when these people feel very provoked or socially isolated their aggression will come out.
> Dr. Bickman and his team have shown that 30% of people who have ***the gene variant*** are behaviourally aggressive.

Participants randomly assigned to the psycho-social emphasis condition read the following paragraph:

> Dr. Bickman's study is one of the few existing ***population*** wide association studies, which compare ***childhood experiences*** of individuals who behave violently to those individuals who don't, making it easier to flesh out important **environmental** factors contributing to ***behavioural aggression***. The team made an important discovery.
> "People who have ***been*** *abused as a child****, witnessed abuse, or where parents often used unnecessary physical force*** exhibit higher levels of behavioral aggression in response to provocation, suggesting some people with certain experiences are **predisposed** to acting violently", said Dr. Bickman.
> "In many, many studies this predisposition appears implicated in behaviors that look like they're related to aggression or some kind of conduct disorder," Rose McDermott, a scientist at Brown and Harvard universities, told CNN news.
> ***These childhood experiences*** are thought to trigger extreme anger and affect a person's ability to resist impulses. Specifically, when these people feel very provoked or socially isolated their aggression will come out.
> Dr. Bickman and his team have shown that 30% of people who have these ***childhood experiences*** are behaviourally aggressive.

Both paragraphs were nearly identical with only information regarding the cause of aggression identified by the new study differing.

**Dependent Measures**

After reading the article, participants completed the following dependent measures, in the order described below. A full list of the items is in Appendix C. Items identical to Study 1 or 2 are light grey, whereas items that were changed are in black.

**Headline.** As in Study 1 and 2, participants were asked to generate a title or headline for the article they read.

**Novelty.** Participants rated how surprising the finding of the reported research study was, on a scale of 1 (not at all surprising) to 7 (very surprising).

**Ease of comprehension.** Comprehension was assessed by ratings of how easy it was to understand the article and how easy it would be to explain the causes of

aggression to someone else. Both items were assessed on a scale from 1 (extremely difficult) to 7 (extremely easy).

**Controllability.** Two items, assessing the extent to which people are able to control their behavioural aggression (1= *not at all*, 7= *completely*), were used to measure perceived controllability of aggressive behaviour.

**Personal responsibility.** Participants rated the extent to which they believe that each individual who displays aggressive behaviour is personally responsible for changing this behaviour (1= *not at all*, 7= *completely*).

**Causal Responsibility**. Unlike in Study 1 and 2, participants rated the extent to which they believed that 'genes' and 'childhood experiences' are the cause of aggressive behaviour (instead of 'responsible for') (1= *not at all*, 7= *completely*). Participants also indicated on a slider bar, the relative degree to which they believed each factor causes aggression.

**Endorsement of solutions.** Replicating study 1 and 2, the primary dependent variable was participants' endorsement of biomedical and psycho-social solutions. Based on the results of study 1 and 2, four solutions representing both biomedical (2 items) and psychosocial solutions (2 items) were presented, and participants were asked to rate the extent to which they agreed that each strategy was an effective solution to behavioral aggression (1= not at effective, 7= very effective). Biomedical strategies were *drugs or medication* and *surgery*. Psycho-social strategies were *training sessions* and *counselling or therapy*.

Participants then completed rating scales that assessed their endorsement of the two general types of solutions. Specifically, participants rated the extent to which

physical or bio-medical adjustments (e.g. medication, surgery) and psychological or psycho-social adjustments (e.g. therapy, education) would be good solutions to aggression (1= *not at all,* 7= *a large extent).*

**Endorsement of research funding**. Next, participants rated what percentage of a research budget studying behavioural aggression should be spend on researching psychological or psycho-social interventions, or physical or biomedical interventions, using a slider. Participants also rated the importance of funding research developing physical or biomedical, or psychological or psycho-social treatments for aggression (1= *not at all important*, 5= *extremely important*).

**Response efficacy of research.** Two items were used to assess participants' beliefs in the efficacy of biomedical and psycho-social research. Participants rated their agreement from 1 (strongly agree) to 7 (strongly disagree) on items suc,h as "learning more about genetic influences of aggression can help with the treatment of aggression".

**Predisposition.** Participants then rated how likely it is that a person who is behaviourally aggressive has the predisposition they read about (1= *extremely unlikely*, 7 = *extremely likely*). Participants also rated how likely a person with the predisposition they read about is to be behaviourally aggressive (1 = *extremely unlikely*, 7 = *extremely likely*).

**Agreement with article**. Participants also indicated how many examples they can think of from their own experiences that are consistent with, and how many examples they can think of that are inconsistent with, the causes of behavioural aggression described in the article (1= *no examples at all,* 7= *many examples).* Next, participants

also rated their agreement from 1= *strongly disagree* to 7= *strongly agree* with the main points of the article.

**Uniformity of cause and solution.** Two items assessed whether participants believed that understanding the causes of aggression is important for treatment of aggression. Level of agreement with items such as "one can treat someone with behavioural aggression even if the cause of his or her aggression is unknown (reverse coded)" was measured from 1 (strongly agree) to 7 (strongly disagree).

**Intuitive thinking.** The cognitive reflection test 2 (CTR-2) (Thomson & Oppenheimer, 2016) was used to assess intuitive thinking. Participants have to respond to four items for which there is an intuitive but incorrect answer, and a less intuitive but correct answer. Further Epstein's (1996) measure of thinking styles was shortened and five items assessing intuitive thinking and five items assessing rational thinking were included.

**Need for cognitive closure.** Roets and Van Hiel's (2011) short version of the need for cognitive closure measure was included to assess need for cognitive closure.

**Memory of media messages.** An open-ended item was included to learn more about participants' prior exposure to media messages linking genetic causes to biomedical solutions.

**Aggression**. Level of aggression was assessed using participants agreement with three face valid items such as '*getting back at others makes me feel better'* immersed in filler items (1= *strongly disagree* , 7= *strongly agree).*

**Demographics and Perceived Knowledge.** The final section of the questionnaire asked participants to indicate their gender, age, ethnicity, educational level, political

orientation, religiosity and their perceived knowledge of genetics and environmental influences on behaviour. Additionally an item assessing participants' actual knowledge of epigenetics was included.

**Attention and manipulation checks.** As a manipulation check, two items assessed whether participants can correctly identify the cause of aggression emphasized in the article. We again included more generic attention check items, such as "To respond to this question, please choose option 4". These items were randomly inserted throughout the questionnaire.

## Results

Again, initially zero-order correlations were calculated between the main dependent variables for the complete sample; the main correlation coefficients are reported in Table 5. A Chi-Square test of independence was conducted to assess condition differences for frequency-coded headline analyses and the manipulation check. The main analyses, testing for the effect of emphasis condition, were conducted using an independent samples t-test. Estimated means are reported; in addition, standard errors, confidence intervals, and effect sizes (Cohen's d) for the analyses can be found in Table 6. Results are reported in the same order that they were reported in Study 1 and 2, and not in the order in which they were presented in the questionnaire. Please refer to the methods section of Appendix C for the order of presentation.

***Table 5.*** *Zero-order correlations among dependent variables (Study 3)*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 1.00 | | | | | | | | | | | | | | | | | | | | | | |
| 2. | -.213** | 1.00 | | | | | | | | | | | | | | | | | | | | | |
| 3. | .690** | -.195** | 1.00 | | | | | | | | | | | | | | | | | | | | |
| 4. | -.129* | .529** | -0.05 | 1.00 | | | | | | | | | | | | | | | | | | | |
| 5. | .646** | -.332** | .518** | -.188** | 1.00 | | | | | | | | | | | | | | | | | | |
| 6. | -.373** | .607** | -.354** | .527** | -.415** | 1.00 | | | | | | | | | | | | | | | | | |
| 7. | .571** | -.483** | .516** | -.384** | .660** | -.669** | 1.00 | | | | | | | | | | | | | | | | |
| 8. | .246** | -.129* | .204** | -0.04 | .253** | -.134* | .179** | 1.00 | | | | | | | | | | | | | | | |
| 9. | -.211** | .334** | -.163* | .338** | -.222** | .359** | -.290** | -0.12 | 1.00 | | | | | | | | | | | | | | |
| 10 | .363** | -.319** | .321** | -.198** | .323** | -.322** | .442** | .553** | -.541** | 1.00 | | | | | | | | | | | | | |
| 11 | -.166* | .247** | -.190** | .322** | -.162* | .194** | -.219** | -.134* | 0.08 | -.170** | 1.00 | | | | | | | | | | | | |
| 12 | -0.06 | 0.00 | -0.05 | 0.07 | -0.07 | -0.06 | -0.06 | -.153* | -0.09 | -0.12 | .439** | 1.00 | | | | | | | | | | | |
| 13 | 0.11 | 0.03 | .140* | 0.10 | 0.11 | 0.07 | 0.10 | .129* | .136* | 0.13 | -0.04 | -.236** | 1.00 | | | | | | | | | | |
| 14 | .159* | -0.09 | .128* | -0.01 | 0.09 | -.136* | .163* | .227** | -0.12 | .210** | -0.04 | 0.12 | -0.09 | 1.00 | | | | | | | | | |
| 15 | -0.12 | .220** | -0.11 | .199** | -0.05 | .176** | -.144* | 0.02 | .224** | -.151* | .270** | 0.08 | 0.01 | -.128* | 1.00 | | | | | | | | |
| 16 | -0.02 | 0.12 | -0.03 | .182** | 0.01 | .141* | -0.05 | 0.11 | .305** | -0.07 | 0.09 | -0.05 | .206** | -0.07 | .477** | 1.00 | | | | | | | |
| 17 | -0.07 | 0.06 | 0.03 | 0.12 | -0.03 | 0.05 | -0.01 | 0.00 | .222** | -0.03 | 0.05 | -0.07 | .382** | -0.11 | 0.12 | .301** | 1.00 | | | | | | |
| 18 | -.128* | -0.07 | -0.11 | -0.03 | -0.08 | 0.00 | -0.04 | 0.06 | -.157* | 0.12 | 0.01 | .139* | -.176** | .183** | -.234** | -.187** | -0.05 | 1.00 | | | | | |
| 19 | 0.09 | 0.10 | 0.13 | .165* | 0.10 | .130* | 0.05 | 0.04 | .173** | 0.02 | -0.06 | -.173** | .407** | -.252** | .214** | .400** | .490** | -.397** | 1.00 | | | | |
| 20 | 0.07 | 0.10 | 0.07 | -0.12 | 0.02 | -0.03 | 0.02 | -0.03 | -.193** | 0.02 | -0.01 | 0.03 | -.140* | -0.09 | 0.09 | -0.02 | -.180** | -0.09 | -0.08 | 1.00 | | | |
| 21 | 0.10 | 0.07 | .170** | 0.05 | 0.10 | 0.01 | 0.05 | 0.07 | 0.09 | 0.02 | -0.06 | -0.12 | .216** | 0.01 | -0.02 | -0.02 | 0.04 | -0.12 | .168** | 0.00 | 1.00 | | |
| 22 | -.132* | .240** | -.147* | .275** | -.147* | .235** | -.177** | -0.09 | 0.12 | -.141* | .280** | .259** | -0.12 | -0.03 | .351** | .332** | 0.02 | 0.01 | 0.03 | 0.07 | -.340** | 1.00 | |
| 23 | 0.01 | 0.05 | 0.02 | .170** | 0.02 | .135* | -0.06 | 0.04 | 0.08 | 0.00 | 0.11 | 0.00 | 0.05 | 0.05 | 0.09 | .162* | 0.08 | -0.09 | .141* | -.169** | 0.01 | .164* | 1.00 |
| *N* | 238 | 238 | 238 | 238 | 237 | 238 | 235 | 237 | 238 | 232 | 238 | 238 | 238 | 238 | 237 | 238 | 237 | 236 | 237 | 238 | 238 | 238 | 238 |
| M | 3.25 | 5.48 | 3.61 | 5.44 | 3.42 | 5.40 | 30.82 | 4.11 | 5.16 | 40.07 | 5.52 | 4.41 | 4.84 | 3.28 | 6.07 | 5.51 | 4.32 | 3.22 | 5.05 | 2.16 | 3.78 | 3.80 | 3.37 |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Sd* | 1.56 | 1.23 | 1.37 | 1.00 | 1.50 | 1.29 | 22.63 | 1.44 | 1.23 | 22.13 | 1.27 | 1.14 | 1.27 | 1.80 | 1.14 | 1.23 | 1.66 | 1.51 | 1.33 | 1.24 | 0.84 | 0.79 | 0.72 |

*Note*. 1= Biomedical Solutions (1-item), 2= Socio-Behavioural Solutions (1-item), 3 = Biomedical Solutions (mean), 4 = Socio-Behavioural Solutions (mean), 5 = Biomedical Funding, 6 = Socio-behavioural Funding, 7 = Funding (Slider), 8 = Gene Responsible 9 = Childhood experiences Responsible, 10 = Cause (slider), 11 = Personal responsibility, 12= Control, 13 = Predisposition, 14 = Surprising, 15 = Ease of understanding, 16 = Ease of explaining, 17 = Consistency, 18 = Inconsistency, 19 = Agreement, 20 = Intuition (CRT), 21 = Need for Cognition, 22 = Rationality, 23 = Intuition
*$p$ <.05; **$p$ < .01

**Manipulation Check**

As expected, the newspaper manipulation significantly affected participants' ratings of which findings were most emphasized in the article, $t(211.72) = 15.83$, $p < .001$ (accounting for unequal variances). As anticipated, participants in the gene emphasis condition believed that genes were emphasized more in the article ($M = 5.71$, $SD = 1.25$) than participants in the psycho-social emphasis condition ($M = 2.56$, $SD = 1.76$). Unlike Study 2, the mean score of participants in the psycho-social emphasis condition is well below the scale midpoint of 4, suggesting a more successful manipulation in Study 3. To assess whether participants correctly identified the cause of aggression emphasized by the new studies mentioned in the article, a Chi-square test of independence was performed. The two conditions were significantly different in indicating that genetic or environmental factors can be a predisposition to aggression but did not differ in selecting 'none of the above', $X^2$ (2, 238) = 129.09, $p < .001$. Further, 89.9% of participants in the gene condition correctly identified 'genes' as having been emphasized by the new studies mentioned in the article, while only 18.5% of participants in the psycho-social emphasis condition endorsed this option (*p of difference* < .05). Similarly, 80.7% of participants in the psycho-social emphasis condition correctly identified environmental factors as having been emphasized in the new studies mentioned in the article, compared to 8.6% of participants in the gene condition choosing this option (*p of difference* < .05). Further, participants in the gene emphasis condition (89.9%) were significantly more likely to give the correct response than participants in the psycho-social emphasis condition (80.7%), (*p of difference* < .05) which might be due to the direct one-to-one matching of cause mentioned in the article and the question in the gene emphasis condition (gene-

gene) and matching by theme only in the psycho-social emphasis condition (childhood experiences – environment).

**Headline**

Coding procedures were held consistent to Study 1 and 2. A Chi-square test of independence indicated that consistent with the hypotheses, the emphasized cause was mentioned more often by participants in the gene condition (60.5%) than by participants in the psycho-social condition (36.1%) (*p of difference* < .05), $X^2$ (2, 238) = 14.15, p<.001 . Example headlines from the gene condition were: "Aggression Gene Found", "Quick to Anger Genetic? and "Aggressiveness can be traced to genetics". Example headlines from the psycho-social emphasis condition include: "Angry easily? You can thank your parent for that" and "What Causes You to Lose Your Cool?".

**Causal Responsibility**

First, I investigated whether condition affects perceptions of causal responsibility. Indeed, as in Study 1 but not in Study 2, condition significantly influenced perceptions of genes as causal, $t(234) = 6.33$, $p < .001$, and of environmental influences as causal, $t(216.87) = -5.61$, $p < .001$ (accounting for unequal variances). Ratings of genes as the cause of aggression were higher in the gene emphasis condition ($M = 4.66$, $SD = 1.24$) than in the psycho-social emphasis condition ($M = 3.56$, $SD = 1.42$), whereas ratings of environmental influences as the cause for aggression were higher in the psycho-social emphasis condition ($M = 5.59$, $SD = .96$) than in the gene emphasis condition ($M = 4.76$, $SD = 1.31$). Additionally the analysis of the one-item forced choice slider bar further supported the previous findings. Condition significantly influenced the relative degree to which participants believed each factor causes aggression, $t(229) = 5.31$, $p < .001$.

Participants in the gene emphasis condition ($M$ = 47.18, $SD$ = 20.80) believed genes were a more important etiological factor in aggression than participants in the psycho-social emphasis condition ($M$ = 32.59, $SD$ = 20.90). However, participants' ratings of genes as causal was still below the mid-point of 50%.

**Ratings of Solutions**

Again, participants' endorsement of biomedical and socio-behavioural solutions to behavioural aggression and ratings of effectiveness were analyzed. Replicating the results of the first two studies, participants in the gene emphasis condition ($M$ = 3.52, $SD$ = 1.59), endorsed biomedical solutions more strongly than participants in the psycho-social emphasis condition ($M$ = 2.97, $SD$ = 1.49), $t(235) = 2.77$, $p = .006$. There were also significant differences on the endorsement of socio-behavioural solutions. Participants in the psycho-social emphasis condition ($M$ = 5.67, $SD$ = 1.13) endorsed socio-behavioural solutions more than participants in the gene emphasis condition ($M$ = 5.32, $SD$ = 1.28), $t(235) = -2.23$, $p = .027$. The two-item ratings of the effectiveness of biomedical solutions and the two-item rating of the effectiveness of socio-behavioural solutions were averaged. The analyses of participants' ratings of effectiveness replicated the findings of the single-item endorsement measure. As hypothesized, participants in the gene emphasis condition ($M$ = 3.84, $SD$ = 1.39) rated biomedical solutions as more effective than participants in the psycho-social emphasis condition ($M$ = 3.38, $SD$ = 1.32), $t(235) = 2.60$, $p = .01$. There was also a marginally significant difference on ratings of effectiveness of socio-behavioural solutions. Participants in the psycho-social emphasis condition ($M$ = 5.56, $SD$ = .89) rated socio-behavioural solutions as marginally more effective than participants in the gene emphasis condition ($M$ = 5.33, $SD$ = 1.08),

$t(226.87) = -1.80$, $p = .073$ (accounting for unequal variances).

**Ratings of Research funding**

Subsequently, I assessed whether the type of research funding participants endorsed was affected by the emphasis condition. As hypothesized, participants in the gene emphasis condition ($M = 3.65$, $SD = 1.56$) endorsed biomedical research more than participants in the psycho-social emphasis condition ($M = 3.17$, $SD = 1.41$), $t(234) = 2.50$, $p = .013$. On the other hand, participants the psycho-social emphasis condition ($M = 5.73$, $SD = 1.03$) endorsed socio-behavioural research more than participants in the gene-emphasis condition ($M = 5.08$, $SD = 1.44$), $t(213.32) = -3.97$, $p < .001$ (accounting for unequal variances).

Likewise, on the one-item forced-choice slider bar, there are significant condition differences, $t(232) = 2.69$, $p = .008$. Participants in the gene emphasis condition ($M = 34.59$, $SD = 22.94$) wanted to allocate a larger percentage of a research budget on biomedical research than participants in the psycho-social emphasis condition ($M = 26.75$, $SD = 21.56$).

**Personal responsibility and Control**

Next, I examined condition differences on perceptions of personal responsibility. There was a significant effect of condition on the ratings of personal responsibility. As expected, participants in the gene condition ($M = 5.36$, $SD = 1.34$) believed that individuals with behavioural aggression are less personally responsible for changing their behaviour than participants in the psycho-social condition ($M = 5.69$, $SD = 1.18$), $t(235) = -1.99$, $p = .048$. No significant condition differences emerged for perceptions of control.

