Introducing a Novel Online Observation of Parenting Behavior: Reliability and Validation

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This article has been accepted for publication in *Parenting: Science and Practice,* published by Taylor & Francis.

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SYNOPSIS

Objective. Observations of parents with their children are important for better understanding the critical role that parents play in their children's adjustment, but resource limitations commonly compromise assessment. A novel online observation tool, *Etch-a-Sketch Online* (ESO), is introduced that allows resource-efficient observations in the family home. ***Design.*** Study 1 was a preliminary, cross-sectional study of 20 mothers with their singleton children (M = 5.96 years). Mothers were observed using both ESO (recorded via Skype) and a traditional Etch-a Sketch task recorded during a home-visit; mothers' positive and negative parenting was coded from these observations. Study 2 was a longitudinal study of 119 mothers and their young twins. Mothers' ESO-observed positive parenting and negative parenting at Time 1 (M = 5.51 years) were examined as predictors of children's disruptive behavior at Time 2 (M = 6.04 years) controlling for mothers' Time 2 self-reported positive and negative parenting. ***Results.*** Study 1 provided preliminary evidence of inter-rater reliability and convergent validity of ESO-observations. Study 2 supported this evidence of inter-rater reliability and ESO's convergent validity as well as providing predictive validity. ESO-observed parenting at Time 1 was associated with children's disruptive behavior at Time 2, over and above concurrent maternal reports of their own parenting. ***Conclusions.*** ESO shows promise in providing the means for detailed assessment of parenting processes in the home.

Key words: family; parenting; parent-child observation; online; child behavior.

INTRODUCTION

Children's psychological adjustment is important, with adjustment problems having serious consequences for individuals and their families as well as for services (Costello & Maughan, 2015). In particular, childhood disruptive behavior problems are common and confer risk for diverse psychological and academic difficulties in the long-term (Kim-Cohen et al., 2003). Interpersonal relationships in the early years have critical implications for children's adjustment, with the salience of parenting and parent-child relationships evident from decades of research (Maccoby, 2015). Indeed, broad constructs commonly conceptualized as "positive parenting" (e.g., positive control, parental warmth, and responsiveness) and "negative parenting" (e.g., negative control, parental hostility, and criticism) have been widely associated with lower and higher levels of children's disruptive behavior respectively (e.g., Eisenberg, Zhou, Spinrad, Valiente, Fabes, & Liew, 2005; Oliver & Pike, 2018; Pinquart, 2017). Nevertheless, effectively characterizing the complexity of contemporary family processes on a large, diverse scale remains a key challenge (Bornstein, 2005; Lunkenheimer & Leerkes, 2015).

Observations of parents with their children are often considered valuable for the assessment of parenting (Hawes & Dadds, 2006). However, the rigorous, fine-grained observational methods which are available require home visits to families or laboratory assessments, both of which are expensive in terms of time, travel, and equipment, as well as potentially having a considerable ecological footprint. These issues are confounded with scale-up and any geographic diversity of samples. Thus, a considerable proportion of extant studies, particularly those that harness the power of large-scale, diverse studies, are reliant on self-reports of positive and negative parenting. Although ostensibly measuring similar constructs, observations and self-reports of parenting show only small to moderate associations with each other (Hendriks, Van der Giessen, Stams, & Overbeek, 2018).

Notably, both observational methods and parent-reports have significant limitations when considered alone and offer distinct and important information for understanding diverse adjustment outcomes (Schofield, Parke, Coltrane, & Weaver, 2016). As such, using multiple methodologies yields the clearest, most detailed picture of family processes (e.g., Aspland & Gardener, 2003; Dunn & Kendrick, 1980; Schofield et al., 2016). However, resource limitations can preclude the use of observational approaches. Technological advance may provide a key for overcoming this.

