NEPS
National Educational Panel Study

Information on Direct Measures

NEPS Starting Cohort 1 — Newborns
Education From the Very Beginning

Wave 1: 7 months

LIfBi

**LEIBNIZ INSTITUTE FOR
EDUCATIONAL TRAJECTORIES**

Direct measures (observations and test information)					
Test situation	Seven-month-old children were observed/tested individually in their homes in the presence of the anchor person and the interviewer.				
Sequence of tests/observations	The direct measures were administered in the following sequence: 1. Habituation-Dishabituation Paradigm 2. Parent-Child-Interaction (Linberg, A., Mann, D., Attig, M., Vogel, F., Weinert, S., & Roßbach, H.-G. (2019). *Assessment of interactions with the macro-analytic ratings system of parent-child-interactions in the NEPS at the child's age of 7, 17, and 26 months* (NEPS Survey Paper No. 51). Bamberg: Leibniz-Institute for Educational Trajectories, National Educational Panel.) 3. Cognitive Development: Sensorimotor Development The direct measures were recorded on video and coded afterwards.				
Duration of observations/tests (excluding setup)	approx. 18,5 minutes				
Information about the administered direct measures					
Construct	Number of tasks	Duration	Mode of administration	Number of coded items	Next assessment(s)
Habituation-Dishabituation Paradigm	1 task with 13 trials	approx. 6,5 minutes	visual stimuli presented on a laptop; coding of visual attention/fixations	132	Wave 2
Parent-Child-Interaction	-	approx. 8 minutes	observed interaction behavior	18	Wave 2 Wave 3
Cognitive Development: Sensorimotor Development	4 tasks	approx. 4 minutes	observed play behavior with novel objects (standardized tasks)	20	-

Preface

The development of the individual tests is based on framework concepts. They are overarching concepts on the basis of which education-relevant competences are to be shown consistently and coherently over the entire personal history. Therefore, the following framework concepts, which served as a basis for the development of the test tools to measure the above-mentioned constructs, are identical in the different studies.

In addition to the competence measures, which are coherently assessed across the lifespan, stage-specific measures are assessed at specific points in time at which these measures are especially meaningful (cf. Berendes, Weinert, Zimmermann, & Artelt, 2013[1]). Usually, these assessments are not repeated.

---

[1] Berendes, K., Weinert, S., Zimmermann, S., & Artelt, C. (2013). Assessing language indicators across the lifespan within the German National Educational Panel Study (NEPS). *Journal for Educational Research Online/Journal für Bildungsforschung Online, 5*(2), 15–49.

Habituation-Dishabituation Paradigm

The habituation-dishabituation paradigm is an empirical procedure that is frequently used to study and assess early processes and abilities of attention and information processing that are considered fundamental for the cognitive development of very young children (Colombo & Mitchell, 2009).

Using visual habituation-dishabituation tasks, children are presented with visual stimuli (e.g., pictures), and their looking behavior and fixation times are observed or recorded and analyzed. In such standard procedure tasks, a sequence of stimuli that are identical or similar with regard to certain aspects (habituation phase) is followed by markedly different stimuli (dishabituation phase). Depending on the exact design, the tasks allow a broad spectrum of early child abilities to be investigated, such as (early) memory (e.g., McCall & Carriger, 1993), sensitivity to and the ability to distinguish properties of objects (e.g., Oakes et al., 1991), recognition of concrete or abstract features (e.g., Casasola, 2005), categorization skills (e.g., Oakes, 2010), early understanding of numerical relations (e.g., Wynn, 1992), and skills in intermodal information processing (e.g., Streri & Féron, 2005).