**Features of the article**

I now examined whether condition affected participants' perceptions of article features: surprise factor, ease of understanding, and ease of transmitting the information. Though condition significantly affected surprise, $t(235) = 6.49$, $p < .001$, and perceived ease of transmitting the information, $t(235) = -2.59$, $p = .01$, it did not affect ease of understanding, $t(234) = -1.62$, $p = .11$, *ns*. The study findings were rated as significantly more surprising by participants in the gene emphasis condition ($M = 3.97$, $SD = 1.74$) than by participants in the psycho-social emphasis condition ($M = 2.57$, $SD = 1.58$). Further, participants in the gene emphasis condition ($M = 5.31$, $SD = 1.36$) believed that it would be less easy to explain the causes of aggression than participants in the psycho-social emphasis condition ($M = 5.72$, $SD = 1.05$).

**Predisposition**

There were no significant differences on participants' ratings of how likely a person with the predisposition they read about is to be behaviourally aggressive, $t(235) = .009$, $p = .99$, *ns*. However, participants significantly differed across the conditions in their beliefs of how likely a person who is behaviourally aggressive is to have the predisposition they read about, $t(229.83) = -2.85$, $p = .005$ (accounting for unequal variances). Surprisingly, participants in the psycho-social condition ($M = 5.08$, $SD = 1.15$) believed that aggressive individuals were more likely to have the predisposition they read about than participants in the gene condition ($M = 4.61$, $SD = 1.35$).

**Consistency and Agreement with article**

Lastly, I tested for participants' perceptions of consistency and agreement with the article. Condition significantly affected all three variables. Participants in the psycho-

social condition ($M$ = 4.69, $SD$ = 1.68) could think of significantly more examples that were consistent with the causes of aggression presented in the article than participants in the gene emphasis condition ($M$ = 3.95, $SD$ = 1.56), $t(234) = -3.53$, $p < .001$. Equally, participants in the gene emphasis condition ($M$ = 3.53, $SD$ = 1.55) could think of more examples that were inconsistent with the causes of aggression presented in the article than participants in the psycho-social condition ($M$ = 2.89, $SD$ = 1.40), $t(233) = 3.32$, $p = .001$. Finally participants in the psycho-social condition ($M$ = 5.43, $SD$ = 1.20) were significantly more likely to agree with the points of the article than participants in the gene emphasis condition ($M$ = 4.69, $SD$ = 1.37), $t(234) = -4.40$, $p < .001$.

Additionally I tested for condition effects on beliefs of cause and treatment consistency, thinking styles and perceived and actual knowledge about genetic and environmental influences on behaviour. No significant condition differences emerged for these remaining dependent variables.

*Table 6.* Primary Dependent Variables by Emphasis Condition (Study 3)

| | Condition | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gene Emphasis | | | Psycho-social Emphasis | | | Difference | | | | | | |
| DV's | *M* | *SD* | *SE* | *M* | *SD* | *SE* | *M* | *SE* | *t* | *df* | CI | *p* | *d* |
| Gene Resp | 4.66 | 1.25 | 0.11 | 3.56 | 1.42 | 0.13 | 1.10 | 0.17 | 6.34 | 234.00 | [0.76, 1.44] | 0.000 | 0.83 |
| Env Resp | 4.76 | 1.31 | 0.12 | 5.59 | 0.96 | 0.09 | -0.84 | 0.15 | -5.61 | 216.87 | [-1.12, -0.54] | 0.000 | -0.76 |
| Cause | 47.18 | 20.80 | 1.93 | 32.59 | 20.90 | 1.95 | 14.59 | 2.74 | 5.32 | 229.00 | [9.18, 20.00] | 0.000 | 0.70 |
| Bio S | 3.52 | 1.59 | 0.15 | 2.97 | 1.49 | 0.14 | 0.55 | 0.20 | 2.77 | 235.00 | [0.16, 0.95] | 0.006 | 0.36 |
| Socio-behavioural S | 5.32 | 1.28 | 0.12 | 5.67 | 1.13 | 0.10 | -0.35 | 0.16 | -2.23 | 235.00 | [-0.66, -0.04] | 0.027 | -0.29 |
| Bio S (mean) | 3.84 | 1.39 | 0.13 | 3.38 | 1.32 | 0.12 | 0.46 | 0.18 | 2.60 | 235.00 | [0.11, 0.81] | 0.010 | 0.34 |
| S-b S (mean) | 5.33 | 1.08 | 0.10 | 5.56 | 0.89 | 0.08 | -0.23 | 0.13 | -1.80 | 226.87 | [-0.48, 0.02] | 0.073 | -0.24 |
| Bio Funding | 3.65 | 1.56 | 0.14 | 3.17 | 1.41 | 0.13 | 0.48 | 0.19 | 2.50 | 234.00 | [0.10, 0.86] | 0.013 | 0.33 |
| S-b Funding | 5.08 | 1.44 | 0.13 | 5.73 | 1.03 | 0.09 | -0.64 | 0.16 | -3.97 | 213.32 | [-0.97, -0.32] | 0.000 | -0.54 |
| Money (slider) | 34.59 | 22.94 | 2.12 | 26.75 | 21.56 | 1.99 | 7.84 | 2.91 | 2.69 | 232.00 | [2.10, 13.57] | 0.008 | 0.35 |
| Personal Resp | 5.36 | 1.34 | 0.12 | 5.69 | 1.17 | 0.11 | -0.33 | 0.16 | -1.99 | 235.00 | [-0.65, 0.003] | 0.048 | -0.26 |
| Surprise/ Novelty | 3.97 | 1.74 | 0.16 | 2.57 | 1.58 | 0.15 | 1.40 | 0.22 | 6.49 | 235.00 | [0.97, 1.82] | 0.000 | 0.85 |
| Ease to Explain | 5.31 | 1.36 | 0.12 | 5.72 | 1.05 | 0.10 | -0.41 | 0.16 | -2.60 | 222.16 | [-0.72, -0.10] | 0.010 | -0.35 |
| Predisposition | 4.61 | 1.35 | 0.12 | 5.08 | 1.15 | 0.11 | -0.46 | 0.16 | -2.85 | 229.83 | [-0.78, -0.14] | 0.005 | -0.38 |
| Consistency | 3.95 | 1.56 | 0.14 | 4.69 | 1.68 | 0.15 | -0.75 | 0.21 | -3.53 | 234.00 | [-1.16, -0.33] | 0.000 | -0.46 |
| Inconsistency | 3.53 | 1.55 | 0.14 | 2.89 | 1.40 | 0.13 | 0.64 | 0.19 | 3.32 | 233.00 | [0.26, 1.02] | 0.001 | 0.44 |
| Agreement | 4.69 | 1.37 | 0.13 | 5.43 | 1.20 | 0.11 | -0.74 | 0.17 | -4.40 | 234.00 | [-1.07, -0.41] | 0.000 | -0.58 |

*Note*. Bio = Biomedical; S = solution(s); S-b = Socio-behavioural; Resp = Responsibility; Essent. = Essentialism; Knowl = Knowledge
N (gene condition) = 199, N (psycho-social condition) = 118

**Mediation**

To elaborate on the process by which condition affects our main dependent variables I tested the following potential mediators using the PROCESS macro for SPSS (Hayes, 2013) (Model 4): perceptions of cause, features of the article, personal responsibility and control, efficacy beliefs, notions of predispositions, and cognitive thinking styles. To test the mediating role of these variables on our main dependent variables I aggregated participants' preference for all biomedical items (endorsement of solutions, rating of effectiveness of solutions and support of research funding) and of all socio-behavioural items. These aggregated scores were entered as the dependent variables into the mediation model, with emphasis condition as the independent variable. The results of these mediations are largely consistent with the results of the analyses of the separate items. Article features, beliefs of treatment efficacy and cognitive thinking styles did not mediate the relationship between condition and the outcome variables and will thus not be discussed. In the following I will discuss the results of the analyses for the remaining mediators, results for biomedical preference as the dependent variable can be found in Table 7, and results for socio-behavioural preference as the dependent variable can be found in Table 8. The indirect effect for all analyses was tested using a bootstrap estimation approach with 1,000 samples, and the 95% confidence interval was computed by determining the indirect effects at the 2.5th and 97.5th percentiles.

**Perceptions of Cause**

First, I aimed to replicate the significant mediation of causal responsibility from Study 1. In order to do so, I entered causal responsibility of genetic, environmental factors and beliefs on cause (high scores indicate belief in genes as causal) as

simultaneous mediators. Only beliefs of cause, an item that arguable captures beliefs in genes and environmental factors as causal, was a significant mediator in this model. Consistent with our hypothesis, emphasis condition had a negative relationship with perceived cause; that is those in the psycho-social emphasis condition were more likely to have a low score of perceived cause (believe that genes are less causal). Perceived cause, in turn, had a positive relationship with biomedical preference, whereby those who felt genes were more causal preferred biomedicine more. Perceived cause also had a negative relationship with socio-behavioural preference, whereby those who felt that genes were more causal were less likely to prefer socio-behavioural approaches to aggression.

**Personal responsibility and Control**

Next, I tested whether beliefs about personal responsibility or beliefs in control are a significant mediator. Personal responsibility and control were entered as simultaneous mediators to investigate whether personal responsibility would mediate the relationship between condition and rating of treatments even after control had been accounted for. Control was not a significant mediator of the relationship between condition and preference. Emphasis condition had a positive, although non-significant, relationship with perceived personal responsibility; that is those in the psycho-social condition were more likely to perceive someone aggressive to be personally responsible for changing their behaviour. Personal responsibility, in turn, was negatively related to biomedical preferences, indicating that those who feel aggressive individuals are more personally responsible prefer biomedical approaches less. On the other hand, personal responsibility was positively related to socio-behavioural approaches, whereby those high on ratings of personal responsibility prefer socio-behavioural approaches more.

**Predisposition**

Lastly, I investigated whether believing more strongly that aggressive individuals must have the predisposition participants read about would mediate the relationship between condition and rating of treatments. This item is very similar to the items on causal perception, as believing that an aggressive individual has a predisposition that made him/her aggressive would imply that the predisposition (either genes or psycho-social causes) caused the aggression. Surprisingly, but consistent with the main effect of predisposition, emphasis condition was positively related to perceptions of predisposition. That is, those in the psycho-social condition were more likely to feel that an aggressive individual has the predisposition they read about. Beliefs in predisposition, in turn, had a positive relationship with biomedical preference, whereby those who felt that aggressive individuals were more likely to have a predisposition were more likely to prefer biomedical approaches. The mediation of perceptions of predisposition on condition and psycho-social treatments was not significant.

Table 7

*Path Results and Confidence Intervals for Overall Mediation on Biomedical Preference (Study 3)*

| DV | a | | b | | c' | | Indirect Effect | | |
|---|---|---|---|---|---|---|---|---|---|
| | B | SE | B | SE | B | SE | B | SE | CI |
| Gene Resp | -1.13*** | .17 | .06 | .56 | -.13 | .18 | -.06 | .08 | [-.24, .11] |
| Env. Resp | .79*** | .15 | -.05 | .08 | -.13 | .18 | -.04 | .06 | [-.17, .08] |
| Cause[a] | -14.19*** | 2.77 | .02*** | .005 | -.13 | .18 | -.25 | .09 | [-.46, -.09] |
| Personal Resp | .32† | .16 | -.18* | .07 | -.43** | .16 | -.06 | .04 | [-.18, -.005] |
| Control | -.10 | .15 | .002 | .08 | -.43** | .16 | -.0002 | .02 | [-.04, .03] |
| Predisposition | .46** | .16 | .18** | .06 | -.57*** | .16 | .08 | .05 | [.02, .20] |

Note: [a] Higher numbers = more belief in genes as causal of aggression
The indirect effect estimates are bootstrapped estimates
†p < .10 *p < .05. **p < .01, ***p < .001.

Table 8

*Path Results and Confidence Intervals for Overall Mediation on Psycho-social Preference (Study 3)*

| DV | a | | b | | c' | | Indirect Effect | | |
|---|---|---|---|---|---|---|---|---|---|
| | B | SE | B | SE | B | SE | B | SE | CI |
| Gene Resp | -1.13*** | .17 | .03 | .05 | .13 | .13 | -.04 | .06 | [-.15, .09] |
| Env. Resp | .79*** | .15 | .25*** | .06 | .13 | .13 | .19 | .06 | [.10, .34] |
| Cause [a] | -14.19*** | 2.77 | -.008* | .004 | .13 | .13 | .11 | .06 | [.02, .26] |
| Personal Resp | .32† | .16 | .27*** | .05 | .30 | .12 | .08 | .05 | [.003, .20] |
| Control | -.10 | .15 | -.13* | .06 | .30 | .12 | .01 | .02 | [-.02, .07] |
| Predisposition | .46** | .16 | .03 | .05 | .38 | .13 | .02 | .03 | [-.04, .08] |

Note: [a] Higher numbers = more belief in genes as causal of aggression
The indirect effect estimates are bootstrapped estimates
†p < .10 *p < .05. **p < .01, ***p < .001.

Next I examined potential moderators of the effect of condition on the dependent variables.

**Moderation analyses**

Last, I examined our proposed moderations. In order to test for moderation I again computed a composite of all biomedical preference items and all psycho-social preference items (i.e., the same procedure used for the mediation analyses). To examine moderation the PROCESS macro for SPSS (Hayes, 2013) (Model 8) was used, condition was entered as the independent variable and preference for biomedicine or socio-behavioural preference were entered as the dependent variables. Follow-up analyses probing the simple slopes were conducted according to Aiken and West (1991). In the following I will discuss the significant results of these analyses.

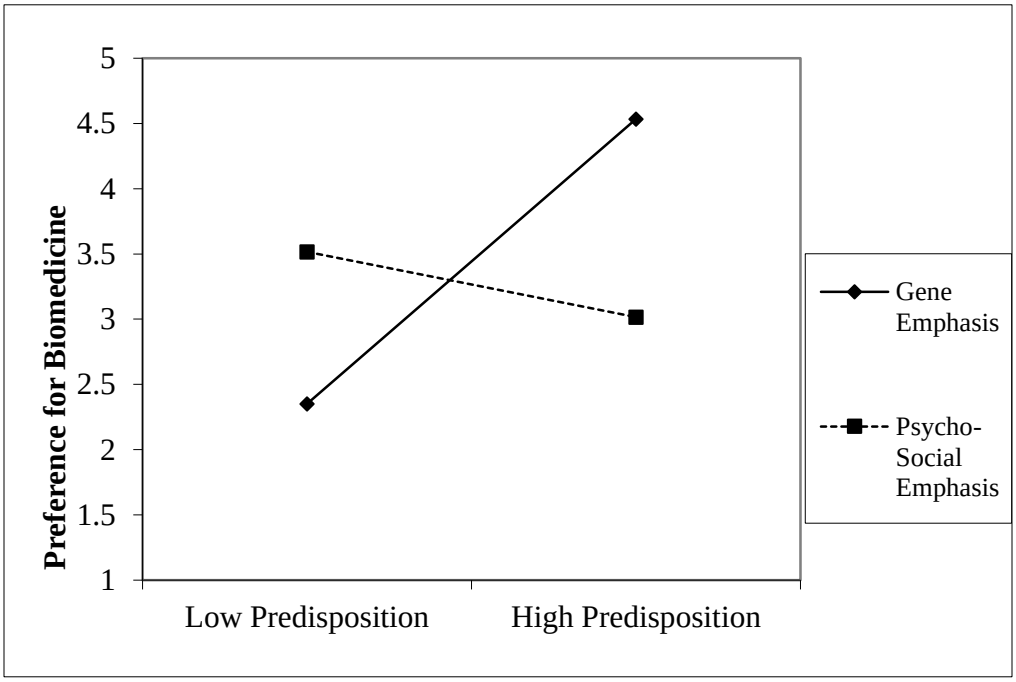
**Perceptions of Predispositions**

First, perceptions of predispositions was examined as a moderator. A higher level of perceptions of predispositions indicates that participants believed that individuals who act aggressively are more likely to have the predisposition they read about. This means that in the gene conditon these predispositions referred to genes whereas in the psycho-social emphasis condition these predispositions refer to childhood experiences. It is also noteworthy that these ratings were affected significantly by condition emphasis. The analysis of preference for biomedicine revealed a significant interaction effect, $\Delta R^2 = .05$, $F(1, 234) = 12.22$, $p = .0006$, indicating that perceptions of predispositions moderated the effect of condition on preference for biomedicine. The unstandardized simple slope for participants 1 *SD* below the mean of perceptions of predisposition was

.014, and the unstandardized simple slope for participants 1 *SD* above the mean of perceptions of predisposition was -1.12.

Follow-up analyses revealed that there is a significant positive relation between perceptions of predisposition and preference for biomedicine in the gene emphasis condition, $B = .36$, $t(238) = 4.40$, $p < .001$. However, there is no relationship between these two variables in the psycho-social emphasis condition ($p = .40$, *ns*).

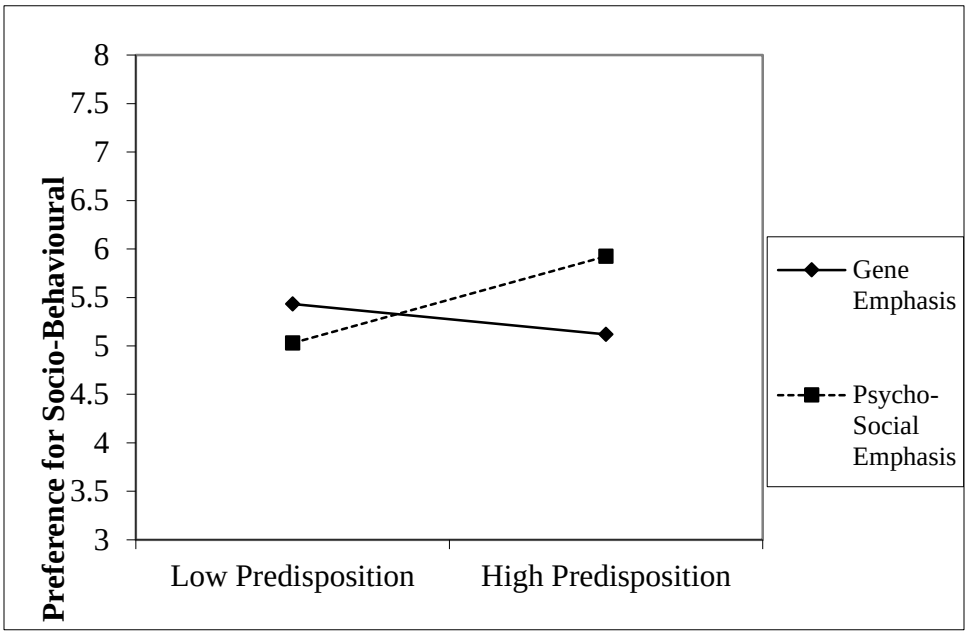
*Figure 3. Moderation of Condition on Preference for Biomedicine by Predisposition*




Perceptions of predispositions were also a significant moderator on socio-behavioural preferences. The interaction between condition and perceptions of predisositions explained a significant increase in variance in socio-behavioural preferences, $\Delta R^2 = .02$, $F(1, 234) = 3.92$, $p = .049$. Thus, perceptions of predispositions were a significant moderator of the relationship between condition and socio-behavioural preferences. The unstandardized simple slope for participants 1 *SD* below the mean of perceptions of predisposition was .12, and the unstandardized simple slope for

participants 1 *SD* above the mean of perceptions of predisposition was .63. Reverse to the results for biomedical preference, there is a marginally significant positive relation between perceptions of predisposition and preference for socio-behavioural approaches in the psycho-social emphasis condition, $B = .15$, $t(238) = 1.92$, $p = .056$. However, there is no relationship between these two variables in the gene emphasis condition ($p = .43$, *ns*).

*Figure 4. Moderation of Condition on Preference for Socio-behavioural by Predisposition*



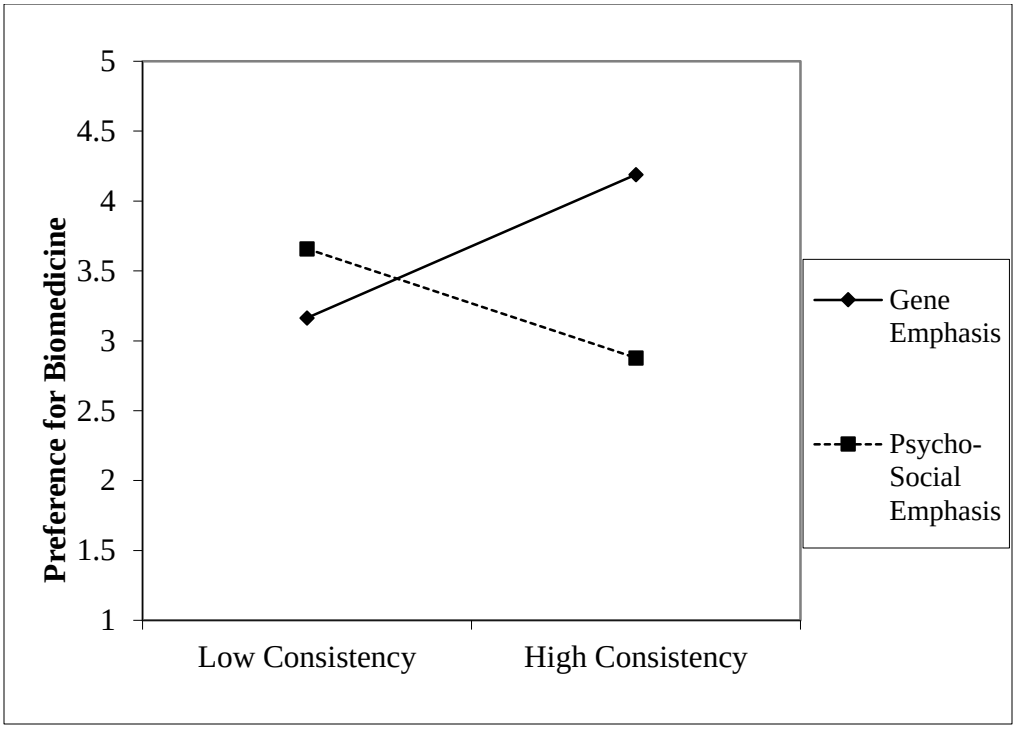

**Coherence with Article Arguments**

Next I examined consistency, inconsistency and agreement with the article as moderators. Consistency and agreement with the article were significant moderators of the relationship between condition and preference for biomedicine, whereas all three variables were significant moderators for the relationship between condition and socio-behavioural preference.

The interaction between condition and consistency explained a significant increase in variance in preference for biomedicine, $\Delta R^2 = .04$, $F(1, 233) = 9.00$, $p = .003$.

The unstandardized simple slope for participants 1 *SD* below the mean of consistency was -.005, and the unstandardized simple slope for participants 1 *SD* above the mean of consistency was -1.00. There is a marginally significant positive relation between consistency and preference for biomedicine in the gene emphasis condition, $B = .17$, $t(237) = 2.33$, $p = .021$. Further, there is a marginally significant negative relation between consistency and preference for biomedicine in the psycho-social emphasis condition, $B = -.13$, $t(237) = -1.90$, $p = .058$. There was no significant moderation for inconsistency on preference for biomedicine.

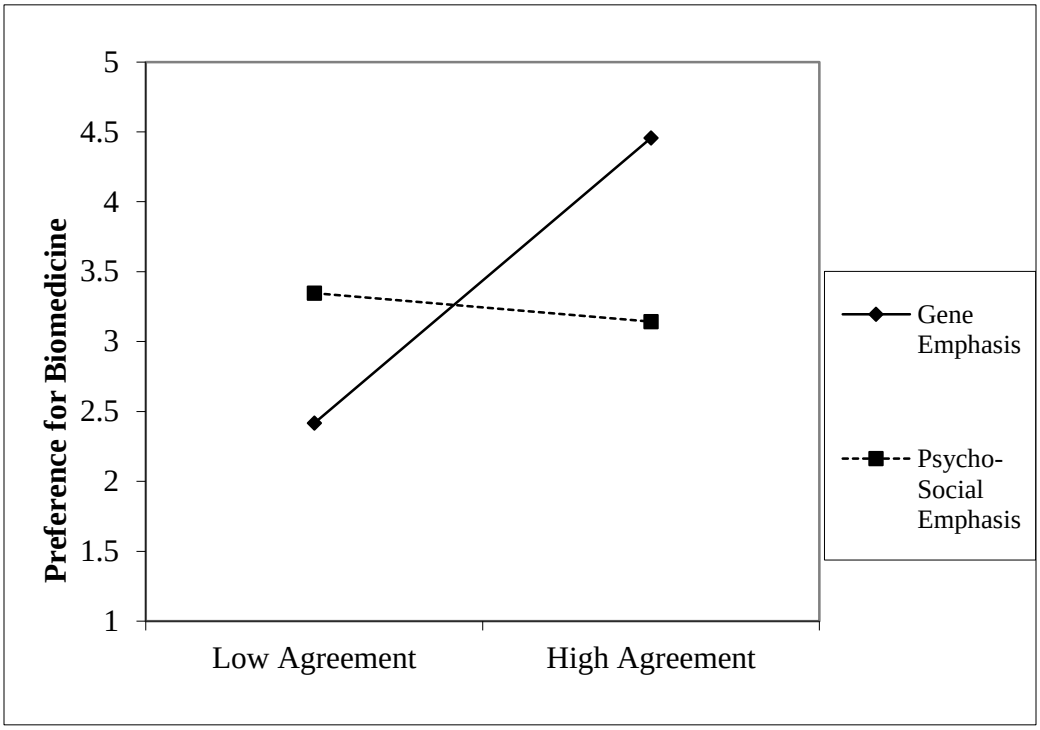
*Figure 5. Moderation of Condition on Preference for Biomedicine by Consistency*




Similarly, the interaction between condition and agreement explained a significant increase in variance in preference for biomedicine, $\Delta R^2 = .035$, $F(1, 233) = 9.01$, $p = .003$. The unstandardized simple slope for participants 1 *SD* below the mean of agreement was -.09, the unstandardized simple slope for participants with a mean level of

agreement was -.58, and the unstandardized simple slope for participants 1 *SD* above the mean of agreement was -1.08. The relation between agreement and preference for biomedicine was positive for participants in the gene emphasis condition, $B = .34$, $t(237) = 4.17$, $p < .001$. However, there was no relationship between these variables for participants in the psycho-social emphasis condition ($p = .72$, *ns*).

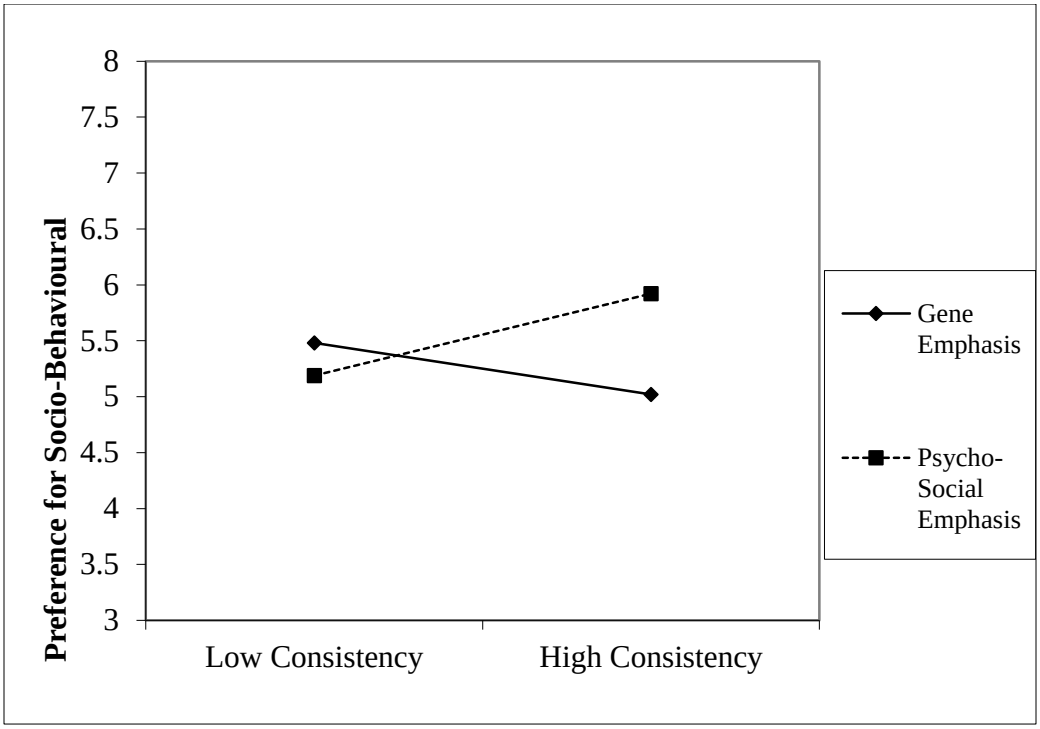
*Figure 6. Moderation of Condition on Preference for Biomedicine by Agreement*




The interaction between condition and consistency also explained a significant increase in variance in socio-behavioural preferences, $\Delta R^2 = .03$, $F(1, 233) = 6.64$, $p = .011$. The unstandardized simple slope for participants 1 *SD* below the mean of consistency was .03 and the unstandardized simple slope for participants 1 *SD* above the mean of consistency was .70. Simple slopes analyses revealed a significant positive relation between consistency and preference for socio-behavioural approaches in the

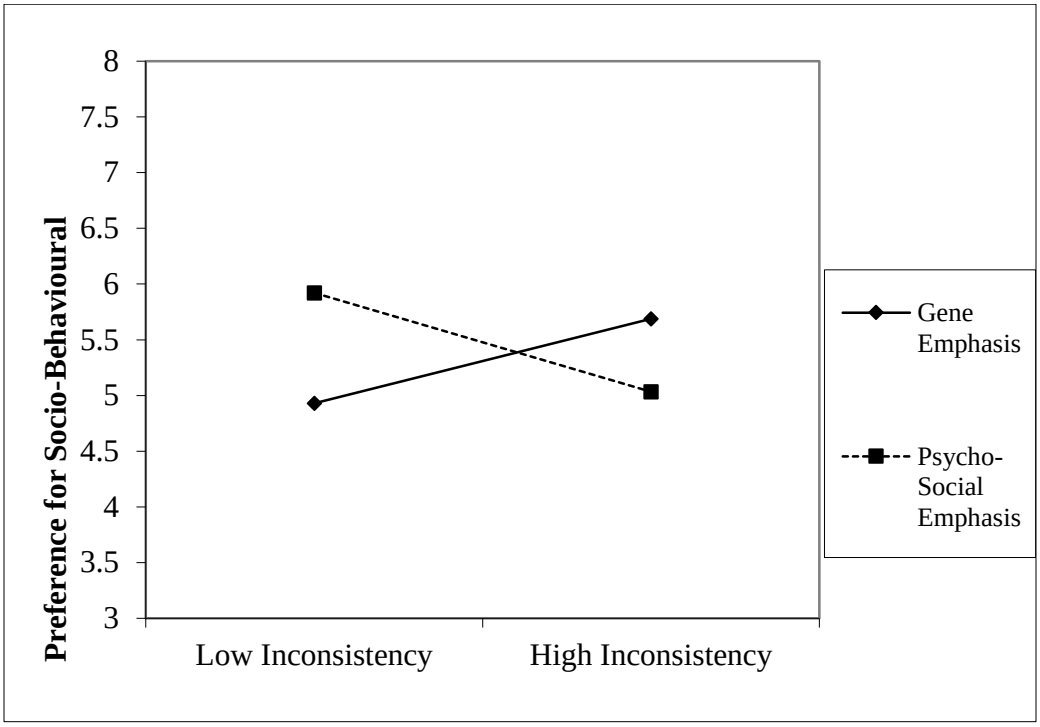
psycho-social emphasis condition, $B = .12$, $t(237) = 2.32$, $p = .021$, but no relation between these two variables in the gene emphasis condition ($p = .174$, *ns*).

*Figure 7. Moderation of Condition on Preference for Socio-Behavioural by Consistency*



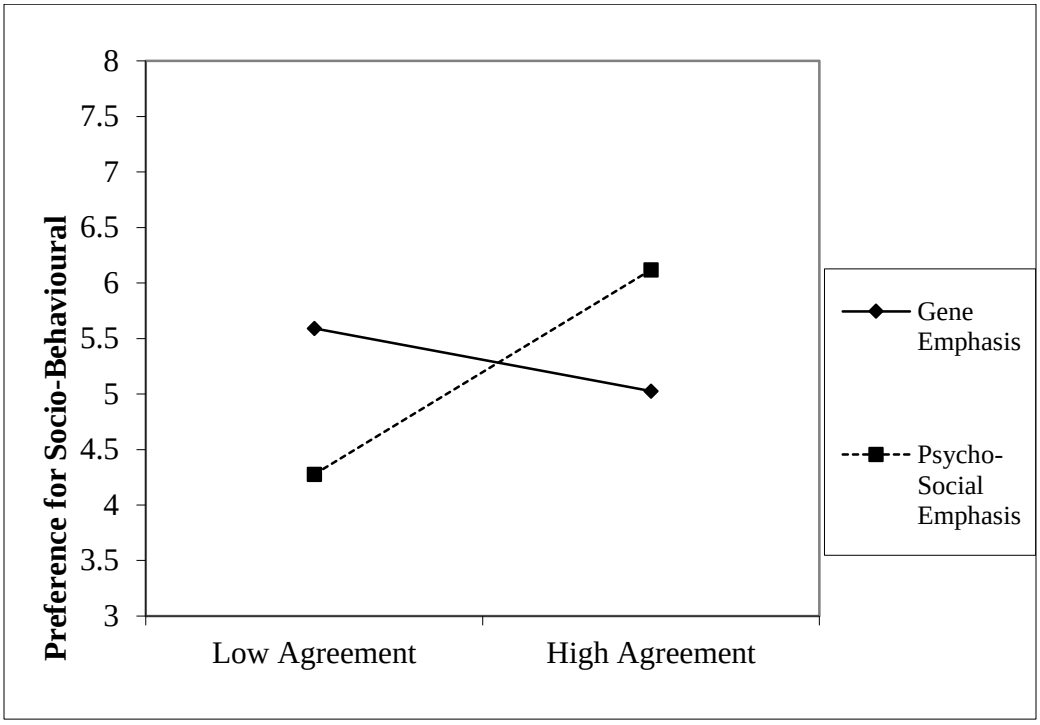

Equally, adding the interaction between condition and inconsistency explained a significant increase in variance in socio-behavioural preferences, $\Delta R^2 = .04$, $F(1, 232) = 10.51$, $p = .0014$. The unstandardized simple slope for participants 1 *SD* below the mean of inconsistency was .80 and the unstandardized simple slope for participants 1 *SD* above the mean of inconsistency was -.03. Simple slopes analyses revealed a significant negative relation between inconsistency and preference for socio-behavioural approaches in the psycho-social emphasis condition, $B = -.15$, $t(236) = -2.38$, $p = .018$, and a significant positive relation between inconsistency and preference for socio-behavioural approaches in the gene emphasis condition, $B = .13$, $t(236) = 2.21$, $p = .028$.

*Figure 8. Moderation of Condition on Preference for Socio-Behavioural by Inconsistency*




Lastly the interaction between agreement with the aritcle and condition explained a significant increase in variance in socio-behavioural preferences, $\Delta R^2$ = .07, $F(1, 233) = 17.58$, $p < .001$. The unstandardized simple slope for participants 1 *SD* below the mean of agreement was -.22, and the unstandardized simple slope for participants 1 *SD* above the mean of agreement was .85. The relation between agreement and preference for socio-behavioural approaches is positive in the psycho-social emphasis condition, $B = 31$, $t(237) = 4.25$, $p < .001$, but not significant in the gene emphasis condition ($p = .14$, *ns*).

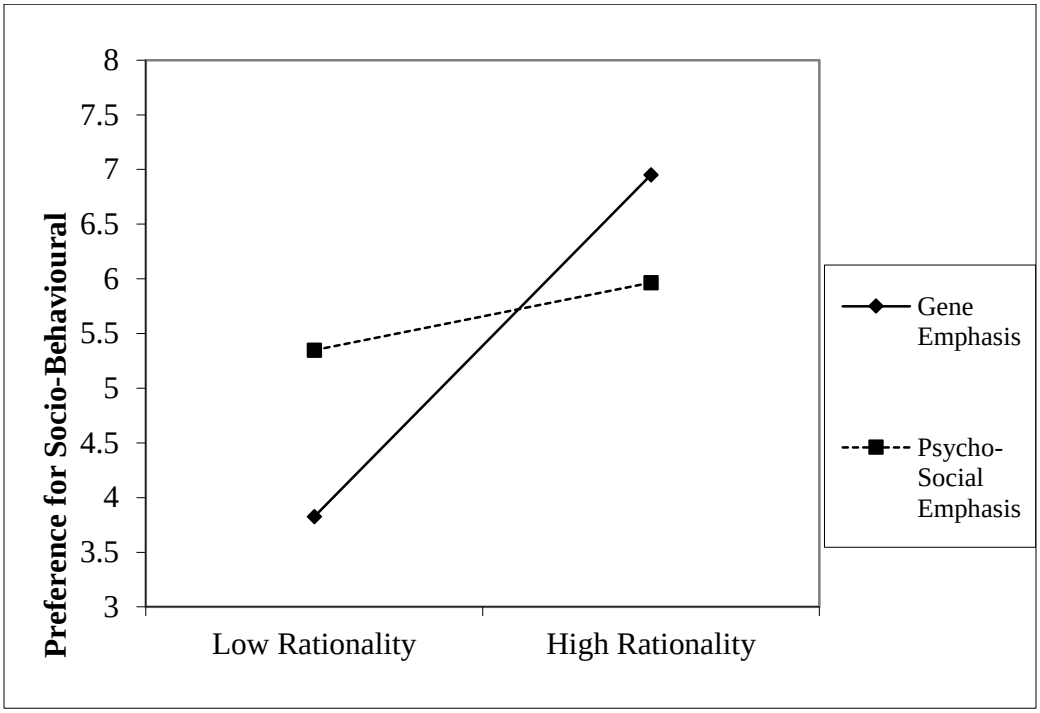
*Figure 9. Moderation of Condition on Preference for Socio-Behavioural by Agreement*




**Intuitive thinking**

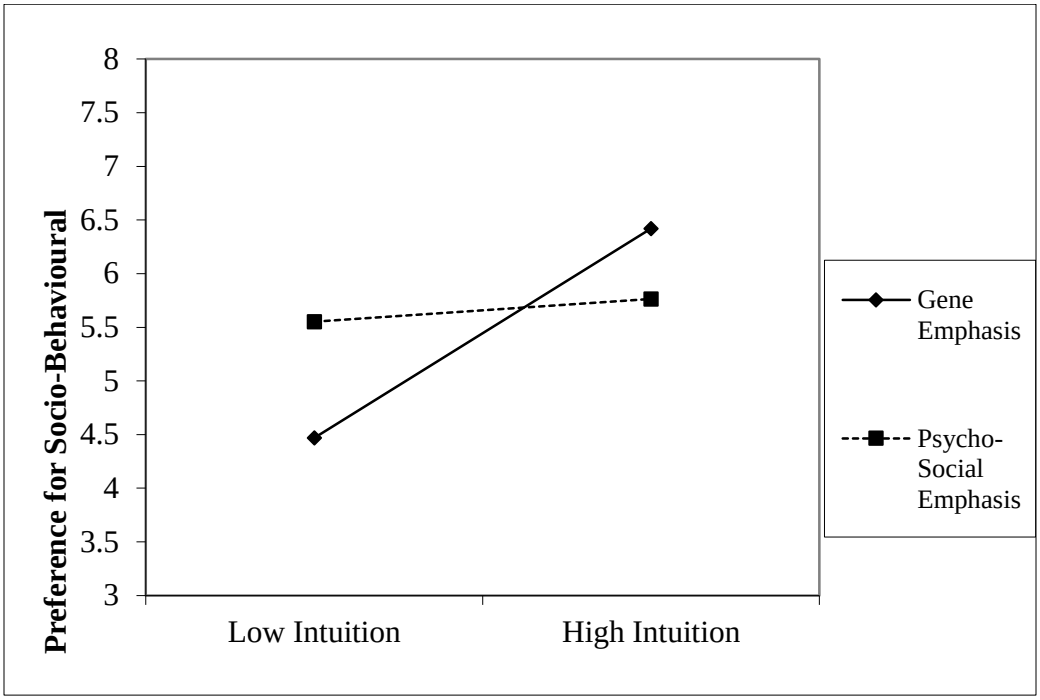
In order to assess intuitive thinking, the five intuitive thinking items and the five rational thinking items (Epstein et al., 1996) were aggregated into composites of intuition and rationality. Neither intuition nor rationality moderated the effect of condition of preference for biomedicine. However, the interaction of condition and rationality explained a significant increase in variance in socio-behavioural preference, $\Delta R^2 = .03$, $F(1, 234) = 7.41$, $p = .007$. As expected, rationality was a significant moderator of the relationship between condition and socio-behavioural preference. The unstandardized simple slope for participants 1 *SD* below the mean of rationality was .68, and the unstandardized simple slope for participants 1 *SD* above the mean of rationality was .02. The relation between rationality and preference for socio-behavioural approaches is positive in the gene emphasis condition, $B = .52$, $t(238) = 5.28$, $p < .001$, but not significant in the psycho-social emphasis condition ($p = .38$, *ns*).