Burgeoning public concern and research attention focus on the sequalae of the quantity and quality of screen use in parents (Radesky & Moreno, 2018) and children (Madigan, Browne, Racine, Mori, & Tough, 2019; Stiglic & Viner, 2019), yet this critical societal shift provides an exciting opportunity for family methodology. Indeed, with increasing global internet penetration (www.internetworldstats.com), the opportunity to develop online approaches to family research is an actuality that many scholars are embracing. Yet, so far, parent-child observation tasks have lagged behind.

The Present Study

We introduce a novel approach to observing parents with their children -- *Etch-a-Sketch Online* (ESO). ESO is an innovative, online direct-observation tool administered via Skype -- or any other similar service provider -- and grounded in methodology that is well-established and widely used for family assessment in early- to mid-childhood (Deater-Deckard, 2000; Jaekel, Pluess, Belsky, & Wolke, 2015; Scott, Nelson, & Dix, 2018). ESO allows the observation -- and remote-recording -- of parents and children interacting using a game-like technological interface in their own home, removing the need for travel and minimising the intrusion of camera equipment and researcher presence.

Here, we describe the ESO tool and related protocol because a principal aim of designing ESO is to make it freely available to other scholars (see Appendix A for details). In

addition, this paper presents our preliminary work to assess three psychometric properties of the ESO approach: reliability and two types of validity. Reliability refers to how consistently a measure performs (Price, Jhangiani, & Chiang, 2015). In both Study 1 and Study 2, through examining coding scores across researchers, we examine inter-rater reliability, that is the extent to which researchers are consistent in rating recorded ESO observations. Validity considers the degree to which scores on a measure align to the intended construct (Price et al., 2015). In addition to face validity – which was high here, with parents and children seeming to behave naturally during the ESO task – we formally tested ESO's convergent and predictive validity. Convergent validity is demonstrated by a measure being associated with established measures of the same or similar constructs. In Study 1, with a sample of mothers and their young children, we compared ESO observations with observations using the traditional in-home Etch-a-Sketch task. In Study 2, we examined ESO-observations in association with mothers' own reports of their parenting. Finally, and most importantly given the aforementioned multi-method expectations in family research, we investigated ESO's predictive validity, that is the extent to which our novel task was able to predict a salient criterion (Price et al., 2015), children's behavioral adjustment. Specifically, in Study 2 we capitalised on a longitudinal study of mothers and their young twins to examine ESO-observed maternal parenting in association with maternal reports of children's disruptive behavior 6 months later. In line with previous research, we expected higher levels of ESO-observed negative parenting and lower levels of positive parenting to be moderately predictive of children's disruptive behavior.

STUDY 1

METHOD

Participants

Twenty mothers of singleton children (60.0% boys; *M* = 5.96 years, *SD* = 0.93) were recruited from elementary schools on the south-coast of England. Sixty-five percent of mothers reported their educational achievement as undergraduate degree or higher; 85% were married to/cohabiting with the child's biological father.

Procedures

Etch-a-Sketch. Mothers and their children completed the ESO (via Skype) as well as the in-home Etch-a-Sketch task (Testing gap: *M* = 6.26 days, *SD* = 9.95). In-home Etch-a-Sketch/ESO data-collection order was counterbalanced.

The traditional Etch-a-Sketch task involved videorecording mothers playing with an Etch-a-Sketch drawing toy with their child during a home visit (Deater-Deckard, 2000; Deater-Deckard, Pylas, & Petrill, 1997). The Etch-a-Sketch toy has two dials, one of which draws horizontal, and the other vertical lines; resulting drawings are lineographic. The traditional task assigns parent and child each to one of the toy's control dials. They are instructed that they should not touch the other's dial, and so must cooperate to complete copies of provided line drawings on the Etch-a-Sketch within 8 min.