Experimental paradigms examining visual habituation are used to assess children's information processing skills, mostly based on the decrease in looking times during the presentation of a sequence of visual stimuli (Colombo & Mitchell, 2009). The repeated presentation of identical or similar stimuli during the habituation phase leads to a decrease in the children's visual attention (i.e., their orientation response decreases). Children look at the pictures less because they classify them as familiar (habituation). If a new stimulus that differs from the previously presented stimuli is introduced and is recognized as such by the children, this triggers a new orientation response and, thus, an increase in visual attention (dishabituation; Oakes, 2010).

In habituation-dishabituation research, there is evidence of a certain amount of intraindividual (Bornstein, 1985; Bornstein et al., 1996) and interindividual (Davis & Anderson, 2001) stability of task performance and, thus, of underlying cognitive abilities. There are predictive relations of various habituation measures and of preference for novelty in the dishabituation phase with later general cognitive performance (e.g., Bornstein & Sigman, 1986; Colombo et al., 2009; Fagan & Singer, 1983) and academic achievement in adolescence (Bornstein et al., 2013). Domain-general tasks (i.e., tasks that are thought to indicate early cross-domain abilities), for example, were shown to be predictive of later general cognitive measures such as categorization or intelligence test performance (Rose & Feldman, 1997). Domain-specific tasks focus on early precursor skills in specific domains of competence (e.g., early comprehension of numbers and quantities or linguistic skills).

In the Newborn Cohort of the German National Educational Panel Study (NEPS SC1), a visual habituation-dishabituation paradigm was used in the first survey wave as well as for half of the sample in the second wave[2]. Although the procedure is usually conducted in a laboratory, it was administered in a household context.

---

[2] The NEPS measures draw on studies and experiences of the Bamberg Baby Lab of the Department of Developmental Psychology at the University of Bamberg (Head: Prof. Dr. S. Weinert). We would also like to thank Prof. Dr. S. Pauen for her advice on the implementation of the paradigm. Preliminary studies on the tasks were conducted at the Bamberg Baby Lab.

Procedure in Wave 1 (children on average 7 months old)

In Wave 1, two domain-general tasks with a fixed sequence of similar pictures (trials) were presented to the children on a laptop. The procedure was the same for all children. Both tasks started with a habituation phase with nine trials each (i.e., nine pictures in a fixed sequence) and were followed by two sequential dishabituation phases (consisting of two trials each). The latter deviated from the pattern of the habituation stimuli to varying extents. While the first dishabituation phase tested children's categorization skills, the main goal of the second dishabituation phase was to test their general attention. The pictures of the first task were based on the stimulus material by Pahnke (2007); those used in the second task were based on stimulus material from studies conducted by the Bamberg Baby Lab[3] (e.g., Zhang, 2007). In both tasks, each picture was shown for 10 seconds, and a non-linguistic auditory cue (i.e., a short sequence of three notes) was played when the picture was first presented to catch the infant's attention. There was a 2-second intertrial interval between the presentation of each trial, and a 1-second intertrial interval between the two trials of each dishabituation phase for the first task. For both tasks, the habituation phase consisted of nine trials, while the two dishabituation phases consisted of two trials each.

The coding of the child's looking times per trial – on or off target, respectively – was done offline by independent raters using video recordings of the child's looking behavior and INTERACT (Mangold, 2011) software (30 frames per second). The following variables were made available based on the coding of the children's looking times[4]: five variables describing the looking behavior at the target picture (maximum, minimum, mean, total fixation time, and the number of fixations on target) and five variables describing the looking behavior off target (maximum, minimum, mean, and total looking time as well as the number of times looked off target).

The available data comprise information on the coding procedure and child-related issues. The corresponding method data set includes additional detailed information on distractions during stimulus presentation and ratings of the video's codability.

References

Bornstein, M. H. (1985). How infant and mother jointly contribute to developing cognitive competence in the child. *Proceedings of the National Academy of Sciences*, *82*(21), 7470–7473. https://doi.org/10.1073/pnas.82.21.7470

Bornstein, M. H., Brown, E., & Slater, A. (1996). Patterns of stability and continuity in attention across early infancy. *Journal of Reproductive and Infant Psychology*, *14*(3), 195–206. https://doi.org/10.1080/02646839608404517

---

[3] DFG project 'Word learning principles, naming effects, and categorical distinctions: Studies of vocabulary acquisition and language effects in young children' (funded by the German Research Foundation; grant to S. Weinert; WE 1478/6-2).

