

Which Counts More: Differential Impact of the Environment or Differential Susceptibility of the Individual?

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Abstract

The theory of differential susceptibility is helping to explain how genetic, neurological and personality factors affect individual mental and physical health and why interventions work better with certain populations. As social workers, however, our focus is more on the impact of the social determinants of health found in people's environments and the nuanced way external factors influence psychological treatment outcomes and human development over time rather than genotypes and phenotypes. This article discusses differential impact theory (DIT) as a complementary theory to differential susceptibility in an effort to make both theories relevant to social work practice. After a brief summary of the differential susceptibility research, I draw from studies of psycho-social interventions and Person \times Environment interactions to show that responsibility for positive adaptation resides within the systems that surround individuals just as much as, *and possibly more than*, within individuals themselves. DIT provides a more balanced explanation than differential susceptibility theory alone for why clinical and community interventions and changes to social policy can have a positive influence on psycho-social outcomes. The implications of DIT are discussed with regard to the design and delivery of psychological and social interventions.

Keywords: Differential impact, differential susceptibility, resilience, critical social work, adverse childhood experiences, environment, genotype, phenotype, psychological interventions

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Introduction

For the past decade, professionals working in the fields of biological and psychological sciences have been advancing theories to explain the origins of mental and behavioural disorders that build upon new discoveries in epigenetics, neuroscience and child development. As social workers, we have followed these trends, contributing to interventions that modify biological and interpersonal processes (e.g. responses to trauma) to enhance coping under stress (Steele *et al.*, 2009). It has not always been clear, however, whether these interventions and the theories upon which they are based reflect the critical social theory and systemic thinking of social workers. Nor is it clear whether the training of social workers and social work research are contributing enough to a critical analysis of neurobiology, epigenetics and human behaviour under stress (Lacasse and Gomory, 2003; Smith, 2016). Unfortunately, where social workers have borrowed and adapted approaches from psychology and psychiatry, such as Mindfulness-Based Stress Reduction (MBSR) (Kabat-Zinn, 1990) and cognitive behavioural therapy for anxiety (Hirshfeld-Becker *et al.*, 2011), these interventions often lack sensitivity to context and the critical lens social workers can bring to psycho-social programming.

Proponents of the biological roots of well-being, however, routinely acknowledge the link between neurons and neighbourhoods, or cells and communities (both common alliterations), expressed as Person \times Environment interactions (National Research Council and Institute of Medicine, 2000). Both negative and positive developmental trajectories can be explained using this formula and by focusing on the social determinants of health such as the quality of one's neighbourhood and school, the safety of one's community and other experiences that promote (or threaten) social integration or fair treatment. For example, we accept that early trauma affects a child's neurological 'wiring' and that neuroplasticity depends on the quality of the environmental stimuli a child receives after being removed from a toxic stressor (Boivin *et al.*, 2013).

On the surface, this Person \times Environment interaction appears to privilege both individual and systemic factors equally. This is, however, a misrepresentation of the evidence. Consistently, research that has examined the impact of social policies, community supports, schools and families on individuals shows that *environments count more* than individual biology or temperament to psycho-social outcomes, especially when risk exposure is high (see e.g. Abramson *et al.*, 2010). A better representation of the interaction, and one which reflects the perspective of social work, would be ENVIRONMENT \times person.

Critical social work theory, research and practice have a particularly strong contribution to make to explanations of these environmental processes and their impact on individual epigenetics, neuroplasticity and

psycho-social development (see e.g. Baines, 2011). One way to show this importance, and thereby social work's contribution to the science of well-being, is to compare two emerging explanations for how individuals and environments interact: differential susceptibility theory (DST) (Belsky and van IJzendoorn, 2015) and differential impact theory (DIT) (Ungar, 2013). In this paper, I will critique a number of existing studies of both DST and DIT to demonstrate the advantages that a more ecological perspective on individual biological processes brings to clinical and community practice by social workers and allied health professionals.