For the ESO task, recordings are made via Skype or another similar service provider. A web-cam and instructions for downloading and using Skype were provided as necessary, and a username and password given to prevent the need to create or use parents' personal accounts. Mothers were provided with a link to a webpage hosting the ESO task, an internet-enabled "on-screen" Etch-a-Sketch that is controlled by keyboard keys in place of the original toy's dials. Mothers and children were contacted by Skype, given scripted verbal instructions by the researcher at the beginning of the call (see Appendix A for verbatim instructions), and videorecorded through the online platform. In all other ways, the ESO protocol mirrors that of the original task: Drawing stimuli are used, and 8-min parent-child interactions recorded. With participant knowledge, researchers "hide" their webcam and

sound so that participating parents and children can see only ESO on their screen during the task to minimize distraction. Recordings capture parents and children as they look at their own screen and complete the ESO task.

The web-cam captured the faces and top torso of each mother and child. The web-cam did not capture hands when on the keyboard, but designated keyboard keys are as far apart as possible, meaning that incidences where mothers used the child's keys were rare and codable. In a minority of cases, it was necessary for the researcher to interrupt the ESO and ask the child to shift position to remain in web-cam view because, for coding purposes, it is important to ensure that parent and child faces are captured and remain in frame.

Coding and Reliability. In-home Etch-a-Sketch and ESO recordings were subsequently coded for positive and negative parenting by two trained observers who were not involved in data collection. Training consisted of four 2-hr sessions watching and coding interactions with the first author; training and discussion resolved differences in interpretation and calibrated coders. After training, the two coders watched each interaction together, stopping the tape to code in 2-min intervals. Coders initially coded independently, after which they compared codes, discussed any discrepancies, and deliberated to reach consensus codes. Scores from the 4 2-min sections were averaged to produce total scores over the full 8 min for each observation. Inter-rater reliabilities were calculated using the initial, independent individual codes. All other analyses were completed using consensus codes.

Measures

The Parent Child Interaction System (PARCHISY; Deater-Deckard, 2000; Deater-Deckard et al., 1997) was adopted for the current coding because it has been used widely with the original in-home Etch-a-Sketch task and because it has been used extensively across a range of populations and procedures (e.g., Hughes & Devine, 2017; Jambon, Madigan, Plamondon, Daniel, & Jenkins, 2018). Observations were coded for mothers' behavior using

the PARCHISY's 7-point Likert scales, coded 1 (*no occurrence of the behavior*) to 7 (*continual occurrence of the behavior*). *Positive Parenting* comprised maternal positive affect (e.g., verbal and non-verbal expressions of happiness or enjoyment of the task, interest, affection; inter-rater reliability (indexed by the intraclass correlation; ICC) ICC(39) = .95, $p<.001$), and positive control (e.g., use of praise, explanation, open-ended questions; ICC(39) = .95, $p<.001$). Positive affect and positive control were summed to derive a composite *Positive Parenting* score ($\alpha = .83$). *Negative Parenting* comprised maternal negative affect (e.g., rejection, frowning, a cold or harsh tone; inter-rater reliability ICC(39) = .83, $p<.001$), and negative control (e.g., use of criticism, shaming, physically taking over the child's keys, physical control of the child's hand/arm/body; ICC(39) = .90, $p<.001$). Negative affect and negative control were summed to derive a composite *Negative Parenting* score ($\alpha = .88$).

RESULTS

There were no mean level differences between assessment methods for mother's positive parenting (Home: $M = 4.07$, $SD = 0.89$; ESO: $M = 4.23$, $SD = 1.18$; $t(19) = -.75$, $p = .464$) or negative parenting (Home: $M = 1.20$, $SD = 0.26$; ESO: $M = 1.26$, $SD = 0.51$; $t(19) = -.61$, $p = .547$), and within-construct correlations were moderate to large (positive parenting, $r(19) = .63$, $p = .003$; negative parenting $r(18) = .45$, $p = .046$).

DISCUSSION

This preliminary study demonstrated high inter-rater reliability for ESO coding as well as promising convergent validity as indicated by the moderate to large associations between ESO and the traditional in-home Etch-a-Sketch task. These results are discussed fully in the overall Discussion (Study 2).