[4] Up to and including version SC1:9.0.1, only codings of the first tasks are available. The German Research Foundation (DFG) within the DFG Priority Programme 1646 Education as a lifelong process. Analyzing data of the National Educational Panel Study (NEPS), project "Video-Based Validity Analyses of Measures of Early Childhood Competencies and Home Learning Environment (ViVA)" (grant to Prof. Dr. S. Weinert, WE 1478/7-1 & 7-2; research assistant responsible for the coding: Dr. J.-D. Freund) funded coding of the second task. The codings will be made available after project completion.

Bornstein, M. H., Hahn, C. S., & Wolke, D. (2013). Systems and cascades in cognitive development and academic achievement. *Child Development*, *84*(1), 154–162. https://doi.org/10.1111/j.1467-8624.2012.01849.x

Bornstein, M. H., & Sigman, M. D. (1986). Continuity in mental development from Infancy. *Child Development, 57*(2), 251–274. https://doi.org/10.2307/1130581

Casasola, M. (2005). When less is more: How infants learn to form an abstract categorical representation of support. *Child Development*, *76*(1), 279–290. https://doi.org/10.1111/j.1467-8624.2005.00844.x

Colombo, J., & Mitchell, D. W. (2009). Infant visual habituation. *Neurobiology of Learning and Memory*, *92*(2), 225–234. https://doi.org/10.1016/j.nlm.2008.06.002

Colombo, J., Shaddy, D. J., Blaga, O. M., Anderson, C. J., Kannass, K. N., & Richman, W. A. (2009). Early attentional predictors of vocabulary in childhood. In J. Colombo, P. McCardle, & L. Freund (Eds.), *Infant pathways to language: Methods, models, and research directions* (pp. 143–167). Psychology Press.

Cooper, R. (1984). Early number development: Discovering number space with addition and subtraction. In C. Sophian (Ed.), *Origins of cognitive skills* (pp. 157–192). Erlbaum.

Davis, H., & Anderson, M. (2001). Developmental and individual differences in fluid intelligence: Evidence against the unidimensional hypothesis. *British Journal of Developmental Psychology*, *19*(2), 181–206. https://doi.org/10.1348/026151001166029

Fagan, J. F., & Singer, L. T. (1983). Infant recognition memory as a measure of intelligence. In L. P. Lipsitt (Ed.), *Advances in infancy research* (Vol. 2, pp. 31–78). Ablex.

Freund, J.-D. (2012). *Erfassung numerischer Kompetenzen im frühen Kindesalter: Entwicklung und Evaluation eines Messinstruments [Assessing numerical competencies in early childhood: Developing and evaluating a measurement instrument]. (Unpublished thesis).* University of Bamberg, Germany.

Mangold (2011). *INTERACT* (Version 9.6.1.170) [Computer software]. Mangold International.

McCall, R. B., & Carriger, M. S. (1993). A meta-analysis of infant habituation and recognition memory performance as predictors of later IQ. *Child Development*, *64*(1), 57–79. https://doi.org/10.1111/j.1467-8624.1993.tb02895.x

Oakes, L. M. (2010). Using habituation of looking time to assess mental processes in infancy. *Journal of Cognition and Development*, *11*(3), 255–268. https://doi.org/10.1080/15248371003699977

Oakes, L. M., Madole, K. L., & Cohen, L. B. (1991). Infants' object examining: Habituation and categorization. *Cognitive Development*, *6*(4), 377–392. https://doi.org/10.1016/0885-2014(91)90045-F

Pahnke, J. (2007). *Visuelle Habituation und Dishabituation als Maße kognitiver Fähigkeiten im Säuglingsalter [Visual habituation and dishabituation as measures of cognitive abilities in infancy] (Unpublished doctoral dissertation)*. Ruprecht-Karls-Universität Heidelberg. https://doi.org/10.11588/heidok.00007459

Rose, S. A., & Feldman, J. F. (1997). Memory and speed: Their role in the relation of infant information processing to later IQ. *Child Development*, *68*(4), 630–641. https://doi.org/10.2307/1132115

Seitz, M., & Weinert, S. (2022). Numeracy skills in young children as predictors of mathematical competence. *British Journal of Developmental Psychology*, *40*(2), 224-241. https://doi.org/10.1111/bjdp.12408

Streri, A., & Féron, J. (2005). The development of haptic abilities in very young infants: From perception to cognition. *Infant Behavior and Development, 28*(3), 290–304. https://doi.org/10.1016/j.infbeh.2005.05.004

Wynn, K. (1992). Addition and subtraction by human infants. *Nature, 358*(6389), 749–750. https://doi.org/10.1038/358749a0

Zhang, D. (2007). *Learn a word learning constraint: Emergence of the taxonomic constraint and its relationship with early word acquisition (Unpublished doctoral dissertation)*. Otto-Friedrich-Universität Bamberg. https://fis.uni-bamberg.de/handle/uniba/125

Parent-Child-Interaction

From the beginning of a child's life, the home learning environment is important for child development and later educational trajectories (Bronfenbrenner & Morris, 2006; Linberg et al., 2019). Thus, the quality of early interactional behaviors in parent-child dyads affects several domains of child development, such as socio-emotional, cognitive, and language development (Newton et al., 2014; Tamis-LeMonda et al., 2001; Tamis-LeMonda et al., 1996; Tamis-LeMonda et al., 1998).

Various theories and empirical studies have emphasized the specific role of different dimensions of parental interaction behaviors, sometimes focusing on specific developmental domains (e.g., Ainsworth et al., 1974; Blomeyer et al., 2010; Linberg, 2018; Newton et al., 2014; NICHD Early Child Care Research Network, 1998; Wood et al., 1976). These dimensions include supportive and sensitive behavior as well as stimulating interactional behavior, emotionally positive and negative regard, parental intrusiveness, or detachment. The quality of parental interaction behavior can be operationalized in a variety of ways, either as a single specific rating or as a global indicator that encompasses multiple facets of parental interaction behavior (e.g., Linberg et al., 2017; NICHD Early Child Care Research, 2005).

Both interaction partners (Rogoff, 1990) mutually influence interactional behavior in parent-child dyads (Bornstein et al., 2008; Kochanska & Aksan, 2004; Masur & Turner, 2001). The child's characteristics and behaviors affect his or her interaction partner and are simultaneously influenced by his or her interaction partner's behavior.

To assess the quality of parent-child interaction in the Newborn Cohort of the German National Educational Panel Study (NEPS SC1), an adapted version of the NICHD-SECCYD study instrument was used (NICHD Early Child Care Research Network, 1991; 1992a; 1992b; see Sommer et al., 2016). Parent-child interactions were observed in a semi-standardized setting in the family home during the first three survey waves, at a time when the children were on average 7, 17, and 26 months old. The interactions were videotaped and subsequently rated off-line by trained observers (Linberg et al.,

2019). More detailed information on the household setting, the coding instrument, coding instructions, and coder consistency can be found in Linberg et al. (2019) for all three waves.

The following aspects were standardized: the general setup, the playtime, and the play materials. The parents were asked to behave as they always do when spending time with their child and to play with their child as usual. In most cases, the mother acted as the child's interaction partner, and in rare cases the father. The survey used different toys that can elicit different responses in children, for example, by means of a sudden discrete effect, an action with continuous effect, state-related goals, pretend play, and joint attention (for a detailed description of the play materials, see Sommer et al., 2016). The data on all German-language interaction situations are available in the scientific use file (SUF).