*Figure 10. Moderation of Condition on Preference for Socio-Behavioural by Rationality*




The moderating effect of intuition of socio-behavioural preference was only marginally significant. The interaction of condition and intuition explained a marginally significant increase in variance in socio-behavioural preference, $\Delta R^2 = .01$, $F(1, 234) = 2.83$, $p = .094$. The unstandardized simple slope for participants 1 *SD* below the mean of rationality was .61, and the unstandardized simple slope for participants 1 *SD* above the mean of rationality was .19.Surprisingly and in contrast to the above results regarding rationality, there is also a positive relationship between intuition and preference for socio-behavioural approaches is in the gene emphasis condition, $B = .33$, $t(238) = 2.78$, $p = .006$, but not in the psycho-social emphasis condition ($p = .78$, *ns*).

*Figure 11. Moderation of Condition on Preference for Socio-Behavioural by Intuition*




## Discussion

In this third study, the main hypotheses were again supported. Participants in the two emphasis conditions endorsed the solutions symmetric to their emphasis condition more than participants in the opposite condition. This means, participants in the gene emphasis condition endorsed biomedical solutions more than participants in the psycho-social emphasis condition, as hypothesized. Further, participants in the psycho-social emphasis condition endorsed socio-behavioural solutions more than participants in the gene condition. These effects emerged both for the endorsement and mean rating of effectiveness of solution items and for the allocation of research funding. Thus, although it was previously confirmed that genetic explanations seem to have a certain allure and make biomedical solutions seem more effective, in this study, also psycho-social explanations increased their respective 'type-consistent' solutions. Further, preference

for biomedicine or socio-behavioural preferences extend past current solutions, to research funding participants endorsed.

These results could potentially point to the existence of a condition type – solution type bias, based on the symmetry principle (Marteau & Weinman, 2004). This bias could be a result of believing in the one-cause – one-condition bias, as the significant mediation between beliefs in cause and preference for biomedicine and socio-behavioural preferences highlights. The degree to which genes (a biomedical cause) or childhood experiences (a socio-behavioural cause) are endorsed as causal of aggression significantly mediates the relationship between condition and preference for solutions and research funding. As beliefs in genes as causal increases, so does preference for biomedicine and as these beliefs decrease, socio-behavioural preferences increase.

Further, it is also noteworthy that though control did not significantly mediate the relationship between condition and preferences (as in previous studies), perceived personal responsibility was a significant mediator of this relationship in this study. Specifically, believing that a person is more personally responsible for changing their behaviour increased the endorsement of socio-behavioural solutions and decreased the endorsement of biomedical solutions. This relationship is relevant because it seems that participants believed that socio-behavioural solutions are tied to personal agency and personal change, whereas biomedical solutions are not perceived this way. It is possible that when an aggressive individual is perceived to be not responsible for their aggression, people would still want this person to change their aggression; however biomedical approaches rather than socio-behavioural approaches are preferred. Potentially biomedical approaches might not be considered within a person's control, and thus

preferred when responsibility is not perceived to be high, whereas socio-behavioural approaches might be considered within a person's control and thus preferred when responsibility is perceived to be high. This mediation did not emerge in Study 1 or 2. The effect size is very small and it is possible that the other two studies did not have enough power to detect this effect. This study significantly cleaned up both the manipulation as well as the main dependent variables. Potentially omitting more extreme solution items allowed for the detection of this small effect. It is also important to note however, that the relationship between condition and personal responsibility is not significant, reducing the significance of this mediation.

Finally, belief in the existence of the predisposition of aggression in all aggressive individuals also increased endorsement of biomedical solutions. It is possible that the existence of a predisposition decreases the belief in the effectiveness of willpower or choice to act 'against' the predisposition. Thus, one could imagine that once a predisposition to aggression is identified (whether genetic of psycho-social) approaches to solving this issue are preferred that (at least conceptually) require less personal agency. It would be interesting to further investigate how these different types of solutions are rated with respect to the personal agency they require to follow through with them.

This study also allows for the elimination of possible alternative explanations for the study findings. First, both articles were rated as similarly difficult to understand, and thus no condition differences exist with respect to the ease or fluency of processing the article. Further, it might have been possible to conceive that genetic information is easily understood because it provides a simple one-gene – one-condition explanation for behaviour and thus participants are more influenced by genetic information when making

their decisions about solutions and research funding. However, this study demonstrated that indeed genetic information is more surprising and also more difficult to explain than non-genetic information.

Further, when asked to think of consistent and inconsistent examples to the information presented in the article, participants could think of more consistent and less inconsistent examples in the psycho-social condition than participants in the gene condition. Thus, it seems that it is overall easier for participants to think of examples when discussing conditions that have psycho-social antecedents. Genes are not observable and thus their existence has to be assumed. When thinking of one's personal life, genes are not often articulated and it is often the media that first makes us aware of genetic causes of a range of human behaviour (Bubela & Caulfield, 2004). It is important to note however, that within the gene condition, participants thought of more consistent than inconsistent example. Overall, participants in the gene condition thought of both less consistent and less inconsistent example, resulting in the observed condition differences. Thus it seems that possible thoughts regarding psycho-social influences are more easily accessible and more connected thoughts come to mind. This is also evident in the increased agreement with the article of participants in the psycho-social condition compared to the gene condition.

Unlike in the other two studies, participants in this study did not differ in their perceived or actual knowledge of influences on human behaviour. The lack of differences, although surprising, provides an ideal condition to test the main hypotheses of this thesis. Thus, even when all participants perceive to know equally much about

influences on behaviour, significant condition differences emerge on preferences for biomedical over socio-behavioural solutions and funding.

Finally, the results of the moderation analyses point to the importance of believing in the predisposition explained in the news article and the effect of this belief on the preference for certain treatments and research. Only when the belief that aggressive individuals have the predisposition participants read about was high, do participants have an increased preference for their symmetric solutions or research funding. This finding seems to provide support to Marteau and Weinman (2004), who assert that the solution individuals endorse for a specific condition is related to the cause (predisposition). Thus, only if the belief in the predisposition of a certain type (genetic or psycho-social) is high then the rating of effectiveness of the respective symmetric solutions is high. Indeed, coherence of the participants' beliefs and the article statements also significantly moderated the relationship between the emphasis condition and preference types. The relationship is as expected when coherence is high (thus participants agree with the article and find it consistent with personal experiences), but the relationship changes and is even inconsistent with expectations when coherence is low. Convincing journalism and strong statements could thus have an enormous influence in readers' beliefs and attitudes towards important social issues. It is possible that by making strong genetic claims in news articles, the articles sound more convincing and thus elicit more coherence on topics that are unfamiliar to the reader and for which no strong pre-existing beliefs exist. However, these findings also suggest that for conditions such as homosexuality or mental illness that have not only strong pre-existing beliefs but also strong ideological underpinnings it may be much more difficult to shift individuals

notions of how best to 'treat' these issues. It is likely that the results of the study are especially pertinent for a whole range of new behaviours that are being linked to genes every day.

Lastly, the results of the moderation of thinking styles showed inconsistent results. Though, as expected, rationality increased the preference for psycho-social solutions in the gene condition, so did intuition. Thus it is at this point not possible to explain these conflicting results.

## General Discussion

People may react differently to etiological information about human behaviour depending on which type of etiology is emphasized. The present studies provide support for the hypotheses that different emphases of etiological information about problematic behaviour generate differences in endorsement of solutions to these behaviours, rating of effectiveness of potential solutions, perceptions of causal responsibility, and also personal responsibility, among others. Evidence across all three studies demonstrates an increase in the preference of biomedicine when genetic causes of behaviour are emphasized. Even more so the studies provide evidence that the preference of biomedicine increases in particular after genes are perceived as the fundamental cause of a condition.

Previous research showed mixed results regarding the impact of genetic information on endorsement and ratings of effectiveness of treatments. Research on genetic essentialism (Dar-Nimrod & Heine, 2011a) highlights the biases stemming from genetic information, making conditions with genetic etiology appear immutable and beyond an individual's control. However, research investigating the link between genetic essentialist biases and behavioural (in)action (e.g. see Dar-Nimrod & Heine 2011a for a

summary), has paid particular attention to a particular kind of action (personal behavioural adjustments) while ignoring another avenue of action (the choice of biomedical interventions). The three studies presented in this paper suggest that when participants rate both socio-behavioural and biomedical actions, there is no evidence of fatalism. Although this study was unable to directly test the notion that considering biomedical solutions as effective solutions to a genetic condition might help regain perceived control, the non-significant mediation of control on the relationship between condition and biomedical preference in Study 3 provides at least partial evidence. These non-findings extend previous studies that were unable to find a mediating role of control once both biomedical and socio-behavioural solution strategies were offered to participants (Wright et al., 2003).

Although this research did not provide direct evidence for the role of the media in perpetrating genetic biases, it does highlight the power of a single article over participants' perceptions regarding important personal or policy decisions. Even though the articles used in the studies were carefully worded to avoid deterministic language, participants did not appear to adopt an interactionist perspective to the role of genes in aggression. For example, participants in the gene condition mirrored common newspaper headlines focusing on genetic influences as *the* cause of a condition. Further participants in both conditions respectively believed their emphasized predisposition was more responsible for aggression that participants in the other condition(s). Thus, simply reporting a balanced perspective of genetic influences seems to not be sufficient to circumvent a focus on genes when they are mentioned in news articles.

The present study also extends previous work on the behavioural and attitudinal effects of genetic information. For example, extending previous work on perceptions of others' behaviour, the studies demonstrated that aggressive individuals are perceived to be less personally responsible for changing their aggression, once genes are implicated in its cause (Monterosso et al., 2005, Dar-Nimrod et al., 2011). Further, the present studies are also the first to directly implicate genetic information in attitudes towards potential solutions towards problematic behaviour. Extending previous work (e.g., Kuppin & Carpiano, 1996), the present research highlights that even if genetic information is not self-relevant, participants led to believe in genetic etiology of behaviour, endorse biomedical solutions more than participants who were not led to believe in genetic etiology. However, unlike studies by Phelan, Yang, and Cruz-Rojas (2006) who found no relationship between belief in genetic factors for mental illness and ratings of treatment effectiveness, the present studies, by dividing treatments into discernible biomedical and socio-behavioural categories, found significant condition differences on these ratings. Based on the present studies it appears that differences in ratings of effectiveness occur between the two types of solution categories (biomedical and socio-behavioural) that match the corresponding causal beliefs. However, the studies did not provide direct evidence that matching was the process by which participants endorsed solutions. Yet, this apparent symmetry can be seen as problematic, as there may be a large disconnect between what people believe is the cause of a condition and the treatments they believe to be effective and the treatments that are actually effective.

**Why is Choice of Behaviour Change Relevant?**

The heightened belief in the effectiveness of biomedical interventions and research after exposure to genetic etiological information is problematic because even if genes were the central causal agent driving human health and well-being, research into identifying genes and creating gene therapies may not improve quality of life or longevity. Essentialist notions of the gene may thus interfere with understanding the multiple determinants of health, thus prioritizing medical and clinical intervention over personal efficacy and control. Marteau et al. (2004, p. 291) caution that "genetic testing might reinforce biologically based ways of reducing risk when behavioral or environmental change is equally if not more effective." This has potential implications for personal decision making as well as public support for social programs, policies, and future research directions. Consider for example the problem of smoking as an undesirable behaviour. When tobacco advertising was implemented as a central strategy for the initiation of smoking behaviour in the 1950s, many countries introduced restrictive policies around this advertising (Pierce et al. 1991; Pierce et al. 1998). Subsequently, a number of studies documented the effectiveness of advertising bans and restrictions (Pekurinen 1989; Smee 1992) on reductions in smoking behaviour. Thus, identifying environmental causes of smoking initiation (in this case, advertising) provided an avenue for successful policy interventions leading to a reduction in this behaviour. What happens when genes are highlighted as the etiology to an undesirable behaviour like smoking? Based on previously reviewed examples showing that people view genetic causes as low in controllability (e.g., Dar-Nimrod & Heine, 2011a), decision makers could conclude that there is little point of restricting advertisements if smoking is genetically predetermined. Alternatively decision makers could point to the medical

establishment to find biomedical treatments for smoking. However, it is easy to see how flawed this logic can be – it would be unreasonable to allow cigarette advertisers free reign in smoking campaigns simply because a gene has been linked to smoking addiction or lung cancer.

It is critical to return to the earlier explanation of the function of genes. Parrot and Smith (2014) argue that support for genetic research often relies on the assumption that genetic science leads to identifying individuals who have specific genetic markers associated with a disease, and that such identification allows for health interventions to improve one's quality and length of life. Though this might be true in some cases, to overemphasize the role of genetic research means to limit potential successful environmental and social interventions. Simon and colleagues (2014) state, "advances in neurobiology and genetics will not necessarily supplant the behavioural-environmental approach but will allow for a better understanding of the occurrence of particular behaviours" (p. 19). Thus, genetic research should not supplant, but rather complement social-behavioural approaches to behaviour and illnesses. The authors further argue that knowledge of a genetic etiology may provide insight in determining successful behavioural interventions (Simon et al., 2014). For example, to address hyperphagia in people with Prader-Willi Syndrome (a genetically determined disorder), environmental changes such as restricted access to food, a schedule with clear menu offerings, as well as the use of non-food reinforcers may be implemented (Simon et al., 2014). It is dangerous to conclude that the identification of genetic influences would necessarily lead to genetic interventions or even screening for conditions. Many diseases stem from several different genes and are triggered by environmental factors. It is these environmental triggers that

are often overlooked, but crucial in the prevention of many conditions. Thus, Dr. Guttmacher of the National Institutes of Health cautions: “A little knowledge is a dangerous thing" (Hamilton, October 29th, 2008). This cautionary note by Dr. Guttmacher reiterates that, due to the emphasis on ‘strong genetic links’ when discussing genetic etiology and the public’s genetic essentialist biases, people attend more to the genetic causes of phenomena at the expense of environmental, experiential, or gene-environment interactional causes. Given the increased endorsement of biomedical solution strategies to genetic conditions, one would expect that etiological beliefs would possibly limit successful prevention and treatment strategies that often rely on the identification of environmental triggers (Hamilton, October 29th, 2008).

Probably the most common genetic disorders that greatly benefit from environmental inventions are metabolic disorders. These disorders are genetic diseases that interfere with the body's ability to process specific substances. Two common diet-affected metabolic disorders are PKU or phenylketonuria, and Maple Syrup Urine Disease (MSUD). For PKU high-protein foods are removed from the diet (removing phenylalanine from the diet), whereas the MSUD diet does not contain any leucine, isoleucine, or valine (James, 2010). For these genetic disorders, when a strict diet is initiated early and maintained well, affected children can expect normal development and a normal life span. Thus, ignoring this crucial environmental intervention would severely limit treatment effectiveness. Equally however, some conditions caused by environmental influences, such as major depressive disorder or post traumatic stress disorder, respond well to medication as a means for addressing these issues.

To conclude, identifying the etiology of an undesirable behaviour or illness offers targets for reducing said behaviour or illness. However, it is important to keep in mind that simply identifying the etiology (whether genetic or environmental as described above) should not foreclose a specific treatment path for any condition.

The knowledge gained from the present research may allow for a better communication of genetic susceptibility and of the effectiveness of social policy and behavioural interventions even for problems with genetic links. For example, a study on genetic counseling in obese individuals showed that when healthy eating and exercise were included as effective strategies for weight loss, differences in weight loss across genetic counseling condition and general consultation were absent (Conradt et al., 2009). Thus simply reiterating that behaviour such as eating and exercise are effective in addressing genetically influenced obesity, lead participants in the gene condition to lose weight equal to the control group. Also both groups reported an adjustment to more realistic weight loss goals and a greater satisfaction with a 5% weight loss. Thus, although genetic information could lead to behavioural inaction or reductions in engaging in risk-reducing behaviours, this may be the result of believing in the effectiveness of biomedical interventions at the cost of effective socio-behavioural interventions.

**Limitations and Future Research**

The studies have some important limitations to consider. Although I believe that aggression is a good example of an undesirable behaviour, the specific choice of one behaviour at least questions the applicability of the present findings to other undesirable behaviours. As mentioned above, I believe that the study findings might be especially different for issues in which coherence with the article is difficult to establish. For

example, people might be less likely to believe in the genetic etiology of bullying behaviour, as preconceived notions of bullying highlights the environmental factors, such as group dynamics that contribute to this behaviour (Garandeau & Cillessen, 2006). In addition, it is not clear how the findings might extend to other conditions, such as health conditions. Today, people can be tested for a large number of genetic conditions, all varying in seriousness and controllability. People may respond differently to risk information concerning genetic conditions for which preventive options are limited (e.g. early onset Alzheimer's disease) than to risk information concerning a genetic condition, like Familial Hypercholesterolemia (FH), with a higher potential for prevention. Because the studies only investigated possible *solutions* to genetic conditions, it is unclear how attitudes and perceptions towards *prevention* shift. Further I do not specifically assess whether the articles invoke any genetic essentialist biases per se. Several findings regarding notions of solvability and personal responsibility were consistent with previous research on genetic essentialism however, suggesting that the use of this framework within these studies is a useful one. Also, the present studies aimed to highlight preferences for biomedicine after exposure to genetic etiological information, however previous research suggests that attitudes do not always consistently link to behaviour (Kruglanski, 2016). Real life contextual factors, such as limits to the accessibility and availability of solutions or treatment options, might be an important deterrent to biomedicine for some individuals. Participants may be more motivated to perceive socio-behavioural solutions as effective if biomedical solutions are out of reach. Likewise, individuals may be particularly susceptible to biomedicine if it is offered as a potential solution, such as in pharmaceutical advertising. The processes by which individuals come

to think of biomedical treatments as more effective when exposed to genetic information versus psycho-social information are currently ill-understood. For a research question investigating novel processes, qualitative approaches are often useful in providing a first insight into the question at hand.