STUDY 2

METHOD

Participants

The sampling frame was the Twins, Family and Behaviour Study (TFaB) of 283 families ("core" sample) with twins born in England and Wales in 2009/2010, recruited through the Office for National Statistics, described in detail elsewhere (Mark, Pike, Latham, & Oliver, 2017). At the time of ESO data collection, 10 families (3.5%) had withdrawn, and two (< 0.1%) families had pertinent data missing and so were excluded; all other mothers were invited to participate and 208 (76.8%) consented to take part. Eighteen consenting mothers (8.7%) opted out when called to arrange data collection, citing a change of heart, lack of time, work commitments, relationship breakdown, or illness. Thirty-six mothers (17.3%) were unavailable within the testing window, 35 (16.8%) were unable to access the internet or had connection/recording issues that precluded coding. Thus, 119 families (238 children) were included (51.2% girls; 42.7% monozygotic twin pairs). Ethnicity was not formally collected, but the sample was largely Caucasian, reflective of the UK as a whole. Mothers were highly educated, with 69.5% reporting their educational achievement as undergraduate degree or higher.

Procedures

Data were collected through ESO at Time 1 (Child age: M = 5.51 years, SD = 4.92 months), and maternal postal questionnaires at Time 2 (Child age: M = 6.04 years, SD = 5.52 months). At Time 1, researchers contacted mothers by telephone to make an appointment for ESO observation recordings, providing them with a link to a webpage hosting the ESO task. The same protocol for the ESO-observation was followed as that described for Study 1. Mothers completed the ESO task with each twin separately (birth order was counterbalanced), and other family members (including co-twin) were asked to be absent.

Measures

Time 1. ESO observations were coded for mothers' behavior using the PARCHISY in the same way as described for Study 1. Inter-rater reliabilities (ICCs) were all > .78. Positive

affect and positive control were summed to derive a composite *Positive Parenting* score (α = .69). Negative affect and negative control were summed to derive a composite *Negative Parenting* score (α = .74).

Time 2. Three parenting questionnaires were completed by mothers; the *Parent-Child Relationship* scales (Hetherington & Clingempeel, 1992), the *Parental Feelings Questionnaire* (Deater-Deckard, 2000), and the *Parenting and Family Adjustment Scales* (Sanders, Morawska, Haslam, Filus, & Fletcher, 2014). To yield the most robust and appropriate maternal-reported parenting variables, items across all three questionnaires that conceptually paralleled the ESO-observed coding (i.e., excluding items of child to parent behavior and parenting items about inconsistent discipline) were subjected to principal components analysis. *Positive Parenting* (α = .68) and *Negative Parenting* (α = .80) factors emerged, with 5 items loading 0.5+ on the Positive factor and 8 items loading 0.5+ on the Negative factor. Positive parenting items included "I praise him/her when he/she behaves well." and "How much do you enjoy spending time alone with your child?" and negative parenting items included "How much do you criticise your child?" and "Sometimes I feel very impatient with him/her." All items and factor loadings are available in Appendix B. *Child disruptive behavior* was reported by mothers using the 36-item Eyberg Child Behavior Inventory (Eyberg & Pincus, 1999). Items include a range of aggressive and non-aggressive disruptive behaviors (e.g., "Acts defiant when asked to do something", "Physically fights with friends own age") rated on a 7-point scale, coded 1 (*never*) to 7 (*always*). Items were summed to form a total *Disruptive Behavior* score (α = .94).

