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Neuroscience and the risks of maltreatment ☆

Eileen Munro [a,*], Kristina Musholt [b]

[a] London School of Economics, United Kingdom
[b] University of Magdeburg, Germany

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ABSTRACT

Findings from neuroimaging are increasingly being cited in policy debates to strengthen the case for early identification of, and intervention with, children at risk of maltreatment and poor outcomes. While agreeing that neuroscientific research into the risks of maltreatment is a very valuable and exciting area of study, this article challenges the confidence with which these findings are used in policy discussions. It critically discusses the reliability and validity of the relevant findings and the contribution they can currently make to our understanding of the causes and consequences of maltreatment. In addition, it is argued that this type of evidence, which is new in policy debates, is often being used in ways that are problematic. Many participants in the relevant policy debates seem to subscribe either to an implicit version of dualism about the relationship between the mind and the body, or to reductionism — the view that the mental can be reduced to the physical. Such assumptions threaten the way we think about human agency and moral responsibility but it is argued that they are misguided for conceptual reasons. It is concluded that neuroscience has the potential to contribute to our understanding of the causes and effects of maltreatment but cannot do so in isolation from the social sciences.

1. Introduction

Societies have long been concerned with reducing the number of children who suffer maltreatment in the family home. In the past, services have tended to become involved only when maltreatment has occurred, but there is increasing interest in intervening at an earlier stage, both to prevent maltreatment occurring and to prevent minor problems escalating to a serious level. This interest is strengthened by research findings that show that children who suffer from neglect, the largest sub-category of maltreatment, are at increased risk of poor outcomes in education, health, and behaviour, especially when combined with socio-economic disadvantage (Lindsey, 2004; Sabates & Dex, 2012; Treasury, 2003). There is clearly a moral argument for preventing harm and the possibility of doing so is now greater, as research finds evidence that a number of service interventions are producing positive results for children (Barlow & Schrader-MacMillan, 2009; MacMillan et al., 2009).

Nonetheless, making the political and economic case for early intervention at a time of economic austerity is proving difficult. Inevitably, early intervention services are more costly than reactive services, at least in the short-term, since a larger number of families have to be offered a service. While research gives us some indicators of increased risk, the complexity and individuality of human development limits our ability to predict precisely which children will suffer harm. It is argued that prevention will lead to savings later on, so that such services are likely to be very cost-effective in the longer term. However, while there is considerable political interest in the policy of early intervention there is limited funding being made available. At the same time, poor economic growth and policies such as welfare reform are potentially increasing the number of children at high risk of poor outcomes.

In this context, the findings from neuroscience research on the neurological impact of maltreatment are being seized on with enthusiasm as showing hard and compelling evidence of the damage children suffer. Interest in neuroscientific research in child welfare is linked both to questions relating to ways of reducing or preventing maltreatment, and to questions about the effective treatment of abused or neglected children. For example, Graham Allen's report for the UK Government (Allen, 2011) has a copy of a CT scan on the front cover to emphasise the message of how seriously children are harmed by poor experiences in their early years and hence the importance of early intervention. The Harvard University Center on the Developing Child claims that "for children at unusually high risk neuroscience provides a compelling argument for beginning programs at birth if not prenatally" (Center on the Developing Child at Harvard University, 2007 p. 3). McCrory, De Brito, and Viding (2010) suggest that advances in neuroscience and genetics are "rapidly changing how we view early adversity, creating a neuro-biologically informed developmental narrative that has the potential to change social policy, societal perceptions of harm and the conceptual framework within which we think about clinical intervention and prevention". As O'Connor, Rees, and Joffe (2012, p.225) suggest: "The brain has been instantiated as a benchmark in

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* Corresponding author at: London School of Economics, Houghton St, London WC2A 2AE, United Kingdom.
E-mail addresses: E.Munro@lse.ac.uk (E. Munro), kristina.musholt@ovgu.de (K. Musholt).

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public dialogue and reference to brain research is now a powerful rhetorical tool". The case for providing early help to families to improve children's safety and development is compelling for a number of reasons, but this article aims to critically assess the contribution to the relevant public policy debates that neuroscientific evidence, and in particular evidence from neuroimaging research, is making at present. We are focusing on neuroimaging in particular because this kind of research has a tendency to elicit particularly strong reactions due to the images it is producing and has recently received a lot of attention. Of course, much could be said about other neuroscientific approaches as well.[1]

Given the extensive social–psychological knowledge that already exists about the detrimental effects of abuse, the question arises as to whether neuroscience, and in particular neuroimaging research, is adding something genuinely new to the discussion. We will argue that, at present, rather than providing us with new insights into *causal* mechanisms, neuroimaging studies present us with information about the neural *correlates* of the effects of child maltreatment. As we will explain in more detail, this can be an important first step towards the identification of the brain mechanisms involved in mediating the effects of maltreatment and hence towards the development of corrective or reparative interventions that target these mechanisms. However, the latter requires an interdisciplinary approach, and the finding of correlates as such is neither sufficient to provide new insights into causal mechanisms, nor should it be surprising — unless one is harbouring dualist intuitions. Nonetheless, and despite the fact that at present results from neuroimaging research at best confirm what is already known from the social sciences, as pointed out above, much weight is currently put on these studies. We suggest that this is due to an implicit bias towards so-called 'hard sciences', which are somehow seen as providing better, more reliable evidence than 'soft sciences', such as the social sciences. However, this is problematic for various reasons including methodological problems, questions of validity, and the (implicit or explicit) reliance of neuroscience on social science research.