Future research should investigate issues of control more fully and, in particular, how to reconcile increased preference for biomedicine with doubts about personal control. Again qualitative studies may help to shed light on the processes by which individuals come to think of biomedicine as more effective after learning about genetic etiology. A logical extension of the present research may be to consider more closely that not all behaviour that was once considered undesirable is considered in need of change now. For example, although homosexuality was once considered part of the DSM (Bayer & Spitzer, 1982) and a behaviour that should be changed it is no longer part of this category. Thus sometimes a genetic etiology argument can be made in support of the acceptance of certain behaviour as 'normal' and thus increases the acceptance of this behaviour. However it is also important to be wary of these arguments, for example, in order for the genetic argument to have the desired effect, the behaviour in question has to be socially accepted. When an unacceptable behaviour like various forms of mental illnesses are considered in genetic terms, empathy towards individuals with mental illness increases, however these individuals are also more likely to be ostracized out of fear of belief that their condition is irreversible (e.g. see Phelan et al., 2002). However, these studies have not yet considered how people with undesirable behaviours are being seen depending on whether they are taking 'action' behaviourally or medical action. Possibly, specifically highlighting that someone with a genetic condition is taking medication to

address their issue might increase acceptance of the person and increase the belief that the treatment will effectively solve the issue. Yet, there is also a lot of stigma around taking drugs, and people may think that individuals on medication do not exercise 'agency' and are thus not 'taking action' to resolve their issues themselves, increasing blame and decreasing sympathy. Lastly future studies should investigate how perceptions of treatment and prevention differ and how preference for biomedicine extends from attitudes towards actual behaviour.

## Conclusions

The present studies expand research into genetic fatalism and significantly contribute to the literature on genetic essentialism and behaviour change by expanding the definition of what 'taking action' could mean. Further, research into public health is extended, by highlighting that indeed ratings of solution effectiveness depends on the type of solution that is being rated (biomedical versus psycho-social). Therefore, it is important to find ways of communicating genetic risk information to people without demotivating them to engage in recommended preventive behaviours (e.g., exercising rather than to revert to purely biomedical interventions). By uncovering the bias that biomedical solutions are perceived as more effective when genetic causes are highlighted, it may be possible to sway participants' beliefs of effectiveness and increase engagement in socio-behavioural approaches to behaviour change. Overall, the studies provide important new insight and cautions for the nascent field of personalized medicine. Although the concept includes promising approaches to things like cancer treatment,

much of the focus has been on using genetic risk information to motivate healthy lifestyles. The promise of personalized medicine and genetic testing lies in its ability to inspire behaviour change, to take actions toward our health. In his 2015 State of the Union address, President Obama suggested that future advances in biomedicine would provide the "personalized information we need to keep ourselves and our families healthier" (The White House Office of the Press Secretary, January 30th, 2015). However, the present studies suggest that knowing one's genetic risk may not lead people to quit smoking or eat healthier diets. In fact, the studies suggest that personalized medicine and genetic testing might have unwelcome consequences of increasing the reliance on medicine in favour of alternative approaches. Caulfield (May 16th, 2016) cautions that "in certain situations, the institutional reverence for personalized medicine may be misguided or even detrimental: It distracts people from more evidence-based approaches to improving population health. It feeds into the myth that living a healthy lifestyle requires complicated solutions, which may, paradoxically, hurt efforts to sustain behavior change or discourage individuals from even trying. And it helps to legitimize the marketing of unproven genetic-testing services."

Media attention, such as around behavioural genetics generally (Bubela & Caulfield, 2004) or the media hype around Angelina Jolie's decision to undergo a mastectomy (Jolie, May 14th, 2013) are further adding to the increased public interest in genetic screening, without increasing the public's understanding of the full emotional, ethical, financial, and physical implications of doing so. Media attention has also piqued public interest in how genetics could be used to reduce the burden of disease in society. However, there is a danger that the focus on genetic information and genes as a

determinant of complex behaviours may shift responsibility to address these behaviours away from social institutions and toward individuals (Caulfield, May 16th, 2016). There is at least some evidence that genetic framing may hurt public support for population-based public-health interventions (Caulfield, May 16th, 2016). It is important to keep in mind that solving an undesirable behaviour is not just the choice of one individual to either seek out biomedical or socio-behavioural solutions. Particularly timely within the discussion of aggression are the influx of mass shootings in the USA. However, gun violence it is not only an individual's choice of acting upon their aggression in a certain way but also a country's decision around gun control. Thus, though considerations of biomedical solutions are certainly important it is also crucial to look at more systemic issues when considering individual behaviour choices. Solutions to complex behavioural issues need to be complex themselves and often include a multitude of policy, behaviour change and biomedical approaches. Although perceptions of effectiveness might be influenced by etiological beliefs, at the end one needs to be aware that sometimes some treatments are objectively more effective. If there is an effective biomedical procedure that can support behaviour change it should be part of the solution. However it is important to consider that most behaviours are complex, and so are undesirable behaviours. Without considering the social circumstances in which these behaviours emerge context is necessarily ignored. "Diet, exercise, substance use—all those are driven by structural factors as much as, or more than, personal choice. Genetic testing won't change that" (Caulfield, May 16th, 2016).

Therefore, it is imperative that scientists, health care providers and policymakers consider the implications of exposure to genetic information for the lay public and invest

in education efforts surrounding this topic. Although understanding the genetic determinants of behaviours and health is a promising field of study, its social implications deserve much greater attention than they have been given so far.

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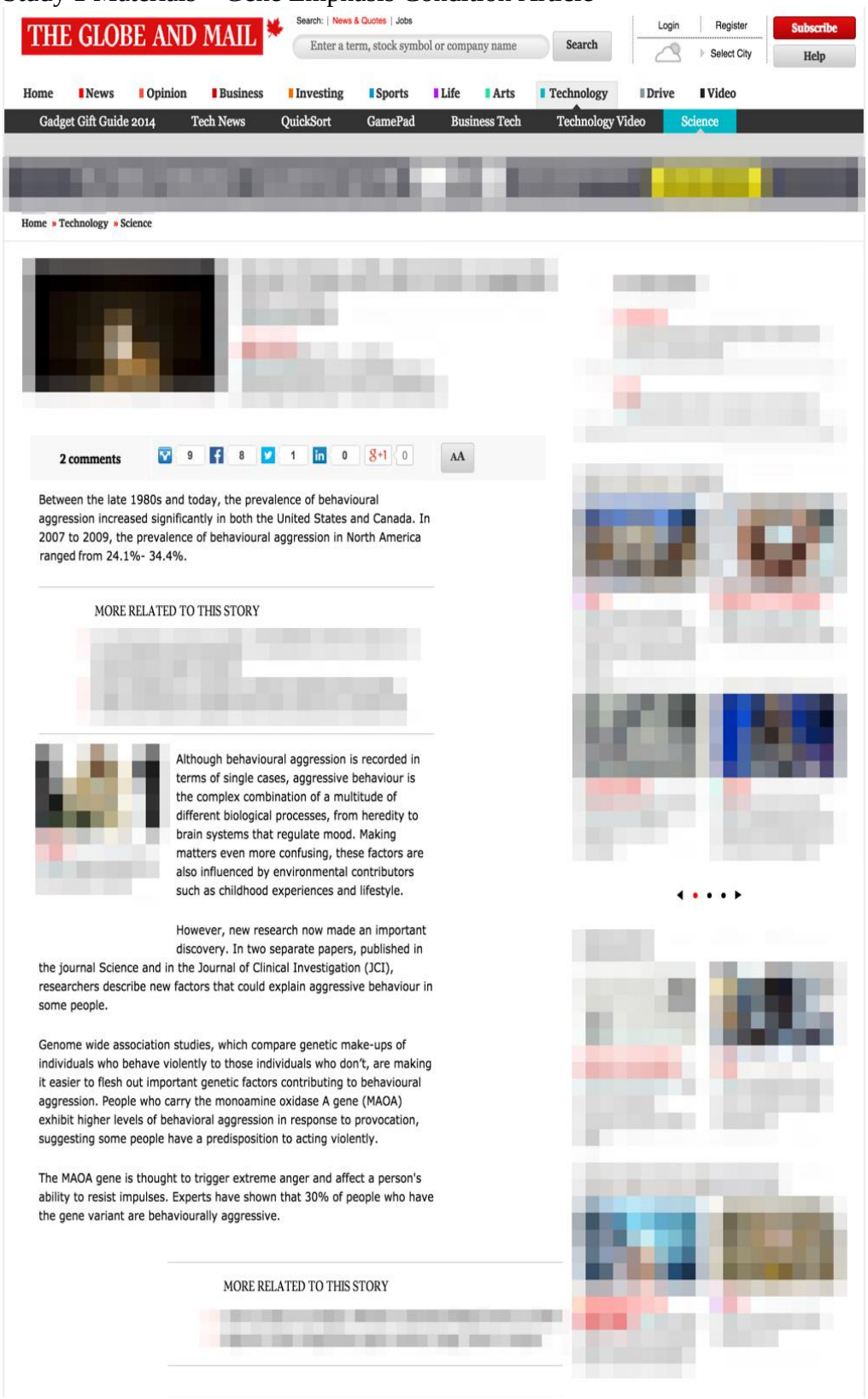
Appendix A1

Study 1 Materials – Gene Emphasis Condition Article



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Between the late 1980s and today, the prevalence of behavioural aggression increased significantly in both the United States and Canada. In 2007 to 2009, the prevalence of behavioural aggression in North America ranged from 24.1%- 34.4%.

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Although behavioural aggression is recorded in terms of single cases, aggressive behaviour is the complex combination of a multitude of different biological processes, from heredity to brain systems that regulate mood. Making matters even more confusing, these factors are also influenced by environmental contributors such as childhood experiences and lifestyle.

However, new research now made an important discovery. In two separate papers, published in the journal Science and in the Journal of Clinical Investigation (JCI), researchers describe new factors that could explain aggressive behaviour in some people.

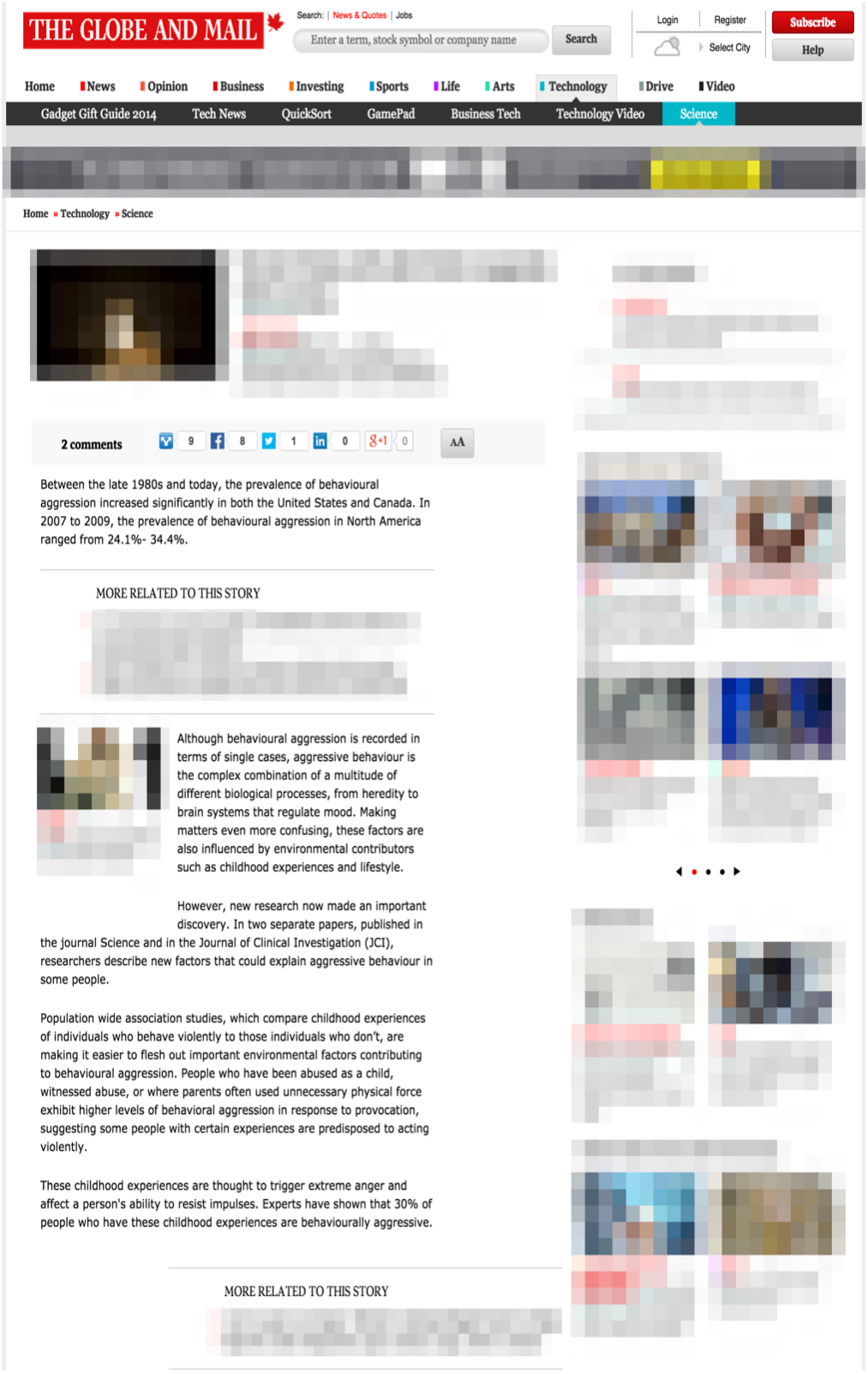
Genome wide association studies, which compare genetic make-ups of individuals who behave violently to those individuals who don't, are making it easier to flesh out important genetic factors contributing to behavioural aggression. People who carry the monoamine oxidase A gene (MAOA) exhibit higher levels of behavioral aggression in response to provocation, suggesting some people have a predisposition to acting violently.

The MAOA gene is thought to trigger extreme anger and affect a person's ability to resist impulses. Experts have shown that 30% of people who have the gene variant are behaviourally aggressive.

MORE RELATED TO THIS STORY

Appendix A2

Study 1 Materials – Psycho-Social Emphasis Condition Article



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Between the late 1980s and today, the prevalence of behavioural aggression increased significantly in both the United States and Canada. In 2007 to 2009, the prevalence of behavioural aggression in North America ranged from 24.1%- 34.4%.

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Although behavioural aggression is recorded in terms of single cases, aggressive behaviour is the complex combination of a multitude of different biological processes, from heredity to brain systems that regulate mood. Making matters even more confusing, these factors are also influenced by environmental contributors such as childhood experiences and lifestyle.

However, new research now made an important discovery. In two separate papers, published in the journal Science and in the Journal of Clinical Investigation (JCI), researchers describe new factors that could explain aggressive behaviour in some people.

Population wide association studies, which compare childhood experiences of individuals who behave violently to those individuals who don't, are making it easier to flesh out important environmental factors contributing to behavioural aggression. People who have been abused as a child, witnessed abuse, or where parents often used unnecessary physical force exhibit higher levels of behavioral aggression in response to provocation, suggesting some people with certain experiences are predisposed to acting violently.

These childhood experiences are thought to trigger extreme anger and affect a person's ability to resist impulses. Experts have shown that 30% of people who have these childhood experiences are behaviourally aggressive.

MORE RELATED TO THIS STORY

# Appendix A3

Study 1 Materials – Headline

Please generate a title (i.e., a "headline") to go with the article you just read

## Appendix A4

Study 1 Materials – Solution Statements

You read a randomly assigned article about a particular social issue prevalent in North America today. Take a moment to think about that social issue. We would now like to ask you some questions regarding this issue. First, you will be asked to write a response to the question below in your own words (about the length of a short paragraph). To allow time for you to complete a thoughtful answer, you will be kept on this page for 60 seconds. After this time, the "next" button will appear allowing you to page forward when you are finished.

What do you think are the key solutions to this kind of social issue?

_____

To what extent do you think physical or biological adjustments (e.g. medication, surgery) would be a good solution to this issue?

- ❍ 1= Not at all
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7= A large extent

To what extent do you think psychological or environmental adjustments (e.g. therapy, education) would be a good solution to this issue?

- ❍ 1= Not at all
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7= A large extent

To answer this question, please choose number four.

- ❍ 1= Not at all
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7= A large extent

Appendix A5

Study 1 Materials – Ratings of Effectiveness

Please indicate to what degree you think the strategies mentioned below are good solutions to this kind of issue?

| | 1 = not at all | 2 | 3 | 4 | 5 | 6 | 7 = very much so |
|---|---|---|---|---|---|---|---|
| genetic therapy | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| electro-shock therapy | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| parenting advice for kids who have the behaviour | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| training programs for anger management/impulse control | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| teaching healthy conflict skills | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| getting a life coach | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| conduct psychological examinations | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| surgery to remove glands that produce “anger”-hormones (e.g. adrenaline) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| medication to control impulses | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| hormone therapy | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| extensive family counseling | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| relaxation and meditation training | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| harsher restrictions on TV and video game violence | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| strict law enforcement | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| anti-bullying programs in schools | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| frontal lobotomy (removing part of | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| brain responsible for aggression) | | | | | | | |
| personal therapy or counseling | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| more affordable sport and lessons to promote healthy leisure activities | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| programs to build self-esteem/ confidence | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| insertion of electrode into brain (would allow for aggressive impulse control) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| free yoga classes | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| community support groups (similar to AA) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| required medical intervention for those identified with predisposition to aggression | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| required medical intervention for those identified with predisposition to aggression | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

Appendix A6

Study 1 Materials – Ranking of Solutions

Please now rank your TOP 5 solutions. Drag and drop the items into the box on the right in the order from your most preferred solution (#1) to your 5th best solution.

| Ranked from Best to Worst option (out of top 5 preferred options) |
| --- |
| _____ genetic therapy |
| _____ electro-shock therapy |
| _____ parenting advice for kids who have the behavior |
| _____ training programs for anger management/impulse control |
| _____ teaching healthy conflict skills |
| _____ getting a life coach |
| _____ conduct psychological examinations |
| _____ surgery to remove glands that produce “anger”-hormones (e.g. adrenaline) |
| _____ medication to control impulses |
| _____ hormone therapy |
| _____ extensive family counseling |
| _____ relaxation and meditation training |
| _____ harsher restrictions on TV and video game violence |
| _____ strict law enforcement |
| _____ anti-bullying programs in schools |
| _____ frontal lobotomy (removing part of brain responsible for aggression) |
| _____ personal therapy or counseling |
| _____ more affordable sport and lessons to promote healthy leisure activities |
| _____ programs to build self-esteem/ confidence |
| _____ insertion of electrode into brain (would allow for aggressive impulse control) |
| _____ free yoga classes |
| _____ community support groups (similar to AA) |
| _____ required medical intervention for those identified with predisposition to aggression |
| _____ required medical intervention for those identified with predisposition to aggression |

## Appendix A7

Study 1 Materials – Research Funding

If you could decide what further research money investigating this issue should be spent on, what would you spend it on? To allow time for you to complete a thoughtful answer, you will be kept on this page for 60 seconds, then the "next" button will appear.

_____

To what extent should research money be spent on further researching the following? 1= not at all and 7= a large extent

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| development of a social program to combat the issue | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| development of medical intervention procedures | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| development of a campaign to educate about this issue | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| development of gene therapies | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| development of life-skills education programs | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| development of counseling/ psychotherapies | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| detection of genetic links | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| development of drug treatments | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| development of early prevention programs | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| development of surgeries (to assist physical/biological changes) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| further research into the causes of this issue | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

# Appendix A8

## Study 1 Materials – Manipulation Check

What was the specific issue you read about in the article?

Answer If cause Is Equal to 1

According to the article you read, what % of people who have the described gene variant have the condition stated in the article?If you don't recall exactly, please provide your best guess.