RESULTS

Descriptive statistics, twin correlations, and cross-construct correlations for all study variables using information from both members of the twin pair and accounting for the nested nature of the data are presented in Table 1. Paired-samples *t*-tests revealed no significant

mean differences between twin-pair members for any variables. For all maternal-reported variables, twin correlations were high, as expected for maternal reports of young twins. Those for ESO-observed parenting were moderate. Cross-method parenting correlations, that is those between ESO-observed parenting and maternal reports, indicated negligible to moderate associations (*range* = .02 to -.29). Maternal reports of positive parenting did not significantly correlate with ESO-observed parenting, whereas maternal reports of negative parenting were significantly correlated with ESO-observed positive and negative parenting, in expected directions. All measures of parenting were significantly related to Time 2 child disruptive behavior (*range* =.20 - .67). ESO-observed positive and negative parenting, and maternal reports of positive parenting were moderately, and equivalently associated with Time 2 child disruptive behavior, whereas maternal reports of negative parenting showed a large association.

A series of multilevel models (MLM) accounted for the nested nature of the data (children nested in families) in the prediction of children's disruptive behavior. These results, including model fit, are presented in Table 2. Residual variables (corrected for age and gender) were used as is standard for twin studies to minimise artificially inflated associations for twins due to the children being the same age and, for two-thirds of the sample, gender (McGue & Bouchard, 1984). Models used centered variables and were estimated using Full Maximum Likelihood in M*Plus* v8.1.

Model 1 provided the baseline model, estimating the variance in maternal reports of children's disruptive behavior at Time 2. Model 2 examined the extent to which ESO-observed positive parenting at Time 1 and maternal reports of positive parenting at Time 2 explained this variance. The variance reduction from Model 1 to Model 2 (786.98-703.57) divided by the total variance in Model 1 (786.98), indicated that 11.6% of the variance in children's disruptive behavior was explained by these positive parenting variables. ESO-

observed positive parenting at Time 1 showed independent and, as expected, negative prediction of child behavior at Time 2, over and above contemporaneous maternal reports of positive parenting, which also showed significant prediction. Mirroring these analyses for negative parenting, Model 3 examined the extent to which ESO-observed and maternal reports of negative parenting explained the variance in maternal reports of children's disruptive behavior at Time 2. The variance reduction from Model 1 to Model 3 (786.98-421.58) divided by the total variance in Model 1 (786.98), indicated that 46.4% of the variance in children's disruptive behavior was explained by the negative parenting variables. Both ESO-observed and maternal reported parenting again evidenced independent prediction, with greater parental negativity predicting higher levels of disruptive behavior. Both Model 2 (Δ-2LL = 29.58, Δdf = 2, $p < .001$) and Model 3 (Δ-2LL = 79.13, Δdf = 2, $p < .001$) showed improvements to model fit from Model 1.

Model 4, our final model, examined the variance in maternal reports of children's disruptive behavior at Time 2 explained by both positive and negative parenting as coded from ESO observations at Time 1 and reported by mothers at Time 2. Here, independent prediction of disruptive behavior was provided only by maternal-reported negative parenting at Time 2 (in the expected direction). This less parsimonious model explained negligible additional variance when compared to Model 3 (< 0.3%: (421.58-419.26)/786.98), and showed no significant improvement to the model fit, as indicated by the higher AIC, and Δ-2LL = 1.18, Δdf = 2, $p > .05$. As such, Model 3 – including negative parenting only -- was the favored model, with independent positive prediction of child disruptive behavior given by ESO observations at Time 1 and maternal reports at Time 2.

DISCUSSION

We introduce ESO, a new, online parent-child observation tool administered online. The primary rationale for designing ESO was to provide an ecologically valid alternative to

traditional observations of parents with their children, relevant for diverse and large-scale studies. Parent-child relationships are complex, and multi-method approaches are key to their characterization, offering distinct information that may be important for understanding child outcomes (e.g., Hendriks et al., 2018; Schofield et al., 2016). As well as showing excellent inter-rater reliability, we demonstrated convergent validity with the traditional in-home Etch-a-Sketch task and providing partial validity support via parent reports. Most important, we demonstrated predictive validity, associating ESO-observed maternal parenting with maternal reports of children's disruptive behavior 6 months later, over and above contemporaneous self-reported parenting.

