

A Scale of Parent-to-Child Emotions (SPCE): Development and validation of a short form

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Abstract

Aim: Parents' emotions towards a child are extremely important. The Scale of Parent-to-Child Emotions (SPCE) consists of five basic and four self-conscious emotion domains for assessment of parental emotional states. Abridgement of the SPCE is needed for research and clinical settings.

Methods: Our previous investigational data for SPCE development were used in this study. The sample of 2336 fathers and 2264 mothers, whose eldest child's age was up to 12 years old, was analyzed. Total information for each pair (form) of items corresponding to a latent trait (θ) was calculated. The form with the greatest amount of total information was selected as the best for each domain. In addition, relative efficiency for each form and correlations of raw sum scores in classical test theory (CTT) for short forms with factor scores in item response theory (IRT) were calculated.

Results: The SPCE was shortened to 18 items by selecting two items each for nine domains. Correlations of raw sum scores in CTT for short forms with factor scores in IRT were correlated strongly and significantly.

Conclusion: This abridged form of the scale, the SPCE-18, may be applicable in a busy clinical setting or research works to investigate the trajectory of parent-to-child emotions across a long span of time.

KEYWORDS

basic emotions, item response theory, parent-to-child emotions, scale development, self-conscious emotions, short form

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INTRODUCTION

Parents' emotions towards a child are an extremely important part of the qualities and characteristics of the dyad relationship. As parents' emotions motivate the child to behave, the parent-child interaction is affected by the parent's emotional states. A meta-analytic review of parent emotional regulation included 53 studies, and of those, 36 studies assessed parenting behaviours.¹ Whereas happiness, confidence, sadness/discouragement, and irritation/anger were more consistently related to motivational states than actual behavior, concern/worry was only related to actual engagement.² A child is a significant other for a father/mother and vice versa. Various emotions spring into a parent's mind when they think about their child. Identification and evaluation of the intensity level of primary emotions towards one's own child are of pivotal importance for the assessment of parental emotional states. These emotions towards one's own child are candidates for the core concept of maternal/paternal bonding.

Basic and self-conscious emotions are representative of human emotions. A basic emotion is a biological reaction, which is characterized by facial expressions via the central nervous systems.^{3,4} A self-conscious emotion is evoked and generated when one's own experiences reflect on the worth or value of the self in one's own or others' view.⁵⁻⁸ Self-conscious emotions are distinct in attributional terms. Shame focuses on the entire, global self, whereas guilt focuses on behaviors, the specific self.^{5,8} Pride is divided into two types: alpha pride is feelings of pride in the entire self, and beta pride is feeling pride having roots in evaluations of specific behaviours.^{5,6,8} The emotions from a parent to their child should be viewed under the rubric of both basic and self-conscious emotions as human emotions.⁹⁻¹¹

Hada et al. developed the Scale of Parent-to-Child Emotions (SPCE), which consists of basic and self-conscious emotion domains: Happiness, Anger, Fear, Sadness, Disgust, Shame, Guilt, Alpha Pride, and Beta Pride.¹¹ Though substantially correlated, we treated these domains as independent according to the theory of emotions. Each of the emotion domains showed unidimensionality by confirmatory factor analysis (CFA). Measurement invariances (MIs) of each SPCE domain were confirmed across gender (father and mother) and child's age from fetal stage to school age by a series of multi-group confirmatory analyses (MGCFAs) in classical test theory (CTT). In addition, item characteristics in item response theory (IRT) were analyzed by using the graded response model (GRM)¹² together with differential item functioning.¹¹ Thus, the SPCE proved to be a scale with robust psychometrical characteristics to measure parent-to-child emotions. The SPCE was developed in Japan; however, it has not yet been used clinically.

The development of the SPCE started with 62 items and was reduced to 43 after rigorous statistical analyses. Nevertheless, the SPCE-43 may still be too large in clinical and research settings. This is particularly the case when clinicians or researchers want to repeatedly measure parent-to-child emotions with

relatively short intervals. Our aim is to develop a short form of the SPCE. The methodology of development of a short version of a psychological measure has often been criticised.¹³⁻¹⁷ We adopted IRT, not CTT, to develop a short-form scale.^{18,19} A short-form scale must keep and summarize the properties of the original scale. Development of a short-form scale has risks of poorer validity and reliability than its original long-form scale. Methodological issues in the process of item reduction lead to poorer validity.¹³ IRT is likely to solve these methodological issues. Item characteristics that are explained by the item parameters in IRT are needed to calculate true emotional intensities in rational construct (i.e., Happiness, Anger, Fear, Sadness, Disgust, Shame, Guilt, Alpha pride, and Beta pride). Many previous studies reported that antenatal bonding status predicted postnatal bonding status.²⁰⁻²⁵ However, these studies used different scales for women in antepartum and postpartum periods. Because no scales had abilities to measure parent-to-child emotion based on the *same* construct regardless of parental demographics (e.g., differences in parent's gender, child's ages, and countries), a child-age nonspecific measurement is desperately needed to cast new light on prediction or trajectory studies.