Differential susceptibility theory (DST)

DST focuses attention on individual characteristics such as genetics, neurobiology and personality factors like temperament to show that children and adults are more or less vulnerable to their environments. The latest research on DST has shown that carriers of some traits associated with greater risk in sub-optimal environments perform much better in well-resourced environments than their peers who lack a particular genetic, neurological or personality profile (Belsky *et al.*, 2007). For example, in a study of the long-term impact of the Fast Track programme in the USA for children with behavioural problems, children with a particular genetic profile (those with a variant in the glucocorticoid receptor gene) were the ones who both benefitted the most from the intervention and the ones in the control group who did the worse when no intervention was provided (Albert *et al.*, 2015).

To summarise, particular genotypes and phenotypes make individuals more or less susceptible to the influence of their environment. For social workers, DST can help to explain why some individuals respond well to an intervention while others do not. As valuable as this idea is, careful reading of this literature shows that, while genetic profiles and individual psychological processes are described in great detail, the quality of the environment and external protective mechanisms is given far less attention in studies of DST. Environments are described with minimal detail. There is either abuse or no abuse; an intervention is provided or not provided; a child's care-giver functions well or poorly. Such dichotomous thinking can make us believe that most of an individual's success is attributable to person-level attributes when in fact the examples referenced above show that the environment plays a much larger role than some mental health professionals assume.

When the environment is studied in more detail, fewer positive outcomes can be linked to single environmental condition. For example, results of van IJzendoorn and Bakermans-Kranenburg's (2015) meta-analysis of DST suggests that the theory fits better for Caucasian

populations and is more likely to account for the effect of interventions on externalising behaviours rather than internalising ones. Likewise, interventions that focus on changing cognitions rather than behaviours show the largest effect sizes but these results tend to apply most to populations that experience very little disadvantage. To illustrate, in studies of people who are high achievers like elite athletes (Sarkar and Fletcher, 2014), the factors that predict an individual's capacity to overcome setbacks include a sense of control, flexibility and adaptability, balance and perspective, and perceived social support. These are all individually oriented factors but they are most relevant only to a highly motivated, often privileged group with enough resources to train full time.

Differential impact theory (DIT)

What happens if we focus as much, or more, attention on the qualities of the environment and their impact on epigenetic, neurological, cognitive and developmental processes? The theory of differential impact is an amalgamation of emerging thinking in fields like social work and prevention science. DIT tells us that changes to the environment cause individuals to change and that these changes depend on the quality of the psychological, sociocultural and economic resources provided by the environment, balanced by the quality and quantity of the individual's exposure to risk (Ungar, 2015). DIT suggests that individual motivation to change is far less important than the external pressure put on an individual by a supportive environment. For example, when Romanian orphans were adopted by well-resourced families in Britain, years of delayed neurological and physical development was partially reversed (Beckett *et al.*, 2006). The more the adopted home and community environments provided access to physiotherapists, speech language pathologists, enriched learning environments and opportunities for emotional attachment to a primary care-giver, the greater were individual children's developmental gains. Such examples challenge theories that attribute individual change to personal agency or changes in personal habits. Instead, individual differences in well-being are largely accounted for by the impact of external factors, including the network of health and social services that are available. Individual susceptibility can only explain a relatively small proportion of a person's successful development.

This understanding of DIT is built on three principles (each is explained in detail in the remainder of this paper). First, environments change people at biological, psychological and social levels. Change the environment and people are compelled to change their thoughts, feelings and behaviours regardless of their motivation to behave differently. Second, the factors that most influence individual outcomes depend on an individual's level of risk exposure. While individual factors like a positive attitude can

be protective at a lower level of risk exposure, their impact diminishes as risk increases. In higher-risk contexts, interventions, access to resources and social policies have a much larger influence on outcomes than individual cognitions. And, third, to fully understand why people change, we need maps that are as complex as the territory they explain. If the individual's problems are multisystemic (e.g. reflecting neurodevelopmental challenges, housing problems and exposure to violence), then adaptation of multiple systems will be required to improve individual well-being.