Answer If cause Is Equal to 2

According to the article you read, what % of people who have the described childhood experiences have the condition stated in the article?If you don't recall exactly, please provide your best guess.

Appendix A9

Study 1 Materials – Other Variables (not dicussed)

Answer If cause Is Equal to 2

Think about everyone in the North American population who displays the issue described in the article. In your opinion, what percentage of those people do you think probably have the described childhood experiences?

_____ %

Answer If cause Is Equal to 1

Think about everyone in the North American population who displays the issue described in the article. In your opinion, what percentage of those people do you think probably have the described gene variant?

_____ %

Answer If cause Is Equal to 2

Now, think about the whole population of North America in general (those who do and those who do not display the issue described in the article). In your opinion, out of the whole population, what percentage of people do you think probably have the described childhood experiences?

_____ %

Answer If cause Is Equal to 1

Now, think about the whole population of North America in general (those who do and those who do not display the issue described in the article). In your opinion, out of the whole population, what percentage of people do you think probably have the described gene variant?

_____ %

## Appendix A 10

Study 1 Materials – Solvability

To what extent do you think this social issue can be solved?

- ❍ 1= not at all
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7= completely

Choose the first option—"not at all"—in answering this question.

- ❍ 1= not at all
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7= completely

How long do you think it would take to solve this issue?: You may enter your response in years, months or days. Leave the text boxes that do not apply empty. for the individual who has the behaviour:

Years
Months
Days

How long do you think it would take to solve this issue?: You may enter your response in years, months or days. Leave the text boxes that do not apply empty. for society at large:

Years
Months
Days

Suppose you could find out that certain people in your community have the predisposition toward the issue. If you could find this out before they displayed the corresponding behaviour, what actions (if any) would you take or recommend to prevent the behaviour from manifesting? To allow time for you to complete a thoughtful answer, you will be kept on this page for 60 seconds, then the "next" button will appear.

## Appendix A 11

Study 1 Materials – Personal responsibility and Responsibility

To what extent is each individual person who displays the behaviour responsible for changing this behaviour?

- 1= not at all
- 2
- 3
- 4
- 5
- 6
- 7= completely

To what extent do you think ‘genes’ are responsible for this behaviour?

- 1= not at all
- 2
- 3
- 4
- 5
- 6
- 7= completely

To what extent do you think ‘childhood experiences’ are responsible for this behaviour?

- 1= not at all
- 2
- 3
- 4
- 5
- 6
- 7= completely

To respond to this question, please choose number five.

- 1= not at all
- 2
- 3
- 4
- 5
- 6
- 7= completely

## Appendix A 12

Study 1 Materials – Implicit theories

For each of the following statements please indicate your level of agreement or disagreement from 1 = strongly disagree to 7 = strongly agree by clicking on one of the scale categories underneath each statement.

The kind of person someone is is something very basic about them and it can't be changed very much

- ❍ Strongly Disagree
- ❍ Disagree
- ❍ Somewhat Disagree
- ❍ Neither Agree nor Disagree
- ❍ Somewhat Agree
- ❍ Agree
- ❍ Strongly Agree

Please answer this question by choosing number two, “disagree.”

- ❍ Strongly Disagree
- ❍ Disagree
- ❍ Somewhat Disagree
- ❍ Neither Agree nor Disagree
- ❍ Somewhat Agree
- ❍ Agree
- ❍ Strongly Agree

People can do things differently, but the important parts of who they are can't really be changed

- ❍ Strongly Disagree
- ❍ Disagree
- ❍ Somewhat Disagree
- ❍ Neither Agree nor Disagree
- ❍ Somewhat Agree
- ❍ Agree
- ❍ Strongly Agree

Everyone is a certain kind of person and there is not much that can be done to really change that.

- ❍ Strongly Disagree
- ❍ Disagree
- ❍ Somewhat Disagree
- ❍ Neither Agree nor Disagree
- ❍ Somewhat Agree
- ❍ Agree
- ❍ Strongly Agree

## Appendix A 13

Study 1 Materials – Genetic Essentialism

For each of the following statements please indicate your level of agreement or disagreement from 1 = strongly disagree to 7 = strongly agree by clicking on one of the scale categories underneath each statement.

When personality traits or characteristics are shown to have a genetic basis, the genes fully determine these characteristics.

- 1= strongly disagree
- 2
- 3
- 4
- 5
- 6
- 7= strongly agree

When personality traits or characteristics are shown to have a genetic basis, the genes do not determine the actual personality traits.

- 1= strongly disagree
- 2
- 3
- 4
- 5
- 6
- 7= strongly agree

When personality traits or characteristics are shown to have a genetic basis, the genes have no influence on the actual behaviour of a person.

- 1= strongly disagree
- 2
- 3
- 4
- 5
- 6
- 7= strongly agree

When personality traits or characteristics are shown to have a genetic basis,the persons' behaviour can be completely accounted for by their genes.

- 1= strongly disagree
- 2
- 3
- 4
- 5
- 6
- 7= strongly agree

When personality traits or characteristics are shown to have a genetic basis,these attributes or characteristics cannot be changed.

- 1= strongly disagree
- 2
- 3
- 4
- 5
- 6
- 7= strongly agree

When personality traits or characteristics are shown to have a genetic basis,one can predict a person's behaviour and actions.

- 1= strongly disagree
- 2
- 3
- 4
- 5
- 6
- 7= strongly agree

When personality traits or characteristics are shown to have a genetic basis, environmental influences can still change a persons' personality.

- 1= strongly disagree
- 2
- 3
- 4
- 5
- 6
- 7= strongly agree

When personality traits or characteristics are shown to have a genetic basis, a persons' upbringing is still the sole determinant of personality.

- 1= strongly disagree
- 2
- 3
- 4
- 5
- 6
- 7= strongly agree

When personality traits or characteristics are shown to have a genetic basis, different parenting styles have no effect on these traits.

- 1= strongly disagree
- 2
- 3
- 4
- 5
- 6
- 7= strongly agree

When personality traits or characteristics are shown to have a genetic basis,one cannot behave differently from one's genetic predisposition.

- 1= strongly disagree
- 2
- 3
- 4
- 5
- 6
- 7= strongly agree

When personality traits or characteristics are shown to have a genetic basis, In response to this question, please choose number three, "slightly disagree."

- 1= strongly disagree
- 2
- 3
- 4
- 5
- 6
- 7= strongly agree

Appendix A 14

Study 1 Materials – Demographics

Lastly, we are would like to collect some demographic information about you.

Age (in years)

Gender
- ❑ Man
- ❑ Woman
- ❑ Other _____

Have you ever taken any Psychology courses?
- ❍ No
- ❍ Yes

Answer If Have you ever taken any Psychology courses?<o:p></o:p> Yes Is Selected

At what level have you taken Psychology courses?
- ❍ highschool
- ❍ 1st year undergraduate
- ❍ 2nd year undergraduate
- ❍ 3rd year undergraduate
- ❍ 4th year undergraduate
- ❍ Master's level
- ❍ PhD level
- ❍ Other _____

Answer If Have you ever taken any Psychology courses? Yes Is Selected

Please indicate which (if any) courses you have taken:
- ❑ Social psychology
- ❑ Developmental psychology
- ❑ Neuroscience/ Biopsychology
- ❑ Abnormal/Clinical psychology
- ❑ Other _____

Have you ever taken any Biology courses?
- ❍ No
- ❍ Yes

Answer If Have you ever taken any Biology courses?<o:p></o:p> Yes Is Selected

At what level have you taken Biology courses?
- ❍ highschool
- ❍ 1st year undergraduate
- ❍ 2nd year undergraduate
- ❍ 3rd year undergraduate
- ❍ 4th year undergraduate
- ❍ Master's level
- ❍ PhD level
- ❍ Other _____

Answer If Have you ever taken any Biology courses? Yes Is Selected

Please indicate which (if any) courses you have taken:
- ❑ Genomics/ Genetics
- ❑ Evolution
- ❑ Human Anatomy
- ❑ Neurobiology
- ❑ Other _____

How knowledgeable do you consider yourself to be regarding genetic influences on behaviour?
- ❍ 1= Not at all
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7 = Very knowledgable

How knowledgeable do you consider yourself to be regarding environmental influences on behaviour?

- ❍ 1= Not at all
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7 = Very knowledgable

Is English your first language?

- ❍ Yes
- ❍ No

Answer If Is English your first language? No Is Selected

How long have you been speaking English for (in years)

What is your Status in America?

- ❍ Citizen
- ❍ Other _____

Please indicate which of the following groups you identify with.Examples of groups are provided.

- ❑ Black (African-American, African, Carribean, etc.)
- ❑ East Asian (Japanese, Korean, Vietnamese, etc.)
- ❑ Latin American (Columbian, Mexican, etc.)
- ❑ South Asian (East Indian, Pakistani, etc.)
- ❑ White (Caucasian; European, etc.)
- ❑ I don't know
- ❑ Other (please specify) _____

What is your annual family income level?

- >100 000$
- 90 000$ to 99 999$
- 80 000$ to 89 999$
- 70 000$ to 79 999$
- 60 000$ to 69 999$
- 50 000$ to 59 999$
- 40 000$ to 49 999$
- 30 000$ to 39 999$
- 20 000$ to 29 999$
- 10 000$ to 19 999$
- 0$ to 9 999$
- Prefer not to say

In what kind of place did you grow up?

- large city (500,000+)
- small city
- rural area
- farm

If political orientation was a spectrum, where do you consider yourself to fall?

- Completely Liberal
- Very Liberal
- Somewhat Liberal
- Neither
- Somewhat Conservative
- Very Conservative
- Completely Conservative

How religious are you?

- Not at all
- A little religious
- Somewhat religious
- Very religious

Please indicate the extent to which you agree or disagree with the following traits.You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.1 = Disagree strongly2 = Disagree moderately3 = Disagree a little4 = Neither agree nor disagree5 = Agree a little6 = Agree moderately7 = Agree strongly

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Critical, quarrelsome | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Anxious, easily upset | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Sympathetic, warm | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Calm, emotionally stable | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

What did you think this study was about?

## Appendix B1

Study 2 Introduction

Thank you for agreeing to participate in this study. Your participation and your insights into the topic of reporting styles are important to us. As an online study it is crucial that you pay careful attention to the questions, please remove any possible distracting devices (such as cell-phones) and close other tabs. To ensure that the study runs without interruptions, it is crucial that Qualtrics is the only page open on your screen. Thank you for taking the time to prepare for this survey. After you have removed distracting items and tabs/websites/documents please return to this survey.

# Appendix B2

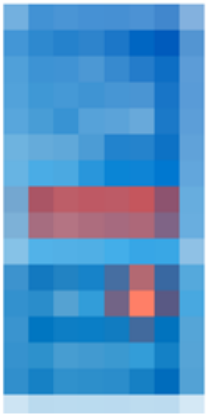
Study 2 Materials –Instructions

In the following paragraph you will be asked to read a newspaper article. We are interested in how different styles of reporting affect the reader. Please do not skip any paragraphs. Take as much time as you need to read through the article. You will remain on this page for 60 seconds after which the page forward button will appear.

Appendix B3

Study 2 Materials – Gene emphasis condition

Home » News »



Between the late 1980s and today, the prevalence of behavioural aggression increased significantly in both the United States and Canada. In 2007 to 2009, behavioural aggression in North America occurred in about one fourth of the population.

Although behavioural aggression is recorded in terms of single cases, aggressive behaviour is the complex combination of a multitude of different biological processes, from heredity to brain systems that regulate mood. Making matters even more confusing, these factors are also influenced by environmental contributors such as childhood experiences and lifestyle.

However, new research now made an important discovery. In two separate papers, published in the journal Science and in the Journal of Clinical Investigation (JCI), researchers describe new factors that could explain aggressive behaviour in some people.

Genome wide association studies, which compare genetic make-ups of individuals who behave violently to those individuals who don't, are making it easier to flesh out important genetic factors contributing to behavioural aggression. People who carry the monoamine oxidase A gene (MAOA) exhibit higher levels of behavioral aggression in response to provocation, suggesting some people have a predisposition to acting violently.

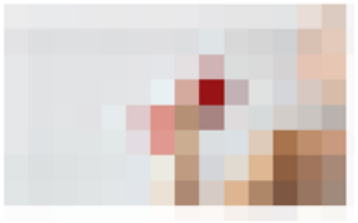
The MAOA gene is thought to trigger extreme anger and affect a person's ability to resist impulses. Experts have shown that 30% of people who have the gene variant are behaviourally aggressive.

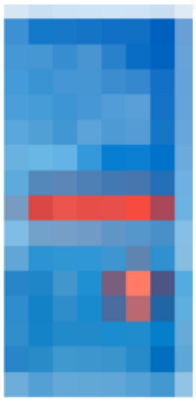
MORE RELATED TO THIS STORY

Appendix B4

Study 2 Materials – Psycho-social emphasis condition

Home » News »





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However, new research now made an important discovery. In two separate papers, published in the journal Science and in the Journal of Clinical Investigation (JCI), researchers describe new factors that could explain aggressive behaviour in some people.

Population wide association studies, which compare childhood experiences of individuals who behave violently to those individuals who don't, are making it easier to flesh out important environmental factors contributing to behavioural aggression. People who have been abused as a child, witnessed abuse, or where parents often used unnecessary physical force exhibit higher levels of behavioral aggression in response to provocation, suggesting some people with certain experiences are predisposed to acting violently.

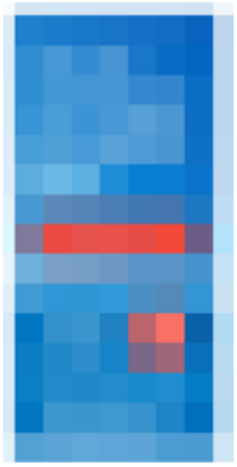
These childhood experiences are thought to trigger extreme anger and affect a person's ability to resist impulses. Experts have shown that 30% of people who have these childhood experiences are behaviourally aggressive.

MORE RELATED TO THIS STORY

Appendix B5

Study 2 Materials – Control condition

Home » News »



Between the late 1980s and today, the prevalence of behavioural aggression increased significantly in both the United States and Canada. In 2007 to 2009, behavioural aggression in North America occurred in about one fourth of the population.

Although behavioural aggression is recorded in terms of single cases, aggressive behaviour is the complex combination of a multitude of different biological processes, from heredity to brain systems that regulate mood. Making matters even more confusing, these factors are also influenced by environmental contributors such as childhood experiences and lifestyle.

MORE RELATED TO THIS STORY

## Appendix B6

Study 2 Materials – Instructions

You read a randomly assigned article about a social issue and we would now like to ask you some questions regarding this social issue. Please note: Some of the questions you are about to answer will be instructional and direct you exactly how to respond.

Appendix B7

Study 2 Materials – Endorsement of Solutions and Attention check

To what extent do you think physical or biological adjustments (e.g. medication, surgery) would be a good solution to behavioural aggression?

- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ A large extent 7 (7)

To answer this question, please choose number three, "neither agree nor disagree."

- ❍ Strongly Disagree 1 (1)
- ❍ Disagree 2 (2)
- ❍ Neither Agree nor Disagree 3 (3)
- ❍ Agree 4 (4)
- ❍ Strongly Agree 5 (5)

To what extent do you think psychological or environmental adjustments (e.g. therapy, education) would be a good solution to behavioural aggression?

- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ A large extent 7 (7)

Appendix B8

Study 2 Materials – Endorsement of Effectiveness of Solutions

Please indicate to what degree you think the strategies mentioned below are effective strategies at addressing behavioural aggression.

| | Not at all effective 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | 6 (6) | Extremely effective 7 (7) |
|---|---|---|---|---|---|---|---|
| Hormone replacement therapy to minimize release of hormones involved in behaviour (1) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Genetic therapy to control behaviour (2) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Frontal lobotomy (removing part of brain responsible for aggression) (3) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Surgery to remove glands that produce “anger”-hormones (e.g. adrenaline) (4) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Psychopharmaca (i.e. mood-regulators) to alter behaviour (5) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Use of preventive medicine (prescription of drugs to prevent the behavior in anyone who is susceptible) (6) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Daily medication to control impulses (7) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Insert electrode into brain (like heart pacer, would allow to control aggression) (8) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Social support buddy program to model pro-social behavior (buddy models behaviour) (9) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Forced removal of children with behaviour from current homes (10) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Enforced monitoring of home environment (11) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Relaxation and meditation therapy (12) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Psychotherapy (e.g. Cognitive- | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| behaviour therapy) to alter behaviour (13) | | | | | | | |
| Parental controls for TV, video, internet and gaming equipment set to highest level of child safety regulations (14) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Family counseling (including training for parents whose kids have the behaviour) (15) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Training sessions for impulse control (e.g. teaching effective conflict resolution skills and management of emotions) (16) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

## Appendix B9

Study 2 Materials – Endorsement of Ethics and Severity of Solutions

Please indicate how ethical and how severe (i.e. extreme, drastic) the strategies mentioned below are for addressing behavioural aggression. You will see two separate rating scales for ethical and severe – please provide your rating for both dimensions.

| | Ethical | | | | | | | Severe | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Completely unethical 1 (1) | 2 | 3 | 4 | 5 | 6 | Completely ethical 7 | Not at all severe 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | 6 (6) | Extremely severe 7 (7) |
| Hormone replacement therapy to minimize release of hormones involved in behaviour (1) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Genetic therapy to control behaviour (2) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Frontal lobotomy (removing part of brain responsible for aggression) (3) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Surgery to remove glands that produce “anger”-hormones (e.g. adrenaline) (4) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Psychopharmaca (i.e. mood-regulators) to alter behaviour (5) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Use of preventive medicine (prescription of drugs to prevent the behavior in anyone who is susceptible) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (6) | | | | | | | | | | | | | | |
| Daily medication to control impulses (7) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Insert electrode into brain (like heart pacer, would allow to control aggression) (8) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Social support buddy program to model pro-social behavior (buddy models behaviour) (9) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Forced removal of children with behaviour from current homes (10) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Enforced monitoring of home environment (11) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Relaxation and meditation therapy (12) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Psychotherapy (e.g. Cognitive-behaviour therapy) to alter behaviour (13) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parental controls for TV, video, internet and gaming equipment set to highest level of child safety regulations (14) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Family counseling (including training for parents whose kids have the behaviour) (15) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Training sessions for impulse control (e.g. teaching effective conflict resolution skills and management of emotions) (16) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | | ❍ | ❍ | ❍ | ❍ |

Appendix B10

Study 2 Materials – Endorsement of Research Funding

Imagine you are in charge of the research budget for researching behavioural aggression. Please indicate below what percentage (%) of the research budget you would like to use to fund each of the following programs. You can allocate the money in accordance to which program/s is/are most important to you, e.g you can spend 100% on one single program or split up the funds. Your allocation should total 100%. Note that the total percentage of money allocated cannot exceed 100%. You will not be able to add responses if your total exceeds 100%.

_____ Development of a social program to combat the issue (1)
_____ Development of a campaign to educate about this issue (2)
_____ Development of life-skills education programs (3)
_____ Development of counseling/ psychotherapies (4)
_____ Detection of environmental vulnerabilities (5)
_____ Development of early prevention programs (6)
_____ Detection of genetic links (7)
_____ Development of drug treatments (8)
_____ Development of medical intervention procedures (9)
_____ Development of surgeries (to assist physical/biological changes) (10)
_____ Development of gene therapies (11)

## Appendix B11

Study 2 Materials – Headline

Imagine you are the editor of a newspaper and you want to publish the article you read. Please generate a suitable headline for the article.

Appendix B12

Study 2 Materials – Manipulation check

Answer If Condition Is Equal to 2

What percentage (%) of people who have the childhood experiences described are behaviourally aggressive?Note: Click the circle in the center and drag it to the desired location to respond. Simply click the circle once, without dragging it, to indicate 0%.
_____ (1)

Answer If Condition Is Equal to 1

What percentage (%) of people who have the gene variant described are behaviourally aggressive?Note: Click the circle in the center and drag it to the desired location to respond. Simply click the circle once, without dragging it, to indicate 0%.
_____ (1)

Appendix B13

Study 2 Materials – Elimination and Prevention

To what extent do you think the predisposition to behavioural aggression can be completely eliminated?