In this study, we aimed, for a practical requirement, to select only two items each for nine domains, for a total of 18 items, from the SPCE full form, which consists of 43 items. Abridgement of the SPCE is needed in research and clinical settings. Dai et al.²⁶ claimed that a measurement of as few as three items could be executable in recovering the person parameters. However, a set of three items for every nine domains is too long to be used in brief practices. Taking into consideration the burden for respondents, the shorter the scale length, the better. Therefore, we decided that two items for each domain would be the best scale length.

METHODS

Study procedure and participants

This report is a secondary analysis of our previous investigation.¹¹ The design of the study was cross-sectional. Participants were fathers and mothers whose eldest child's age was up to 12 years old (including the fetus stage). Twenty segments by the parent's gender (father/mother) and child's age stages were set. All participants were allocated into appropriate segments. Details are described elsewhere.¹¹

With the cooperation of Rakuten Insight Inc. (Setagaya, Tokyo), parents who were or whose partners were pregnant or who lived with their child/children were recruited from 47 prefectures in Japan. The total number of respondents was 4600. Of those, 2336 were fathers and 2264 were mothers. A webpage for the invitation to our study contained all the necessary information for participation: the purpose of the research and affiliations of the study, and information about ethics. The Rakuten Insight web page was available from November 30 to December 6, 2021.

Measurement

The SPCE is a scale consisting of nine domains: Happiness (four items), Anger (six items), Fear (four items), Sadness (five items), Disgust (five items), Shame (five items), Guilt (seven items), Alpha Pride (three items), and Beta Pride (four items).

Statistical analyses

An abridged form is important because a long-form scale makes respondents feel burdened. On the other hand, the psychometric properties of the original scale (full form) should be kept for its validity and reliability. A notable characteristic of IRT is to analyze the individual items of a scale to measure underlying latent traits. Its advantage is to describe difficulties and abilities of the items one by one. A latent trait can be estimated as accurately as possible from participants' responses. A mathematical statement as to how the response depends on the level of ability or skill (i.e., latent trait) is an initial step.²⁷ This relationship is given by the item response function. A latent trait (e.g., depression), is usually scaled to a mean of 0 and a standard deviation of 1.0. This latent trait is named theta (θ). Item information function (IIF) is a curve that indicates the amount of information about θ level that an item score provides at each point on the θ scale. Test information function (TIF) provides at each θ level the amount of information obtained from the total score on a scale about a person's latent trait level expressed on the θ metric. TIF is also the sum of each IIF.²⁸ The comparison of information functions is done by computing the relative efficiency of one test, compared with the other:

$$RE(\theta) = \frac{I_A(\theta)}{I_B(\theta)}$$

$RE(\theta)$ denotes relative efficiency and $I_A(\theta)$ and $I_B(\theta)$ are the information functions for Tests A and B, respectively.^{28,29} If, for example, $I_A(\theta) = 18$ and $I_B(\theta) = 25$, then $RE(\theta) = 0.72$. Test A consists of 15 items, and Test B consists of 30 items for measuring the same construct. The items of Test A are nested in the items of Test B. Test A reduced items to half of Test B ($15/30 = 0.5$) and yet $RE(\theta) = 0.72$ (>0.5). Higher $RE(\theta)$ than the item reduction rate indicates sufficient test information. Thus, $RE(\theta)$ is a useful concept to select optimal items for a short form. First, we created short forms that were all combinations of two items for each domain: six pairs for the Happiness domain, 15 pairs for Anger, six pairs for Fear, 10 pairs for Sadness, 10 pairs for Disgust, 10 pairs for Shame, 21 pairs for Guilt, three pairs for Alpha Pride, and six pairs for Beta Pride. The total information of each pair (form) corresponding to a latent trait (θ) was calculated. GRM was adopted for computing total information. The form with the greatest amount of total information was selected as the best for each domain. In addition, relative efficiency for each form was calculated. The selected short form was considered for its relative efficiency for the item reduction rate. After finalizing the best 2-item domains, correlations of raw sum scores in CTT for short forms with factor scores in IRT were computed.

RESULTS

The best forms for the domains were: form2, form3, form3, form3, form3, form3, form9, form2, and form2 for Happiness, Anger, Fear, Sadness, Disgust, Shame, Guilt, Alpha Pride, and Beta Pride, respectively (Supporting Information: Table S1). $RE(\theta)$ of each form was greater than expected from the ratio of short-form and full-form item numbers.

Correlations of raw sum scores in CTT for short forms with factor scores in IRT were all significant ($p < 0.001$) and strong ($r > 0.8$) (Table 1). Plots of sum scores in CTT with factor scores in IRT for each domain showed on Supporting Information: Figure S1. On the y-axis is the traditional score, formed by summing responses to each short form. On the x-axis is the SPCE score produced using IRT such that scores are calibrated with, and thus are directly comparable to, SPCE factor scores in IRT. Sum scores for each short form are likely to be corresponding to the SPCE factor scores in IRT. Finally, 18 items were selected for a short form of the SPCE. Item contents and selected items for the SPCE-18 are shown in Supporting Information: Table S2.