To illustrate these three principles, consider [Rengasamy *et al.*'s \(2013\)](#) study of the impact of parent–child conflict (a systemic process) on course of treatment for treatment-resistant adolescent depression. Their findings show that parent–child conflict moderates treatment response, influences adherence to course of medication or other therapy, and predicts rates of remission for depression, with higher levels of reported conflict at baseline decreasing the likelihood of positive treatment outcomes. In this example, the environment matters more than individual characteristics and outcomes vary by level of risk exposure. The complexity of pathophysiological processes associated with individual depression are in fact matched by the sophistication of the interventions across multiple systems that are required to prevent remission. Interestingly, even a biological condition like depression can be influenced more by the individual's environment than the individual's genotypical and phenotypical qualities.

This same degree of environmental influence is found across diagnoses. For example, neuroendocrinology, neurochemistry and neuroimmunology have all been implicated in the course of disorders like Post-Traumatic Stress Disorder (PTSD). As [Rasmusson and Shalev \(2014\)](#) explain, however, 'the biology pertinent to PTSD may not be limited to individual biology and must take into account the biological impact of group and social factors' (p. 290). Therefore, neither DST nor DIT provides sufficiently complete accounts of human development in complex environments. Even proponents of DST such as [Belsky and van IJzendoorn \(2015\)](#) suggest that we need better tools to predict which programmes work for whom given that effect sizes across interventions are relatively modest. The most fruitful path forward may be to rely on social workers and other systemic thinking professionals to consider the differential impact of environments on the efficacy of interventions even as our colleagues in other professions study individual susceptibility.

Problems with DST when applied to intervention research

As social workers, we can see the obvious limitations of DST. For example, there is very little appreciation shown to the intersectionality of factors that cause individuals to experience their environments as helpful or

unhelpful. Studies tend to treat environments as homogenous, stratifying samples by broad indicators like race, ethnicity and socio-economic status. There is also little attention paid by epigeneticists and neurodevelopmentalists to experiences of stigma or the lack of discursive power to define what is a good developmental outcome. These are unfortunate oversights, as there are numerous environmental mechanisms that shape whether a particular genotype or phenotype will be adaptive in a particular context or culture.

To illustrate the advantages that occur when we consider the impact of the environment on differential susceptibility, we need to deconstruct well-reputed DST study. Brody *et al.* (2015), for example, assessed the differential susceptibility of African American adolescents from high- and low-risk families enrolled in a six-week intervention to prevent drug use called Adults in the Making (AIM). AIM was provided to youth and their parents with the assumption that by both increasing parenting capacity and training youth in cognitive skills, escalation in drug use over time would be reduced. Saliva was gathered to test for the presence of long or short alleles of the *DRD4* gene that is associated with self-control problems like alcoholism. As expected, over a twenty-seven-month period, the best predictor of outcomes was the *DRD4* \times Family Risk \times AIM interaction, with the impact of the intervention greatest for youth from contexts of high family risk who had the long-allele genotype. This group of adolescents had a rate of increase in drug use over time much lower than both the control group that did not receive the intervention and youth in both the control and intervention groups with the short-allele genotype.

While the example is illustrative of an individual Gene \times Environment interaction and confirms the theory of differential susceptibility, the results tell us only half the story. We do not know how much of the variation in outcomes between the two genotypes is accounted for solely by the change in the children's environments at home. To elaborate, the efficacy of the AIM intervention was predicted based on the assumption that it was necessary to change the capacity of parents to provide their children with support, improve positive racial socialisation, give children strategies for dealing with racism, make accessible occupational and educational mentoring, enhance autonomy and open opportunities for responsible decision making. The results show exactly what DST predicts: youth with greater genotypical susceptibility and originating from high-risk family environments benefitted the most from the intervention. If we pay more attention to the environment, however, it is also plausible that the children's genotype accounted for a relatively small amount of the variance between those who received the intervention and those who did not. If, according to previous research, children with the long allele exhibit more impulsive behaviour, then the intervention may have been particularly effective at providing families that had the least parenting

capacity (pre-intervention) and the most challenging children with the tools they required to cope well. If this is the case, could it be that there was also a differential impact of the AIM programme on family systems, which in turn exerted an impact on child behaviour? The differential susceptibility of the children could have played a relatively minor role in determining the efficacy of the programme overall. Change may have occurred simply because the programme fit best for highly stressed families with less capacity to parent children with impulsive behaviours. If this was the case, then it was changes to family-level factors, not genetics, that were responsible for most of the variation in programme outcomes between the two genic profiles.