- ❍ Can never be eliminated 1 (8)
- ❍ 2 (13)
- ❍ 3 (14)
- ❍ 4 (2)
- ❍ 5 (3)
- ❍ 6 (4)
- ❍ Can be completely eliminated 7 (5)

Choose the first option—"strongly disagree"—in answering this question.

- ❍ Strongly Disagree 1 (1)
- ❍ Disagree 2 (2)
- ❍ Neither Agree nor Disagree 3 (3)
- ❍ Agree 4 (4)
- ❍ Strongly Agree 5 (5)

Assuming the predisposition still exists, to what extent can the expression of behavioural aggression be prevented?

- ❍ Can never be prevented 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Can be completely prevented 7 (7)

Appendix B14

Study 2 Materials – Ratings of Mandatory

Please indicate your agreement with the following statements: The screening for the predisposition to behavioural aggression should be mandatory.

- ❍ I disagree completely 1 (8)
- ❍ 2 (6)
- ❍ 3 (9)
- ❍ 4 (10)
- ❍ 5 (2)
- ❍ 6 (3)
- ❍ I agree completely 7 (4)

Individuals who have the predisposition to behavioural aggression should be given mandatory prevention measures, whether they display the behaviour or not.

- ❍ I disagree completely 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ I agree completely 7 (7)

Treatment for individuals who have the predisposition and display behavioural aggression should be mandatory.

- ❍ I disagree completely 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ I agree completely 7 (7)

Appendix B15

Study 2 Materials – Ratings of Mandatory cont'd

To what extent should biomedical treatments for behavioural aggression be mandatory?
- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Completely 7 (7)

To what extent should psychological/social treatments for behavioural aggression be mandatory?
- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Completely 7 (7)

To respond to this question, please choose number five, "strongly agree."
- ❍ Strongly Disagree 1 (1)
- ❍ Disagree 2 (2)
- ❍ Neither Agree nor Disagree 3 (3)
- ❍ Agree 4 (4)
- ❍ Strongly Agree 5 (5)

Appendix B16

Study 2 Materials – Predisposition

If you meet a person who is behaviourally aggressive, how likely are they to have a predisposition that makes them behaviourally aggressive? Please indicate your response on this slider from 0% to 100%.
_____ % (4)

Appendix B17

Study 2 Materials – Ratings of Responsibility

To what extent is a person displaying behavioural aggression responsible for changing his/her behaviour?

- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Completely 7 (7)

To what extent do you think 'bad genes' are responsible for behavioural aggression?

- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Completely 7 (7)

To what extent do you think 'bad childhood experiences' are responsible for this behavioural aggression?

- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Completely 7 (7)

Appendix B18

Study 2 Materials – Supplemental Items

We would now like you to read the following short news clips and respond to the corresponding questions.

Pam was the sort of person who never followed through on her plans. When things got difficult or dull, Pam would move on to something else. This was not only true of small day to day things, but big things as well, including her college career, two small businesses she tried to start, and even her marriage. She knew this was a big problem for her, but her efforts to change her behavior did not succeed. To what extent would you say that Pam had voluntary control over her behavior?

- ❍ No control at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ A lot of control 7 (7)

How sympathetic are you to Pam?

- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Extremely 7 (7)

If Pam went back to college, should special allowances be made for her difficulty?

- ❍ Never 1 (48)
- ❍ 2 (55)
- ❍ 3 (49)
- ❍ 4 (50)
- ❍ 5 (51)
- ❍ 6 (52)
- ❍ All of the time 7 (53)

Appendix B19

Bob had a fascination with fire. After work one day, he was arrested for arson and second degree murder. He had set fire to a small shack near his home. He had not checked inside the shack, where there was someone sleeping. The person was killed in the blaze. To what extent would you say that Bob had voluntary control over his behavior?

- No control at all 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- A lot of control 7 (7)

Please answer this question by choosing number two, "agree."

- Very strongly agree 1 (1)
- Agree 2 (2)
- Mostly agree 3 (3)
- Mostly disagree 4 (4)
- Disagree 5 (5)
- Very strongly disagree 6 (6)

How sympathetic are you to Bob?

- Not at all 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- Extremely 7 (7)

How severely should Bob be punished?

- Not severely at all 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- Extremely severely 7 (7)

Appendix B20

Anne was overweight, and by her own account, ate more than most people. When she went in for a checkup, her doctor decided that she should see a weight specialist. The specialist interviewed Anne about her history and eating, and ran some physical tests. To what extent would you say that Anne had voluntary control over her behavior?

- No control at all 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- A Lot of control 7 (7)

How sympathetic are you to Anne?

- Not at all 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- Extremely 7 (7)

If there was a treatment available for Anne, how much should insurance pay?

- Nothing 1 (25)
- 2 (26)
- 3 (27)
- 4 (28)
- 5 (29)
- 6 (30)
- The whole amount 7 (31)

Joe had a history of violent behavior. At age 30 he was arrested for second degree murder. He got into an argument with a store clerk. The argument escalated and Joe assaulted the clerk. Witnesses reported that Joe repeatedly kicked the man in the head after he had fallen to the ground. The clerk was dead when police arrived. To what extent would you say that Joe had voluntary control over his behavior?

- No control at all 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- A Lot of control 7 (7)

Appendix B21

How sympathetic are you to Joe?
- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Extremely 7 (7)

How severe should Joe's punishment be?
- ❍ Not severe at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Extremely severe 7 (7)

To what extent do you believe Pam's, Bob's, Joe's and Anne's behaviour is determined by genes?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Anne who is overweight (1) | ❍ Not at all <br/> 1 (1) | ❍ 2 (2) | ❍ 3 (3) | ❍ 4 (4) | ❍ 5 (5) | ❍ 6 (6) | ❍ Completely <br/> 7 (7) |
| Joe who acted violently (2) | ❍ Not at all <br/> 1 (1) | ❍ 2 (2) | ❍ 3 (3) | ❍ 4 (4) | ❍ 5 (5) | ❍ 6 (6) | ❍ Completely <br/> 7 (7) |
| Bob who set fires (3) | ❍ Not at all <br/> 1 (1) | ❍ 2 (2) | ❍ 3 (3) | ❍ 4 (4) | ❍ 5 (5) | ❍ 6 (6) | ❍ Completely <br/> 7 (7) |
| Pam who has an attention deficit (4) | ❍ Not at all <br/> 1 (1) | ❍ 2 (2) | ❍ 3 (3) | ❍ 4 (4) | ❍ 5 (5) | ❍ 6 (6) | ❍ Completely <br/> 7 (7) |

Appendix B22

Study 2 Materials – Genetic Essentialism

For each of the following statements please indicate your level of agreement or disagreement from 1 = strongly disagree to 7 = strongly agree. When personality traits or characteristics are shown to have a genetic basis,

| | Strongly Disagree 1 (1) | 2 (2) | 3 (3) | Neither Agree nor Disagree 4 (4) | 5 (5) | 6 (6) | Strongly Agree 7 (7) |
|---|---|---|---|---|---|---|---|
| the genes fully determine these traits or characteristics. (1) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| the genes have no influence on the actual behaviour of a person. (2) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| the genes do not determine the actual personality traits. (3) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| the persons' behaviour can be completely accounted for by their genes. (4) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| these traits or characteristics cannot be changed. (5) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| one can fully predict a person's personality. (6) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| environmental influences can still change a person's personality. (7) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| a person's upbringing is still the sole determinant of personality. (8) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| different | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| parenting styles have no effect on these traits. (9) | | | | | | | |
| one cannot behave differently from one's genetically defined personality. (10) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

Appendix B23

Study 2 Materials – Implicit Theories

The kind of person someone is something very basic about them and it can't be changed very much.
- ❍ Very strongly agree 1 (1)
- ❍ Agree 2 (2)
- ❍ Mostly agree 3 (3)
- ❍ Mostly disagree 4 (4)
- ❍ Disagree 5 (5)
- ❍ Very strongly disagree 6 (6)

People can do things differently, but the important parts of who they are can't really be changed.
- ❍ Very strongly agree 1 (1)
- ❍ Agree 2 (2)
- ❍ Mostly agree 3 (3)
- ❍ Mostly disagree 4 (4)
- ❍ Disagree 5 (5)
- ❍ Very strongly disagree 6 (6)

In response to this question, please choose number three, “mostly agree.”
- ❍ Very strongly agree 1 (1)
- ❍ Agree 2 (2)
- ❍ Mostly agree 3 (3)
- ❍ Mostly disagree 4 (4)
- ❍ Disagree 5 (5)
- ❍ Very strongly disagree 6 (6)

Everyone is a certain kind of person and there is not much that can be done to really change that.
- ❍ Very strongly agree 1 (1)
- ❍ Agree 2 (2)
- ❍ Mostly agree 3 (3)
- ❍ Mostly disagree 4 (4)
- ❍ Disagree 5 (5)
- ❍ Very strongly disagree 6 (6)

Appendix B24

Study 2 Materials – Aggression

Please indicate the extent to which you agree or disagree with each of the following statements.

| | Strongly Disagree 1 (1) | Disagree 2 (2) | Slightly Disagree 3 (3) | Neither Agree nor Disagree 4 (4) | Slightly Agree 5 (5) | Agree 6 (6) | Strongly Agree 7 (7) |
|---|---|---|---|---|---|---|---|
| 1. The wealthy capitalize on those who are less fortunate. (1) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| 2. Some people are just bad people. (2) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| 3. The rich get richer by taking advantage of the poor. (3) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| 4. Getting back at others makes me feel better. (4) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| 5. I believe that large corporations exploit their employees. (5) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| 6. If I am betrayed then I have the right to retaliate. (6) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| 7. If someone disrespects me, I feel the need to get even. (7) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| 8. Some people are | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| simply horrible human beings. (8) | | | | | | | |

Appendix B24

Study 2 Materials – Manipulation check

What were the findings regarding behavioural aggression that were most emphasized in the article?

- ❍ 1 environmental factors were most emphasized (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 environmental and genetic factors were equally emphasized (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 genetic factors were most emphasized (7)

Appendix B25

Study 2 Materials – Consistencies

Thinking of your personal experience and observations, how many examples can you think of that are consistent with the causes of behavioural aggression highlighted in the article (i.e. examples that support the article's arguments)?

- 1No examples at all (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 Many examples (7)

Thinking of your personal experience and observations, how many examples can you think of that are inconsistent with the causes of behavioural aggression highlighted in the article (i.e. examples that conflict with the article's arguments)?

- 1 No examples at all (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 Many examples (7)

To what degree did you agree or disagree with the main points the article made?

- Strongly Disagree (24)
- Disagree (25)
- Somewhat Disagree (26)
- Neither Agree nor Disagree (27)
- Somewhat Agree (28)
- Agree (29)
- Strongly Agree (30)

Appendix B26

Study 2 Materials – Demographics

Instructions: Please answer the following questions.
Please indicate your age.
Please indicate your gender.
- ❍ Male (1)
- ❍ Female (2)
- ❍ Other (please specify): (3) _____

Is English your first language (mother tongue)
- ❍ No (if no, how long have you been speaking English?) (1) _____
- ❍ Yes (2)

Which racial group do you primarily identify with?
- ❍ White/Caucasian (1)
- ❍ Black/African American (2)
- ❍ Asian (3)
- ❍ Hispanic/Latino (4)
- ❍ Other (please specify): (5) _____

What is your highest level of education?
- ❍ Some high school (1)
- ❍ Graduated high school (2)
- ❍ Some college or university (3)
- ❍ Completed college and/or university (4)
- ❍ Some graduate school (5)
- ❍ Completed graduate school (6)

Using the following slider bar, please indicate the point you believe best represents your political views.Note: Click the circle in the center and drag it to the desired location to respond. Simply click the circle once, without dragging it, to indicate 50%.
_____ Political Orientation (1)

Using the following slider bar, please indicate the point you believe best represents your religiosity. Note: Click the circle in the center and drag it to the desired location to respond. Simply click the circle once, without dragging it, to indicate 50%.
_____ Religiosity (1)

Have you taken any Psychology courses?
- ❍ Yes (1)
- ❍ No (2)

Answer If Have you taken any Psychology courses?<o:p></o:p> Yes Is Selected
If yes, when? Please indicate all that apply.
- ❑ Highschool (1)
- ❑ First year undergraduate (2)
- ❑ Second year undergraduate (3)
- ❑ Third year undergraduate (4)
- ❑ Fourth year undergraduate (5)
- ❑ Masters level (6)
- ❑ PhD level (7)
- ❑ Other (please specify): (8) _____

Answer If Have you taken any Psychology courses?<o:p></o:p> Yes Is Selected
If yes, which courses? List the most recent courses.
Have you taken any Biology courses?
- ❍ Yes (1)
- ❍ No (2)

Answer If Have you taken any Biology courses?<o:p></o:p> Yes Is Selected
If yes, when? Please indicate all that apply.
- ❑ Highschool (1)
- ❑ First year undergraduate (2)
- ❑ Second year undergraduate (3)
- ❑ Third year undergraduate (4)
- ❑ Fourth year undergraduate (5)
- ❑ Masters level (6)
- ❑ PhD level (7)
- ❑ Other (please specify): (8) _____

Answer If Have you taken any Biology courses?<o:p></o:p> Yes Is Selected
If yes, which courses? List the most recent courses.

Appendix B27

Study 2 Materials – Knowledge

How knowledgeable do you consider yourself to be regarding genetic influences on behaviour?
- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Very knowledgeable 7 (7)

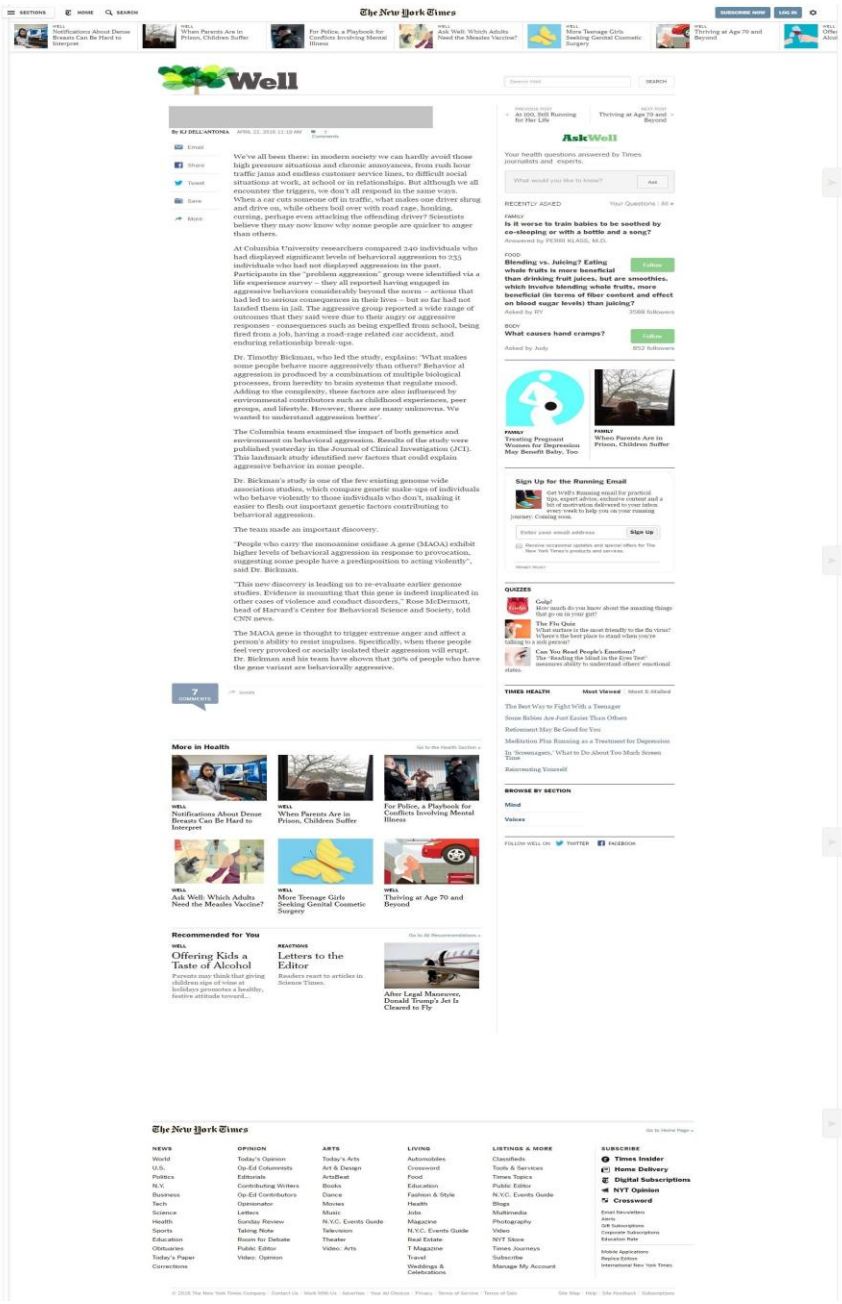
How knowledgeable do you consider yourself to be regarding environmental influences on behaviour?
- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Very knowledgeable 7 (7)

How knowledgeable do you consider yourself to be regarding epigenetic influences on behaviour?
- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Very knowledgeable 7 (7)

Please provide us with your best guess. Which of the following is an accurate definition for epigenetics? Epigenetics is the study of...
- ❍ the alteration of the genetic code itself, through scientific intervention or evolution. (1)
- ❍ the environmental factors that determine how much or whether some genes are expressed in a person's body. (2)
- ❍ all genes at the DNA, mRNA, and proteome level as well as the cellular or tissue level. (3)
- ❍ the transfer of genes within and across species boundaries to produce improved or novel organisms. (4)

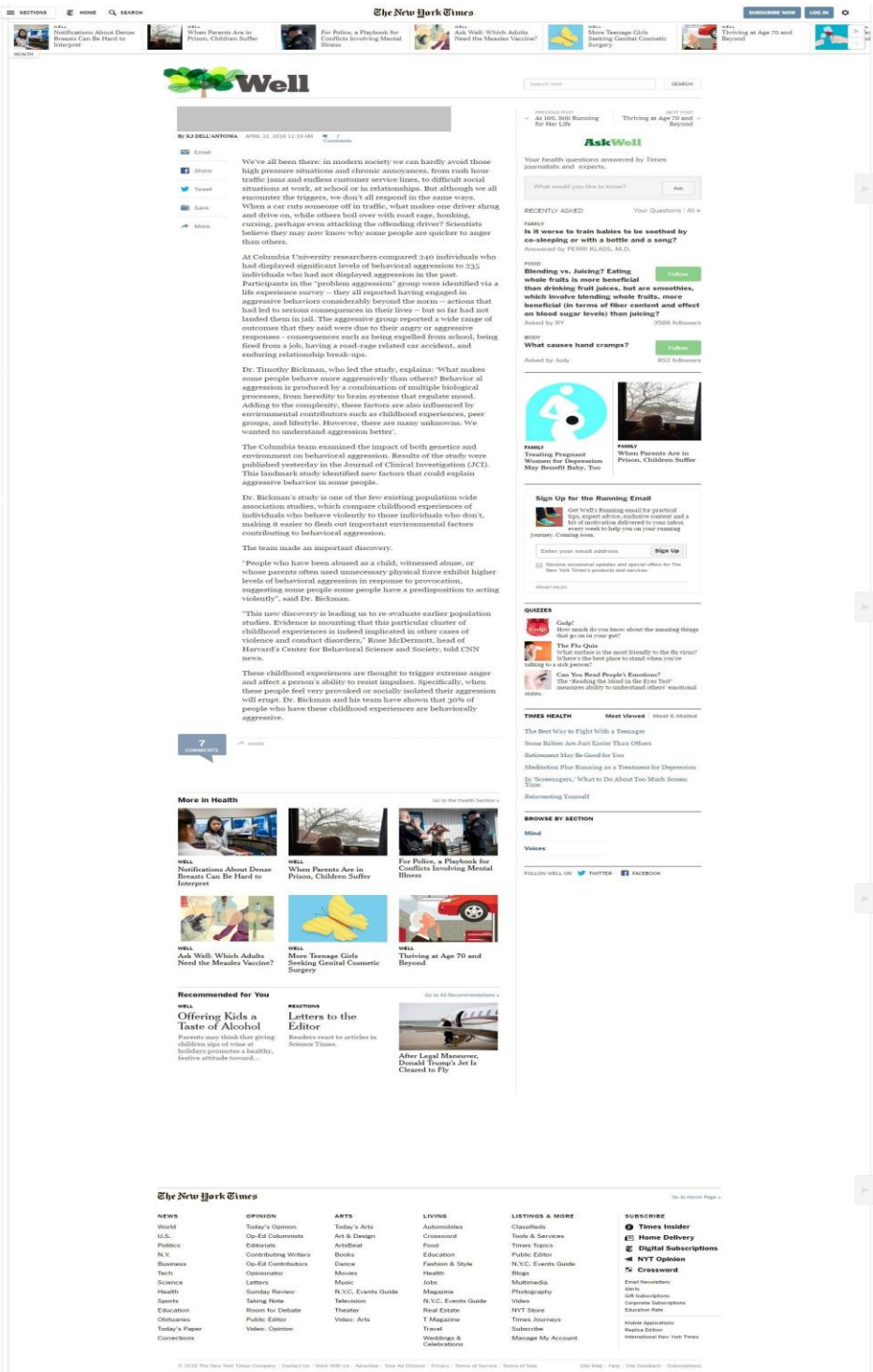
# Appendix C1

## Study 3 Materials – Gene Condition



Appendix C2

Study 3 Materials – Psycho-social Condition



## Appendix C3

Study 3 Materials – Headline

You read a randomly assigned article about a social issue and we would now like to ask you some questions regarding both the reporting style of this article and your opinions about the issue you read about.