DISCUSSION

This study used IRT to select items for the short-form SPCE. The SPCE was shortened to 18 items by selecting two items each for nine domains with the least reduction of psychometric properties including item response of the SPCE. Each short form of all the domains preserved sufficient information to estimate latent traits. Moreover, significant correlations were shown between raw sum scores for short forms and factor scores.

This abridged form of the scale, the SPCE-18, may be used in a busy clinical setting or research works to investigate the trajectory of

TABLE 1 Correlations of raw sum scores (in CTT) for short form with factor scores in IRT.

	Correlation of factor score with sums score	95% CI
Happiness	0.900***	0.893 (0.883–0.914)
Anger	0.910***	0.910 (0.901–0.919)
Fear	0.911***	0.910 (0.896–0.923)
Sadness	0.870***	0.869 (0.854–0.884)
Disgust	0.828***	0.827 (0.808–0.846)
Shame	0.886***	0.885 (0.874–0.897)
Guilt	0.873***	0.872 (0.862–0.883)
Alpha Pride	0.867***	0.856 (0.826–0.889)
Beta Pride	0.879***	0.878 (0.864–0.893)

Abbreviations: CI, confidence interval; CTT, classical test theory; IRT, item response theory.

*** $p < 0.001$.

parent-to-child emotions across a long span of time. Only by such a longitudinal study can researchers investigate the influences of parent-to-child emotions upon parental and child behaviors as well as causes of parent-to-child emotions. Another area of research interest is the cultural aspect of parent-to-child emotions. Cross-cultural differences in parent-to-child emotions might be observed. Western culture has high arousal emotions, whereas Eastern culture has low arousal emotions.²⁹ The distinct characteristics of individualist and collectivist cultures explains those cultural differences in arousal emotions.³⁰ Development of a measure in the framework of IRT may make it easier to conduct transcultural studies. For example, Gibbons and Skevington³¹ demonstrated how to compensate for differential item functioning across four countries to be compared on a common metric in computer-adaptive tests of quality of life using IRT.

As mentioned earlier, parent-to-child emotions are candidates for the core concept of maternal/paternal bonding. The parental bonding states can be measured by the SPCE, regardless of gender difference or the child's age. The comparable measurement tools cast light on the individual differences in parental bonding. We should pay more attention to the qualities and characteristics of the dyad relationship described by parent-to-child emotions. Parent-child bonding should be nurtured from the antenatal period to develop strong family relationships. Medical professionals should provide continuous support for families that considers the quality and characteristics of bonding. The SPCE-18 may be a promising tool for clinical situations.

This study is not without drawbacks. This is a preliminary study. We must further investigate the abridged scale's validity and reliability, including its usage in clinical situations. First, each domain should be studied in its correlations with psychological variables akin to its domain (construct validity); test-retest reliability also needs to be conducted. Second, the emotional status and characteristics among the different groups, which were measured by the SPCE, should be described. Third, in this study, only the emotions focused on the first child were measured. Further investigation is needed to explain differences in the order of the child. Fourth, psychometric properties should be examined among populations in English-speaking cultures or other cultural settings. Within the limitations thus noted, we believe that the SPCE-18 can create an avenue for further care for parent and child relationships as well as research in this field.

AUTHOR CONTRIBUTIONS

All authors set up the research design. A.H. collected data. A.H. and T.K. analyzed data. A.H. and T.K. wrote the manuscript. All the authors read and approved the final draft.

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We thank all participants. The SPCE full form and short form (including the Japanese version) used in this study may be available upon reasonable request to the first author. This study was supported by JSPS KAKENHI Grant Number 21H03255 (PI: Yukiko Ohashi) and T. and F. Kitamura Foundation for Studies and Skill Advancement in Mental Health Grant Number 2021101401 (PI: Ayako Hada).

CONFLICT OF INTEREST STATEMENT

T.K. and Y.O. are directors of T. and F. Kitamura Foundation for Studies and Skill Advancement in Mental Health. A.H. and Y.U. have no conflicts of interest to report.

DATA AVAILABILITY STATEMENT

The data set analyzed and used in this study may be available upon reasonable request to the first author.

ETHICS APPROVAL STATEMENT

This study was conducted under the approval of the Institutional Review Board (IRB) of the Kitamura Institute of Mental Health Tokyo (No. 2021101401).

PATIENT CONSENT STATEMENT

All participants were provided with an explanation about the aim as well as the procedure of this survey. They were regarded as agreeing to participate by responding to the questionnaire. Written informed consent is not necessary for this type of study.

CLINICAL TRIAL REGISTRATION

N/A.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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