Andrea Frick

June 2020

Publications

Journal Articles

Röthlisberger, M., & Frick, A. (in press). Development of stereo vision in young infants. *Infancy.*

Pedrett, S., