Hormones and Behavior 77 (2016) 53–61

Contents lists available at ScienceDirect

Hormones and Behavior

journal homepage: www.elsevier.com/locate/yhbeh

Review article

# Parent–offspring transaction: Mechanisms and the value of within family designs☆

Jennifer M. Jenkins [a,*,1], Patrick McGowan [b,*,1], Ariel Knafo-Noam [c,*,1]

[a] University of Toronto, Canada
[b] University of Toronto Scarborough, Canada
[c] Hebrew University, Israel

ARTICLE INFO

Available online 2 July 2015

*Keywords:*
Differential parenting
Transactional process
Parenting
Child effects
Genetics
Epigenetics
Twin studies
Gene–environment correlation
Within family
Siblings

ABSTRACT

This article is part of a Special Issue "Parental Care".

Parenting is best understood as a transactional process between parents and their offspring. Each responds to cues in the other, adapting their own behavior to that of their partner. One of the goals of parenting research in the past twenty years has been to untangle reciprocal processes between parents and children in order to specify what comes from the child (child effects) and what comes from the parent (parent effects). Child effects have been found to relate to genetic, pre and perinatal, family-wide, and child-specific environmental influences. Parent effects relate to stresses in the current context (e.g. financial strain, marital conflict), personality and ethnicity but also to adverse childhood experiences (e.g. parental mental health and substance abuse, poverty, divorce). Rodent models have allowed for the specification of biological mechanisms in parent and child effects, including neurobiological and genomic mechanisms, and of the causal role of environmental experience on outcomes for offspring through random assignment of offspring–mother groupings. One of the methods that have been developed in the human and animal models to differentiate between parent and child effects has been to study multiple offspring in the family. By holding the parent steady, and studying different offspring, we can examine the similarities and differences in how parents parent multiple offspring. Studies have distinguished between family average parenting, child-specific parenting and family-wide dispersion (the within family standard deviation). These different aspects of parenting have been differentially linked to offspring behavioral phenotypes.


**Contents**



☆ We are grateful to Reut Avinun and Michelle Rodrigues for comments on an earlier draft of this paper. Jenkins is supported by the Canadian Institutes of Health Research and the Social Sciences and Humanities Research Council of Canada. McGowan is grateful to the Canadian Institutes of Health Research and the Natural Sciences and Engineering Research Council of Canada. Knafo-Noam is supported by Starting Grant # 240994 from the European Research Council (ERC).

* Corresponding authors.
*E-mail addresses:* jenny.jenkins@utoronto.ca (J.M. Jenkins), patrick.mcgowan@utoronto.ca (P. McGowan), msarielk@mscc.huji.ac.il (A. Knafo-Noam).

[1] All authors contributed equally to this publication.

http://dx.doi.org/10.1016/j.yhbeh.2015.06.018
0018-506X/

## Introduction

Parenting is best understood as a transactional process between parents and their offspring. Each responds to cues in the other, adapting their own behavior to that of their partner. Biology and behavior are finely interwoven in these transactional processes. Characteristics of children, influenced by both genetic and uterine experiences have effects on the parenting that children receive. Parenting is influenced not only by such child characteristics but by the experiences and characteristics of parents. And to add further complexity to the dynamics of reciprocal interactions, there are individual differences in the extent to which one is influenced by others. These influences interact in the context of life history shaped by natural selection, which defines the degree of 'plasticity' within biological systems that underlie phenotype. Thus, one person can be highly influenced by the behavior of another, while others are less influenced, both behaviorally and biologically.

One of the goals of human parenting research in the past twenty years has been to find methods for untangling reciprocal processes between parents and children: what comes from the child, what comes from the parent, what is emergent between them, as well as which bits of these processes influence the biology and behavior of offspring? One of the methods that has been developed in human parenting research has been to study multiple children in the family environment. By holding the parent steady, and studying their different offspring, we can examine the similarities and differences in how parents parent multiple siblings and factors that explain such differential parenting. When the siblings are twins, it is also possible to determine the extent to which genetic influences explain the differences in the parenting received by children. These within family designs in human research serve to further the understanding of the mechanisms that underlie parents' and children's influence on one another.

Animal studies of parent–offspring interaction have also, in recent years, exploited within family designs (Pan et al., 2014). Rodent models have the advantage that the breeding cycle is short (2 months from birth to adulthood) and the litters are large (3–9 pups per litter for mice and 8–18 pups per litter for rats). Of course, the beauty of the animal models in parenting research is the unambiguous demonstration of causal influence when random assignment is used and the understanding of social processes at the level of biological mechanisms. To date, there is a much more extensive literature on the topic of differential parenting in humans relative to non-human model organisms. The goal of this paper is to review the findings from the human and rodent literatures that inform why offspring from the same family are differently parented as well as the impact of such differential parenting on development.