Reliability

Measures of inter-rater reliability for coding ESO were excellent (Cicchetti, 1994), and similar to those reported for in-home parent-child observations. An important future direction will be a short-term longitudinal study to assess ESO's test-retest reliability. In addition, a longer-term longitudinal study will be able to address stability and change in ESO observations.

Convergent Validity

When we compared ESO with the traditional in-home Etch-a-Sketch task (Study 1), coded negative parenting behaviors were moderately correlated, and positive parenting behaviors were substantially correlated. We suggest that this discrepancy in effect size is most likely due to the lower frequency and variance of parental negativity as opposed to positivity. It is a research challenge, especially for longitudinal studies, to design tasks that will elicit parental negativity while remaining acceptable to participants. We were encouraged, however, that the ESO elicited the same average levels of negativity as the well-established and widely used in-home version of the task.

Study 2 also included a test of convergent validity, this time in the associations between mothers' self-reported positive and negative parenting and ESO observations. Mother-reported negativity was moderately correlated with the ESO coded observations, but mother-reported positivity was not. We posit that parent reports of negativity are especially important to collect because of negativity's less frequent occurrence, such that, by their nature, single time observations may not capture them. Crucially, the modest associations we found between direct observations and parent reports accord with expectations from the literature (Hendriks et al., 2018; Schofield et al., 2016). Indeed, it is precisely the lack of overlap between methodologies in family-process research that necessitates multi-method approaches, including observational measures, and prompted the design of ESO as a resource-efficient, eco-friendly alternative. As such, arguably the key test was of ESO's predictive capability.

Predictive Validity

We showed that ESO-observed maternal positivity predicted child disruptive behavior even after accounting for mothers' reports of their own positivity, and that ESO-observed negativity predicted child behavior even after accounting for mothers' reports of their negativity. Notably, these maternal reports of parenting were a particularly conservative control, because, unlike ESO observations, they were collected contemporaneously and share method variance with our measure of child disruptive behavior. The current findings are thus strong support for ESO as a tool that captures additional -- and important -- aspects of parenting not accessed via parent questionnaire.

Our predictive validity findings offer preliminary support for ESO's practical utility for eliciting parent-child interactions in ways valuable for broadening the scale and scope of family research. Although costs associated with coding remain, data are collected in participants' own homes, yet without time and travel costs associated with lab-based or in-

home data collection. As such, ESO is an important methodological development for diverse, large-scale research.

We acknowledge that for our sample, only negativity was required to predict child disruptive behavior, reflecting commonly found negativity biases in psychology (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). In addition, we posit that observations of positivity may be important for more positive child outcomes. This is an avenue for future research.

Despite its strengths (including the counterbalancing of home-visit and ESO-observations in Study 1, and of older/younger twins in Study 2), limitations of our work are acknowledged. First, although there is no obvious reason for ESO to be unsuitable for other samples, care should be taken when generalizing because mothers in both studies were highly educated. Future research using larger and more diverse samples will allow consideration of generalizability, as well as more complex research questions, such as likely bidirectional and genetic links between parenting and child behavior (Avinun & Knafo, 2014; Oliver, 2015). Second, there was attrition from ESO, with internet-connection issues partly accountable. Of note, ESO observation data were collected in 2014-15; although internet connection still varies throughout the United Kingdom, it is being continually improved (OfCom, 2017). Finally, ESO observations were brief, and the coding we used was global. Similar procedures have been widely used (e.g., Hughes & Devine, 2017; Jambon, et al., 2018) and have the important advantage of being time- and resource efficient (e.g., Morawska, Basha, Adamson & Winter, 2015). However, crucially, it is possible to change the drawing stimuli, to use an alternative coding scheme, and to change the length of parent-child interactions using ESO, for researchers interested in extending the current methodology.