Procedure in Wave 1 (children on average 7 months old)
In Wave 1, the children first played with their own toys during a 3-minute warm-up period. After 3 minutes, these toys were put aside, and the parent was given the play materials (NEPS toys) and instructed to play with his or her child for another 5 minutes. Only the 5 minutes of interaction while playing with the NEPS toys were coded.

The parent-child interactions were coded on the basis of video recordings using eight rating scales for parental interaction behavior and five rating scales for different facets of child interaction behavior. The ratings of parental interaction behaviors referred to parents' sensitivity to distress and non-distress, cognitive-linguistic stimulation, emotionality, positive and negative regard, intrusiveness, and detachment (Linberg et al., 2019). The ratings of child interactional behavior referred to the child's positive and negative mood, activity level, non-social sustained attention, and social engagement. Each rating scale included five qualitatively defined levels, ranging from 1 "not at all characteristic" to 5 "very characteristic".

In addition to the eight ratings of parental interaction behavior and the five ratings of child interaction behavior, the SUF[5] contains variables with information on whether data on parent-child interaction are available, which coder rated the interaction, whether the interaction language was German, whether there were deviations from the standardized setting, and whether the parent spoke to the child during the interaction. Apart from additional useful information on the parents in the parent interview data set, the SUF also contains information about which parent participated in the parent-child interaction.

References

Ainsworth, M. D., Bell, S. M., & Stayton, D. F. (1974). Infant-mother attachment and social development: Socialization as a product of reciprocal responsiveness to signals. In M. Richards, *The integration of a child into a social world* (pp. 99–135). Cambridge University Press.

---

[5] Up to and including version SC1:9.0.1, only macro codings are available. As part of the project "Video-Based Validity Analyses of Measures of Early Childhood Competencies and Home Learning Environment (ViVA)" (supervisors: Prof. Dr. H.-G. Roßbach, Prof. Dr. S. Weinert) funded by the German Research Foundation (DFG) within the DFG Priority Programme 1646 (Education as a lifelong process. Analyzing data of the National Educational Panel Study (NEPS)), micro codings were carried out, which will also be made available after project completion.

Blomeyer, D., Pfeiffer, F., Reuß, K., & Laucht, M. (2010). Mutter-Kind-Interaktion im Säuglingsalter, Familienumgebung und Entwicklung früher kognitiver und nicht-kognitiver Fähigkeiten: Eine prospektive Studie (Mother-child interaction in infancy, family environment, and the development of early cognitive and non-cognitive abilities: A prospective study). *Vierteljahrshefte zur Wirtschaftsforschung, 79*(3), 11–26. https://doi.org/10.3790/vjh.79.3.11

Bornstein, M. H., Tamis-LeMonda, C. S., Hahn, C.-S., & Haynes, O. M. (2008). Maternal responsiveness to young children at three ages: Longitudinal analysis of a multidimensional, modular, and specific parenting construct. *Developmental Psychology, 44*(3), 867–874. https://doi.org/10.1037/0012-1649.44.3.867

Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In R. M. Lerner (Ed.), *Handbook of child development: Vol. 1. Theoretical models of human development* (pp. 793–828). Wiley. https://doi.org/10.1002/9780470147658.chpsy0114

Kochanska, G., & Aksan, N. (2004). Development of mutual responsiveness between parents and their young children. *Child Development, 75*(6), 1657–1676. https://doi.org/10.1111/j.1467-8624.2004.00808.x

Linberg, A. (2018). *Interaktionen zwischen Mutter und Kind. Dimensionen, Bedingungen und Effekte. Empirische Erziehungswissenschaft (Mother-child interactions. Dimensions, prerequisites, and effects)*. Waxmann.