## What is differential parenting?

Differential parenting refers to differences in the parenting received by different children in the same family. Differential positivity refers to one child in the family receiving more positive affect, engagement, and involvement from the parent than another child in the family. Differential negativity refers to the parent directing more affectively negative behavior towards one sibling than towards another. Depending on the methods used for assessing human parenting, less than 50% of the variance in parental negativity and positivity is the same across siblings (using parental report) and this is reduced to around 25% with observational measurement studies (Browne et al., 2012; Jenkins et al., 2003a). The similarity in parenting is higher for monozygotic twins than dizygotic twins or full siblings, an issue we return to below (Avinun and Knafo, 2014).

One way that differential parenting has been framed is as a potentially negative factor (Plomin and Daniels, 1987; Turkheimer and Waldron, 2000). This is because children who are treated more negatively than their siblings show small increases in psychopathology over time (see 'Effect of differential parenting on offspring'). However, for both conceptual and empirical reasons, parenting siblings differentially embodies both negative and positive elements (Jenkins et al., 2003a). With respect to the positive aspect, parenting can be understood as a problem solving task. Parents have socialization goals for their children in which they try to moderate their children's predispositions to enable smooth integration with the society (Grusec and Ungerer, 2003). As parents respond to individual differences in their children and make judgments about what to require of them, when to push, etc. their sensitivity (seen as the essence of good parenting (Ainsworth et al., 1978)) results in differential parenting. On the other hand, links to adjustment, sibling relationship quality and children's accounts (see section 'What is the effect of differential parenting on the offspring?') suggest a more negative component. The child who gets less praise, or elicits more negativity, feels disadvantaged. Thus, when we observe differences in the parental behavior directed to individual siblings in all likelihood both negative and positive (pathogenic and benign) elements are embodied within the same score, with the same score differentially correlated with child outcomes.

The advantage of the within family design is that it allows us to parse the direct parenting score (that which is received by an individual offspring) into component parts: that which is in common to all children and that which is unique to one child. Most studies of differential parenting have only involved one sibling pair and use the difference score as the measurement of interest (Mullineaux et al., 2009). More subtle distinctions can be achieved by including the parenting to all children in the family and doing the analysis with multilevel modeling to distinguish between family-wide and child specific parenting. Such a design allows for the distinction of 3 parenting elements: the average parenting across children (family-wide mean), the within family standard deviation (family-wide dispersion) and each child's deviation from the mean (child-specific) (Meunier et al., 2013). Such distinctions have been found to be differentially predictive of child behavior, an issue we return to in the section 'Effect of differential parenting on offspring'. Even more important is the methodology from the Social Relations Model (Kenny et al., 2006) because it allows us to differentiate between a person effect (an aspect of a person's behavior that is evident in all their interactions) versus an effect of a relationship (the way in which a person behaves in a specific relationship). By observing a person interacting with every other person in the family (called a round-robin design) we can determine the extent to which an individual behaves in the same way across all family members (called the person's actor effect), elicits the same behavior from all family members (called the person's partner effect), the extent to which all family members behave similarly to one another and different from other families (called the family effect) and the components of interpersonal behavior that are unique to one particular dyad (the dyad effect). The component that this design offers, over the multilevel differential parenting design, is that we can isolate the behavior of the child that occurs in all relationships from the behavior that is specific to one mother–child relationship. Is the mother being specifically reactive to one child or does the child behave provocatively with everyone and elicit irritation from everyone? This enables us to understand processes in differential parenting more accurately. We return to this issue when we consider gene–environment correlation.

The animal studies have, to date, not attempted to isolate and remove the contribution of the individual pup to the parenting that the pup receives. However, it has been noted for some time that the care received by individual pups varies substantially within litters. Decades ago, it was observed that male rodent pups receive twice the ano-genital licking that female pups receive within a litter, and that these differences have sex-specific effects on offspring behavior and neuroendocrine development (Moore, 1984). Recently, a handful of animal studies have used rank order measurement within families distinguishing between pups that receive above and below average (in their litter) levels of care (Cavigelli et al., 2010; Pan et al., 2014; Ragan et al., 2012; van Hasselt et al., 2012a, 2012b). Studies that have