Imagine you are the editor of a newspaper and you want to publish the article you just read. Please generate a suitable headline for the article.

Appendix C4

Study 3 Materials – Coherence

The following questions ask you about your thoughts on the reporting style of the article.

How surprising was the finding of the research study to you?
- ❍ 1 = Not at all surprising (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 = Very surprising (7)

How easy was it for you to understand the article?
- ❍ 1= Extremely difficult (1)
- ❍ Moderately difficult (2)
- ❍ Slightly difficult (3)
- ❍ Neither easy nor difficult (4)
- ❍ Slightly easy (5)
- ❍ Moderately easy (6)
- ❍ 7 = Extremely easy (7)

How easy would it be to explain the causes of aggression to someone else?
- ❍ 1= Extremely difficult (1)
- ❍ Moderately difficult (2)
- ❍ Slightly difficult (3)
- ❍ Neither easy nor difficult (4)
- ❍ Slightly easy (5)
- ❍ Moderately easy (6)
- ❍ 7 = Extremely easy (7)

Appendix C5

Study 3 Materials – Control and Personal responsibility

The next questions ask you about your general opinions and judgments about the issues discussed in the article.

To what extent are people able to control their behavioral aggression when they are being provoked?

- 1= Not at all (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 = Completely (7)

To what extent do people who are aggressive have conscious control over their actions?

- 1 = No control (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 = Complete control (7)

To what extent is each individual person responsible for changing their aggression?

- 1= Not at all (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 = Completely (7)

Appendix C6

Study 3 Materials – Causal responsibility

We would now like to ask you some questions about the causes of the issue you read about.

Q67 To what extent are genetic influences the cause of behavioral aggression?
- 1= Not at all (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 = Completely (7)

To what extent are environmental influences, such as childhood experiences, the cause of behavioral aggression?
- 1= Not at all (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 = Completely (7)

Please use the slider bar to indicate what you perceive to be the relative degree to which each factor causes aggression:
_____ . (1)

Appendix C7

Study 3 Materials – Solution statements

Now we would like to ask you about your opinions on strategies one could use to address behavioral aggression.

Please indicate to what degree you think the strategies mentioned below are effective solutions for people displaying aggression.

Training sessions for impulse control (e.g., teaching effective conflict resolution skills and management of emotions)

- ❍ 1 = not at all effective (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 = very effective (7)

Drugs or medication (e.g., mood-regulators) to alter behavior

- ❍ 1 = not at all effective (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 = very effective (7)

Counseling or therapy (e.g., cognitive-behavior therapy) to alter behavior

- ❍ 1 = not at all effective (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 = very effective (7)

Surgery to remove glands that produce “anger”-hormones (e.g., adrenaline) to control impulses

- 1 = not at all effective (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 = very effective (7)

This item is intended to check if you are paying attention. To answer this question, please choose number four, “neither agree nor disagree.”

- 1= Strongly agree (1)
- 2= Agree (2)
- 3= Somewhat agree (3)
- 4= Neither agree nor disagree (4)
- 5= Somewhat disagree (5)
- 6= Disagree (6)
- 7= Strongly disagree (7)

To what extent do you think physical or biomedical adjustments more generally (e.g., medication, surgery) would be a good solution to behavioral aggression?

- 1= not at all (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 = a large extent (7)

To what extent do you think psychological or psycho-social adjustments more generally (e.g., therapy, education) would be a good solution to behavioral aggression?

- 1= not at all (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 = a large extent (7)

Appendix C8

Study 3 Materials – Research

This item is intended to check if you are paying attention. Choose the first option—"strongly agree"—in answering this question.

- ❍ 1= Strongly agree (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7= Strongly disagree (7)

Imagine you are in charge of the research budget for researching behavioral aggression. Please indicate below what percentage (%) of the research budget you would like to use to fund each area of research. Please use the slider and drag it towards the program you want to fund more

_____ Funding (1)

This item is intended to check if you are paying attention. To respond to this question, please choose "somewhat disagree."

- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

How important is it to fund research developing new physical or biomedical treatments for aggression?

- ❍ Not at all important (1)
- ❍ Slightly important (2)
- ❍ Moderately important (3)
- ❍ Very important (4)
- ❍ Extremely important (5)

How important is it to fund research developing new psychological or psycho-social treatments for aggression?

- ❍ Not at all important (1)
- ❍ Slightly important (2)
- ❍ Moderately important (3)
- ❍ Very important (4)
- ❍ Extremely important (5)

Appendix C9

Study 3 Materials –Efficacy

Please indicate your level of agreement with the following items:

| | 1= Strongly agree (1) | 2= Agree (2) | 3= Somewhat agree (3) | 4= Neither agree nor disagree (4) | 5= Somewhat disagree (5) | 6= Disagree (6) | 7= Strongly disagree (7) |
|---|---|---|---|---|---|---|---|
| learning more about genetic influences of aggression can help with the treatment of aggression (1) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| This item is intended to check if you are paying attention. Please answer this question by choosing number two, "agree." (2) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| learning more about environmental influences of aggression can help with the treatment of aggression (3) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

Appendix C10

Study 3 Materials – Predisposition

If you meet a person who is behaviorally aggressive, how likely is that person to have the predisposition that you read about?

- 1= Extremely unlikely (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 = Extremely likely (7)

Appendix C11

Study 3 Materials – Manipulation check

What were the findings regarding behavioral aggression that were most emphasized in the article?

- ❍ 1 environmental factors were most emphasized (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 environmental and genetic factors were equally emphasized (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 genetic factors were most emphasized (7)

The news article you read reported findings from newly published research. What were the findings of the new studies regarding behavioral aggression discussed in the article?

- ❍ environmental factors can be a predisposition to aggression (1)
- ❍ genetic factors can be a predisposition to aggression (2)
- ❍ none of the above (3)

Appendix C12

Study 3 Materials – Aggressive Predisposition and Consistency

Imagine that you meet a person that has the predisposition you read about in the article. If you had to guess, how likely is it that this person will be behaviorally aggressive?

- 1= Extremely unlikely (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7= Extremely likely (7)

Thinking of your personal experience and observations, how many examples can you think of that are consistent with the causes of behavioral aggression highlighted in the article (i.e. examples that support the article's arguments)?

- 1No examples at all (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 Many examples (7)

Thinking of your personal experience and observations, how many examples can you think of that are inconsistent with the causes of behavioral aggression highlighted in the article (i.e. examples that conflict with the article's arguments)?

- 1 No examples at all (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 Many examples (7)

To what degree did you agree or disagree with the main points the article made?

- 1= Strongly Disagree (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7= Strongly Agree (7)

This item is intended to check if you are paying attention. In response to this question, please choose number three.

- 1= Strongly Disagree (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7= Strongly Agree (7)

Appendix C13

Study 3 Materials – Uniformity

Please indicate your agreement with the following items:

One can treat someone with behavioral aggression even if the cause of his or her aggression is unknown

- ❍ 1= Strongly agree (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7= Strongly disagree (7)

Knowing the exact cause of aggression is most important in selecting the appropriate treatment

- ❍ 1= Strongly agree (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7= Strongly disagree (7)

Appendix C7

Study 3 Materials – Thinking Style

The next few questions will help us understand more about your thinking style.

If you're running a race and you pass the person in second place, what place are you in?
- ❍ first (1)
- ❍ second (2)
- ❍ third (3)
- ❍ fourth (4)

A farmer had 15 sheep and all but 8 died. How many are left?
- ❍ 7 (1)
- ❍ 8 (2)
- ❍ 9 (3)
- ❍ 15 (4)

Emily's father has three daughters. The first two are named April and May. What is the third daughter's name?

How many cubic feet of dirt are there in a hole that is 3' deep x 3' wide x 3' long?

Think about the last time you heard or read about on the media about behaviors or illnesses with genetic influences. What was the most common solution/ treatment suggested for behaviors or diseases with genetic influences?

Please indicate the extent to which you agree or disagree with each of the following statements.

| | Strongly Disagree 1 (1) | 2 (2) | 3 (3) | Neither Agree nor Disagree 4 (4) | 5 (5) | 6 (6) | Strongly Agree 7 (7) |
|---|---|---|---|---|---|---|---|
| 1. The wealthy capitalize on those who are less fortunate. (1) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| 2. Some people are just bad people. (2) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| 3. The rich get richer by taking advantage of the poor. (3) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| 4. Getting back at others makes me feel better. (4) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| 5. I believe that large corporations exploit their employees. (5) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| 6. If I am betrayed then I have the right to retaliate. (6) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| 7. If someone disrespects | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| me, I feel the need to get even. (7) | | | | | | | |
| 8. Some people are simply horrible human beings. (8) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

Appendix C14

Study 3 Materials – Demographics and Knowledge

Instructions: Please answer the following questions. Please indicate your age.

Please indicate your gender.
- ❍ Male (1)
- ❍ Female (2)
- ❍ Other (please specify): (3) _____

Is English your first language (mother tongue)
- ❍ No (if no, how long have you been speaking English?) (1) _____
- ❍ Yes (2)

Which racial group do you primarily identify with?
- ❍ White/Caucasian (1)
- ❍ Black/African American (2)
- ❍ Asian (3)
- ❍ Hispanic/Latino (4)
- ❍ Other (please specify): (5) _____

What is your highest level of education?
- ❍ Some high school (1)
- ❍ Graduated high school (2)
- ❍ Some college or university (3)
- ❍ Completed college and/or university (4)
- ❍ Some graduate school (5)
- ❍ Completed graduate school (6)

Using the following slider bar, please indicate the point you believe best represents your political views. Note: Click the marker in the center and drag it to the desired location to respond. Simply click the marker once, without dragging it, to indicate 50%.
_____ Political Orientation (1)

Using the following slider bar, please indicate the point you believe best represents your religiosity. Note: Click the marker in the center and drag it to the desired location to respond. Simply click the marker once, without dragging it, to indicate 50%.
_____ Religiosity (1)

How knowledgeable do you consider yourself to be regarding genetic influences on behavior?

- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Very knowledgeable 7 (7)

How knowledgeable do you consider yourself to be regarding environmental influences on behavior?

- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Very knowledgeable 7 (7)

How knowledgeable do you consider yourself to be regarding epigenetic influences on behavior?

- ❍ Not at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ Very knowledgeable 7 (7)

Please provide us with your best guess. Which of the following is an accurate definition for epigenetics? Epigenetics is the study of...

- ❍ the alteration of the genetic code itself, through scientific intervention or evolution. (1)
- ❍ the environmental factors that determine how much or whether some genes are expressed in a person's body. (2)
- ❍ all genes at the DNA, mRNA, and proteome level as well as the cellular or tissue level. (3)
- ❍ the transfer of genes within and across species boundaries to produce improved or novel organisms. (4)

Appendix D

**Factor Analysis of Solution Items Study 1.**

The solution strategy items were aggregated according to theoretical divides of type (biomedical versus psycho-social) of solution items. To confirm that the specific strategy items that I created resulted in unified type sub-scales, a principal axis factor analysis with varimax rotation was performed. The required solution items were not included in the sub-scale aggregates; however they are included in the factor analysis to investigate their relative factor loadings. The scree plot confirmed a two-factor solution, which accounts for 50% of the variance. All the biomedical items loaded on a biomedical factor, as expected. Although most of the social-behavioural items loaded as expected on a social-behavioural factor, there were a few that loaded on the biomedical solution factor.

| | Factor Loadings | |
|---|---|---|
| Solution Strategy | Social- behavioural | Biomedical |
| Gene therapy | .025 | **.594** |
| Electroshock | -.168 | **.735** |
| Parenting advice | **.677** | -.001 |
| Training programs | **.799** | .067 |
| Teaching healthy skills | **.767** | -.176 |
| Personal trainer /coach | **.589** | .384 |
| Psych exams | **.515** | .404 |
| Surgery | -.149 | **.751** |
| Medication | .297 | **.692** |
| Hormone therapy | .277 | **.757** |
| Family counseling | **.778** | .068 |
| Meditation training | **.685** | -.117 |
| Restrictions media | .227 | ***.433*** |
| Strict law enforcement | .327 | ***.469*** |
| School bully | **.520** | .289 |

| | | |
|---|---|---|
| Lobotomy | -.082 | **.804** |
| therapy /counseling | **.667** | .068 |
| Programs | **.596** | .019 |
| Self-esteem program | **.755** | .100 |
| Electrodes | -.124 | **.857** |
| Free yoga | **.421** | .080 |
| Community support | **.639** | .170 |
| Required social prevention | .201 | ***.785*** |
| Required medical prevention | .166 | **.738** |

*Note*. Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.
Items italicized loaded on factor other than expected

When the subscale scores are changed to reflect the factors identified by the factor analysis, the results of the ANOVA do not change substantively and condition differences remain significant in the same direction. In the thesis the scores based on the theoretically derived subscales are reported. However, it is important to note that items may also vary according to other dimensions, aside type, such as for example severity.

The two items focusing on required medical and environmental prevention will be analyzed separately. Interestingly both items indicating required preventions load on the factor of biomedical solutions, indicating that biomedical solution strategies may also indicate a loss of control over treatments.

Appendix E

**Factor Analysis of Solution Items Study 2.** The solution strategy items for ratings of effectiveness, ethicality and severity were aggregated according to theoretical divides of type (biomedical versus psycho-social) of solution items. Eight items are theoretically biomedical solution items, and eight other items are theoretically socio-behavioural solution items. To confirm that the specific strategy items that I created resulted in unified type sub-scales, a principal axis factor analysis with varimax rotation was performed.

For the ratings of effectiveness, the two factor solution accounts for 51.34% of the variance. All the biomedical items loaded on a biomedical factor, as expected. Although most of the social-behavioural items loaded as expected on a social-behavioural factor, there were a few that loaded on the biomedical solution factor. In an effort to add more severe items to socio-behavioural solution items, these severe items also tend to load onto the biomedical factor.

| | Factor Loadings | |
|---|---|---|
| Solution Strategy | Biomedical | Social- behavioural |
| Hormone replacement | **.764** | .033 |
| Genetic therapy | **.760** | .003 |
| Frontal lobotomy | **.667** | -.306 |
| Surgery | **.771** | -.219 |
| Psychopharmaca | **.761** | .131 |
| Preventive medicine | **.740** | .127 |
| Daily medication | **.774** | .116 |
| Brain electrode | **.774** | -.177 |
| Social support | .017 | **.722** |
| Forced removal of children | ***.533*** | -.134 |
| Enforced home monitoring | ***.469*** | .183 |

| | | |
|---|---|---|
| Relaxation and meditation | -.020 | **.737** |
| Psychotherapy | .205 | **.614** |
| Parental controls | ***.305*** | .251 |
| Family counselling | -.168 | **.776** |
| Training sessions | -.115 | **.793** |

*Note*. Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.
Items italicized loaded on factor other than expected

For the ratings of ethicality, the two factor solution accounts for 52.98% of the variance. Again, all the biomedical items loaded on a biomedical factor, as expected. Although most of the social-behavioural items loaded as expected on a social-behavioural factor, there were a few that loaded on the biomedical solution factor. As in study 1 and also consistent with the results of the factor analysis for ratings of effectiveness, the more severe items added were the items that loaded on the biomedical factor.

| | Factor Loadings | |
|---|---|---|
| Solution Strategy | Biomedical | Social- behavioural |
| Hormone replacement | **.737** | -.031 |
| Genetic therapy | **.628** | -.138 |
| Frontal lobotomy | **.319** | -.752 |
| Surgery | **.559** | -.522 |
| Psychopharmaca | **.690** | .143 |
| Preventive medicine | **.755** | .127 |
| Daily medication | **.685** | .255 |
| Brain electrode | **.566** | -.476 |
| Social support | .122 | **.811** |
| Forced removal of children | ***.397*** | -.368 |
| Enforced home monitoring | ***.439*** | .057 |
| Relaxation and meditation | -.007 | **.851** |

| | | |
|---|---|---|
| Psychotherapy | .332 | **.482** |
| Parental controls | .236 | **.645** |
| Family counselling | .050 | **.850** |
| Training sessions | -.028 | **.821** |

*Note*. Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.
Items italicized loaded on factor other than expected

For the ratings of severity, the two factor solution accounts for 53.22% of the variance. Again, all the biomedical items loaded on a biomedical factor, as expected. Although most of the social-behavioural items loaded as expected on a social-behavioural factor, there were a few that loaded on the biomedical solution factor. As in study 1 and also consistent with the results of the previous two factor analyses, the more severe items added to the socio-behavioural solutions were the items that loaded on the biomedical factor.

| | Factor Loadings | |
|---|---|---|
| Solution Strategy | Biomedical | Social- behavioural |
| Hormone replacement | **.666** | -.067 |
| Genetic therapy | **.667** | -.074 |
| Frontal lobotomy | **.147** | -.819 |
| Surgery | **.347** | -.652 |
| Psychopharmaca | **.737** | .028 |
| Preventive medicine | **.768** | .112 |
| Daily medication | **.683** | .163 |
| Brain electrode | **.285** | -.534 |
| Social support | .225 | **.804** |
| Forced removal of children | ***.406*** | -.542 |
| Enforced home monitoring | ***.518*** | .025 |
| Relaxation and meditation | .090 | **.871** |
| Psychotherapy | .445 | **.437** |

| | | |
|---|---|---|
| Parental controls | .244 | **.660** |
| Family counselling | .236 | **.740** |
| Training sessions | .203 | .808 |

*Note*. Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.
Items italicized loaded on factor other than expected

Overall, the theoretical subscales were confirmed by the factor analyses. However, it seems that more severe items load more on the biomedical solutions factor. In the thesis the scores based on the theoretically derived subscales are reported. However, it is important to note that items may also vary according to other dimensions, aside type, such as for example severity.