Moreover, neuroscience provides a type of evidence which is new to policy makers and which, due to the underlying assumptions that tend to be associated with this kind of evidence, has the potential to impact discussions about human agency and determinism in policy and practice debates in fundamental ways. This potential will be critically examined in the second half of this article. In particular, there is a tendency to ascribe a diminished level of responsibility to persons with altered brain structure or functionality. However, this threatens to undermine the persons' agency even though, as we will argue, the evidence to date does not warrant such a judgment.

We begin by examining the reliability and validity of structural magnetic resonance imaging (MRI) and functional MRI (fMRI) scans (Section 2.1). There is a danger that people will overvalue findings from an unfamiliar but high status discipline such as neuroscience, so we go into some detail on how evidence is produced by neuroscientists. This draws attention to the number of hypotheses (many contested) and statistical analyses involved in producing the final MRI/fMRI picture. Note that this section is directed towards readers who are not familiar with neuroimaging techniques; readers with knowledge of this area of research may want to skip this section. We then (Section 2.2) critically appraise the neuroimaging studies that have looked at children and adults who have been maltreated, examining what they currently tell us about the impact of childhood maltreatment on brain development. In so doing, we will also highlight some more specific methodological concerns regarding the existing imaging studies concerning children who have suffered from maltreatment.

Based on this, in Section 3, we critically discuss how this type of evidence influences debates about how to improve children's development and help the victims of maltreatment. We analyse the assumptions implicit in current discussions about the relationship between the mind and the body, the disputed views on agency and moral responsibility, and the implicit assumptions in discussions about the relative status of the findings of the natural and the social sciences. In particular, we will question the claim that neuroscience provides independent evidence of the harm of maltreatment by showing how interpretations of the relevant findings are reliant on existing social science research.

Nothing in this article should be taken as an attack on neuroscience per se. Neuroscience, including neuroimaging research, can add important and valuable information. A better understanding of the neurological processes underlying certain behaviours is both valuable in its own right and is beginning to produce some insights that contribute to a better identification of and response to problems. Nonetheless, it is important to be aware of the current technical as well as principled limitations of MRI/fMRI studies in order to be able to properly assess the data provided by this research. Moreover, as we will argue, in the context of a better understanding of the effects of maltreatment on children, insights from neuroimaging are at their most valuable and useful when combined with insights from the social sciences (see Section 4). Thus, this article should be read as a plea for a more integrated and interdisciplinary approach to the study of maltreatment of children.

2. How reliable are the results from neuroimaging research?

To a non-specialist it might seem as though brain scans provide us with something akin to a photograph of the brain, allowing direct insights into the brain's structure and inner going-ons. Photographs can provide vivid and reliable evidence. A photograph of a bruise on a child's skin is treated with respect in a legal hearing. Even an X-ray of a fractured bone has some of the qualities of a photograph and conveys some of the same reliability. In the 1960s, X-ray evidence of fractured bones played a significant role in raising public concern about the prevalence of physical abuse. For some it seems that MRI and fMRI scans can play a similarly powerful role in current policy and practice debates. However, the images we find in the neuroscience literature are in fact far from being such simple records of damage or healthy development.[2] They are the results of a complex computational and statistical process and their interpretation requires considerable skills; they do not provide direct measures of neural activity. In being indirect measures, they do not differ from many other areas of study in child welfare: measures of individual traits, social constructs and emotional states are all of this kind. However, the apparent tendency in the literature to think of them as akin to photographs leads to a tendency to over-estimate their reliability. Moreover, neuroscience, and in particular neuroimaging research, is a relatively young and still developing field. While it generates a lot of excitement, it also shows teething problems with regard to the reliability and interpretation of its results. These need to be understood if the true potential of neuroimaging studies to inform our understanding of complex psychological and social phenomena is to be appreciated.

In the following, we will provide an overview of the underlying principles of neuroimaging research and its limits. The aim is to contribute to an informed discussion among researchers and policy makers who are not familiar with this technique as to how to properly assess neuroimaging results in the context of public policy debates regarding the consequences of the maltreatment of children. We shall begin by explaining the difference between a structural and a functional MRI (fMRI) and by presenting a very brief and strongly simplified description of the basic technical principles underlying structural and functional MRI research. A more detailed description can be found in Logothetis (2008, supplementary material), as well as in numerous textbooks on the topic (e.g. Buxton, 2002; Wood & Wehrli, 1998). We will then highlight some of the methodological problems associated with neuroimaging research; first in terms of the general challenges and limits of its

[1] For a critical discussion of the – often problematic – use of neuroscience in social policy discussions in more general terms, see Wastell and White (2012).

[2] Though note that there can be problems with reliability in reading X-rays, photos, and graphs, too. For example, for X-rays, trained and untrained observers may draw different conclusions.