Linberg, A., Freund, J.-D. & Mann, D. (2017). Bedingungen sensitiver Mutter-Kind-Interaktionen (*Prerequisites of sensitive mother-child-interactions*). In H. Wadepohl, K. Mackowiak, K. Fröhlich-Gildhoff, & D. Weltzien (Eds.), *Interaktionsgestaltung in Familie und Kindertagesbetreuung*, (pp. 27–52). Springer VS. https://doi.org/10.1007/978-3-658-10276-0_2

Linberg, A., Mann, D., Attig, M., Vogel, F., Weinert, S., & Roßbach, H.-G. (2019). *Assessment of interactions with the macro-analytic rating system of parent-child-interactions in the National Educational Panel Study at the child's age of 7, 17, and 26 months (NEPS Survey Paper No. 51)*. Leibniz-Institut für Bildungsverläufe, Nationales Bildungspanel.

Masur, E. F., & Turner, M. (2001). Stability and consistency in mothers' and infants' interactive styles. *Merrill-Palmer Quarterly, 47*(1), 100–120. https://doi.org/10.1353/mpq.2001.0003

Newton, E. K., Laible, D., Carlo, G., Steele, J. S., & McGinley, M. (2014). Do sensitive parents foster kind children, or vice versa? Bidirectional influences between children's prosocial behavior and parental sensitivity. *Developmental Psychology, 50*(6), 1808–1816. https://doi.org/10.1037/a0036495

NICHD Early Child Care Research Network. (1991). *Procedures for videotaping mother-child-interaction at 6 months (Unpublished document)*. NICHD Study of Early Child Care.

NICHD Early Child Care Research Network. (1992a). *Procedures for videotaping mother-child-interaction at 15 months (Unpublished document)*. NICHD Study of Early Child Care.

NICHD Early Child Care Research Network. (1992b). *Procedures for videotaping mother-child-interaction at 24 months in the 3-boxes paradigm (Unpublished document)*. NICHD Study of Early Child Care.

NICHD Early Child Care Research Network (1998). Relations between family predictors and child outcomes: Are they weaker for children in child care? *Developmental Psychology*, *34*(5), 1119–1128. https://doi.org/10.1037/0012-1649.34.5.1119

NICHD Early Child Care Research Network. (2005). Child care and mother-child interaction in the first 3 years of life. In NICHD Early Child Care Research Network (Ed.), *Child care and child development* (pp. 231–245). The Guilford Press.

Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. Oxford University Press.

Sommer, A., Hachul, C., & Roßbach, H.-G. (2016). Video-based assessment and rating of parent-child interaction within the National Educational Panel Study. In H.-P. Blossfeld, J. v. Maurice, M. Bayer, & J. Skopek (Eds.), *Methodological issues of longitudinal surveys. The example of the National Educational Panel Study* (pp. 151–167). Springer VS. https://doi.org/10.1007/978-3-658-11994-2_9

Tamis-LeMonda, C. S., Bornstein, M. H., & Baumwell, L. (2001). Maternal responsiveness and children's achievement of language milestones. *Child Development*, *72*(3), 748–767. https://doi.org/10.1111/1467-8624.00313

Tamis-LeMonda, C. S., Bornstein, M. H., Baumwell, L., & Melstein Damast, A. (1996). Responsive parenting in the second year: Specific influences on children's language and play. *Early Development and Parenting*, *5*(4), 173–183. https://doi.org/10.1002/(SICI)1099-0917(199612)5:4<173::AID-EDP131>3.0.CO;2-V

Tamis-LeMonda, C. S., Bornstein, M. H., Kahana-Kalman, R., Baumwell, L., & Cyphers, L. (1998). Predicting variation in the timing of language milestones in the second year: An events history approach. *Journal of Child Language*, *25*(3), 675–700. https://doi.org/10.1017/S0305000998003572

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry*, *17*(2), 89–100. https://doi.org/10.1111/j.1469-7610.1976.tb00381.x