IMPLICATIONS FOR PRACTICE AND THEORY

Observations of parents and children are invaluable for understanding family mechanisms. Here, ESO, an innovative online parent-child observation tool is introduced, and preliminary

reliability and validity data provided. ESO yields parent-child interaction videos situated in participants' own homes. The richness of the ensuing data allows numerous approaches to assessment and coding and may open the door to online assessment of parent-child processes, facilitating scale and reach for the study of families in contemporary contexts.

ADDRESSES AND AFFILIATIONS

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ARTICLE INFORMATION

Conflict of Interest Disclosures: Each author signed a form for disclosure of potential conflicts of interest. No authors reported any financial or other conflicts of interest in relation to the work described.

Ethical Principles: For Study 1, informed consent was obtained, with ethical approval from the University of Sussex Science & Technology Cross-schools Research Ethics committee. For Study 2, informed consent was collected at each study stage, with ethical approval from NHS Health Research Authority, National Research Ethics Service and University of Sussex Science & Technology Cross-schools Research Ethics committees. The authors affirm having followed professional ethical guidelines in preparing this work. These guidelines include obtaining informed consent from human participants, maintaining ethical treatment and respect for the rights of human or animal participants, and ensuring the privacy of participants and their data, such as ensuring that individual participants cannot be identified in reported results or from publicly available original or archival data.

Funding: None.

Role of Funders/Sponsors: N/A

Acknowledgements: The authors thank Katie Mark, Rachel Latham, and Alex Earl for data collection and the core team of coders. We are very grateful to the families who participated in both studies. The ideas and opinions expressed herein are those of the authors alone, and endorsement by the Goldsmiths, University of London and University of Sussex is not intended and should not be inferred.

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APPENDIX A

Access to ESO

ESO can be found here: https://thenurturelab.itchaskitch.com

The recommended **drawing stimuli** are also at this link, and are based on the traditional task.

However, please note that it is possible to use other drawing stimuli as appropriate for individual studies.

Scripted instructions

This has been modified from our study for use with non-twin samples. Please note that these instructions assume the session has been pre-booked with the parent, and all equipment checks have been made.

[Start video-recording]

Hello *[Parent Name]*, it's nice to see you! Is that [*Child Name*] too?
Hi *[Child Name]*, my name is *[Researcher Name]*. Is/are *[other child(ren)]* okay elsewhere for the time being?

Mum/Dad, could you click on the etch-a-sketch weblink I've sent you so that you have the webpage open in front of you?

You will probably find it easiest for *[Child Name]* to be sitting on your left so they are nearest to the keys they will be using.

[Check positioning of parent and child so that child is on the left, and to ensure valid video capture; ask them to move if necessary until this is achieved]

Ok, so now I'm going to talk to you *[Child Name]*.

This is called an 'etch-a-sketch' and it's a toy that you can use to draw pictures. Your Mum/Dad *[present parent]* might have had an etch-a-sketch toy when they were little!
Can you see on the screen there are two pictures? One is a rectangle with a cross in it and the other is a house.

[Wait for confirmation]

The game is to use the etch-a-sketch to copy these pictures.

The way it works is that your Mum/Dad can draw lines that go **up and down** by pressing the '**O**' and '**M**' keys on the keyboard,

…and you can draw lines that go **side to side** by pressing the '**A**' and '**D**' keys.

Mum/Dad, can you point these out so you can both see where they are?

[Check in for confirmation]

But with this game there is an extra special rule -- you are not supposed to touch each others' keys!

So *[Child Name]* you are not allowed to press the up and down keys..

…and your Mum/Dad mustn't touch your side-to-side keys.

Do you both understand?

[Wait for confirmation]

You will have eight minutes to have a go at drawing these pictures together.

So that I don't distract you I will switch off my video and sound, though I will still be here. I will speak to you to tell you when the time is up. You can then decide if you have finished or if you wish to carry on a bit longer with it.

Does that sound alright? Do you have any questions before you get started?

Okay, you can get started then!

[Switch off audio and video – watch for positioning problems]

[After eight minutes, switch on audio and video]

Hello again, that's your time done -- how are you getting on?

APPENDIX B

Principal Component Analysis: Factor loadings > .5+ ordered by factor/magnitude

(Measure) Item	Positive Parenting	Negative Parenting
(PFQ) Child makes me angry		.75
(PFQ) Sometimes frustrated by child		.75
(PAFAS) Get annoyed with child		.69
(PAFAS) Argue with child about behaviour/attitude		.67
(PFQ) Sometimes feel very impatient with child		.65
(PAFAS) Shout/get angry when child misbehaves		.62
(PCR) Nag child about what they are doing wrong		.59
(PCR) Criticise child		.55
(PAFAS) Praise child for good behaviour	.73	
(PAFAS) Give attention for good behaviour	.70	
(PCR) Enjoy being a parent to child	.55	
(PCR) Enjoy spending time alone with child	.55	
(PFQ) Usually feel close to child	.54	
Additional items not included (loadings < .5)		
(PFQ) Sometimes wish child would go away		
(PFQ) Feel quite happy with relationship with child		
(PAFAS) Try to make child feel bad (guilt/shame)		
(PAFAS) Smack child when misbehave		
(PFQ) Sometimes amused by child		
(PCR) How much think of child		
(PCR) Find easy to be affectionate towards child		
(PAFAS) Treat/reward child for behaving well		
(PCR) Care about what child thinks [of parent]		

Note: PFQ: Parent Feelings Questionnaire (Deater-Deckard, 2000); PAFAS: Parenting and Family Adjustment Scales (Sanders et al., 2014); PCR: Parent-Child Relationship (Hetherington & Clingempeel, 1992).

TABLE 1

Descriptive Statistics and Correlations Among Study Variables

	Descriptives			Correlations (N = 119)			
	Older Twin *M (SD)*	Younger Twin *M (SD)*	Twin r (N = 100-115)	1.	2.	3.	4.
Time 1: ESO observations							
1. Positive parenting	6.04 (1.82)	6.01 (1.72)	.44***	--			
2. Negative parenting	2.24 (.46)	2.19 (.41)	.31***	-.29***	--		
Time 2: Maternal questionnaire							
3. Positive parenting	4.34 (.34)	4.34 (.35)	.76***	.14	.02	--	
4. Negative parenting	2.72 (.59)	2.71 (.57)	.91***	-.29***	.17*	-.32***	--
5. Child disruptive behavior	110.58 (29.55)	110.02 (26.99)	.87***	-.29***	.25**	-.20**	.67***

Note: †Descriptives given for raw variables; all correlations given for variables corrected for age and sex, using information from both twins, accounting for the nested nature of the data.
*p < .05. **p < .01. ***p < .001.

TABLE 2

Predicting Child Disruptive Behavior at Time 2: Multilevel Results Accounting for Nested Data

	Parameter Estimate (95% C.I.)			
	Model 1	Model 2	Model 3	Model 4
Fixed effects				
Time 1: ESO observations				
Positive parenting		-4.32***		-1.37
		(-6.10 – -2.53)		(-2.83 – .10)
Negative parenting			9.53*	8.01
			(2.59 – 16.48)	(.90 – 15.12)
Time 2: Maternal questionnaire				
Positive parenting		-12.67*		1.00
		(-21.70 – -3.64)		(-6.30 – 8.30)
Negative parenting			31.87***	30.97***
			(27.63 – 36.11)	(26.40 – 35.55)
Random effects	786.98***	703.57***	421.58***	419.26***
-2LL	950.18	920.60	871.05	869.87
AIC	1904.35	1849.20	1750.10	1751.74
RMSEA	.00	.00	.00	.00
df	0	2	2	4
χ^2	.00***	22.59***	121.69***	124.05***

Note. All variables corrected for age and sex and centred.
*p < .05. **p < .01. ***p < .001.