A more complete explanation for why the AIM programme suppressed the expected increase in drug use of adolescents would need to account for the fit between the families and the intervention at different levels of risk (an Environment \times Intervention interaction). Could it be that the tools shared during the intervention were ineffective with less impulsive children? Children with the less impulsive genotype (those with short alleles) and from high-risk, disordered family environments (who showed no significant differences from the control group in their drug use) may have not needed the intervention because they already had individual capacities to cope with drug-use cues and other factors related to escalation in drug use during adolescence. Responsibility for differences in outcomes between the two genotypes may be the result of the differential impact of the AIM programme on the parents more than the differential susceptibility of the children. It is interesting that, in their concluding remarks, Brody *et al.* make a similar observation, speculating that familial and extra-familial factors influenced the more impulsive children's attention to drug-related cues that would have increased their drug use without treatment.

When we pay more attention to the environment, we begin to see patterns to the differential impact of external factors on problems that are the concern of social workers. For example, changes to school climates can motivate young people to remain engaged at school regardless of individual-level risk factors (Shernoff and Schmidt, 2008); emotionally sensitive children perform extremely well in stable supportive environments but are known to do poorly in unstable ones (Ellis and Boyce, 2008); foster children succeed when the public agencies looking after them create case plans that meet the children's complex needs (Pecora, 2012); and rates of child maltreatment and other stress-related patterns of family behaviour tend to decline when social and economic development is enhanced in vulnerable neighbourhoods (Jaffee *et al.*, 2007). In each of these examples, the differential impact of systemic factors compels individual change and lowers the rate of psychological disorders and problem behaviours. Very few of the changes that occur, however, can be attributed exclusively to individual etiological factors.

For this reason, DIT has implications for the design and delivery of psychological services that are more systemic in their application. To illustrate, the efficacy and effectiveness of third-wave cognitive and behavioural therapies like MBSR (Kabat-Zinn, 1990) could be strengthened by a greater focus on the environment and less attention on individual changes in cognition. Though the evidence for MBSR is well marketed, there are only a small number of under-powered studies that have suggested support for the benefits of MBSR. For example, a Cochrane systematic review of the evidence to support third-wave CBT for depression concluded that there was very weak evidence for the effectiveness of the approach overall (Churchill *et al.*, 2013). Perhaps this is because few, if any, of the studies that tested MBSR have accounted for the differential impact of environmental conditions, levels of risk exposure or factors that affect access to and compliance with treatment protocols. A meta-analysis by de Vibe and his colleagues (2012) found consistent effect sizes over 0.50 for MBSR when used to treat depression, anxiety and related mental illnesses, but did not explore environmental factors. Only nine of the twenty-six studies reviewed reported follow-up data, with effects diminishing over time. Interestingly, none of these meta-analyses found evidence that contextual factors were considered in the implementation of treatment, and few data were provided on social functioning outcomes or selection bias with regard to which individuals found mindfulness training useful and at what dose.

Conclusion

It is likely that some combination of environmental impact and individual susceptibility offers the best explanation for which interventions are the most effective with which population. Arguably, DST and DIT are complementary maps of the same territory. If brought together, studies of susceptibility and impact could further our understanding as social workers of intervention efficacy in complex systems (Heim and Binder, 2012). Programmes that show no statistically positive effect on overall outcomes across a population might still have a differentially large impact on a subpopulation with a unique risk profile (Jones *et al.*, 2005; Larkin *et al.*, 2012). For both social workers and policy makers, this is particularly important to know, as the science justifies providing more and better services to clients who face the greatest risk.

Clearly, a focus on differential susceptibility alone does not provide enough information to build effective social programmes for populations that experience significant adversity. Instead, we will need the sophistication of systemic thinking (and the social workers with that expertise) to add a broader critical perspective to epigenetics, neuroscience and efforts to enhance child development.

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