Cognitive Development: Sensorimotor Development

When international, large-scale cohort studies of newborns include a direct assessment of infants' sensorimotor and basic cognitive abilities, which is not always the case, they usually use a version of the Bayley Scales of Infant Development (Bayley, 1993; 2006; see Hachul et al., 2019). Worldwide, the Bayley Scales are frequently used to examine the development of infants aged 1-42 months (Albers & Grieve, 2007; Nellis & Gridley, 1994). To ensure compatibility with international studies and to include an indicator of the children's sensorimotor development at around 7 months of age, the Newborn Cohort Study of the German National Educational Panel Study (NEPS SC1) also investigated selected aspects of children's sensorimotor development in Survey Wave 1 (children on average 7 months old).

In previous feasibility and pilot studies[6], it has been shown that the standardized administration of the overall test or selected subscales as well as certain items in the families' homes is prone to error if conducted by trained interviewers who do not have experience in infant testing (Weinert et al., 2016). Because the survey time was limited, four tasks were administered in NEPS SC1, which proved to be easily standardizable. Based on these tasks, 16 items related to the children's sensorimotor development could be coded. Using a variety of materials (i.e., a bell stick, a fish rattle, an oval teething ring, a ring on a string, and a squeaky rubber duck), the interviewers administered the tasks according to standardized instructions. The interviewers involved the child in standardized interactions, which were intended to elicit various behaviors in the child, such as the child actively searching for an object that had fallen out of his or her field of view.

The items were coded offline by trained coders using the coding scheme of the Bayley Scales (BSID-III; Bayley, 2006) based on video recordings (i.e., data are only available for cases with corresponding video recordings). The coded items relate to the domain of cognition (e.g., object-related visual attention, means-ends task), the domain of motor skills (e.g., pincer grasp), and the domain of linguistic precursor skills (e.g., use of gestures). In addition to the scored items, the scientific use file (SUF) provides an estimate of person ability (weighted likelihood estimation, WLE; Warm, 1989) and its standard error.

References

Albers, C. A., & Grieve, A. J. (2007). Test review: Bayley, N. (2006). Bayley Scales of Infant and Toddler Development–Third edition. San Antonio, TX: Harcourt Assessment. *Journal of Psychoeducational Assessment*, *25*(2), 180–190. https://doi.org/10.1177/0734282906297199

Bayley, N. (1993). *Bayley Scales of Infant Development–Second edition.* The Psychological Corporation.

Bayley, N. (2006). *Bayley Scales of Infant and Toddler Development–Third edition.* Harcourt Assessment.

Hachul, C., Attig, M., Lorenz, J., Weinert, S., Schneider, T., & Roßbach, H.-G. (2019). From birth to early child care: The newborn cohort study of the National Educational Panel Study. In H.-P. Blossfeld, & H.-G. Roßbach (Eds.), *Education as a lifelong process: The German National Educational Panel Study (NEPS)* (pp. 195–214). Springer VS. https://doi.org/10.1007/978-3-658-23162-0_11

Nellis, L., & Gridley, B. E. (1994). Review of the Bayley Scales of Infant Development–Second edition. *Journal of School Psychology*, *32*(2), 201–209. https://doi.org/10.1016/0022-4405(94)90011-6

Warm, T. A. (1989). Weighted likelihood estimation of ability in item response theory. *Psychometrika*, *54*(3), 427–450. https://doi.org/10.1007/BF02294627

---

[6] These studies were conducted at the Bamberg Baby Lab of the Department of Developmental Psychology (Head: S. Weinert), University of Bamberg.

Weinert, S., Linberg, A., Attig, M., Freund, J. D., & Linberg, T. (2016). Analyzing early child development, influential conditions, and future impacts: prospects of a German newborn cohort study. *International Journal of Child Care and Education Policy, 10,* 7. https://doi.org/10.1186/s40723-016-0022-6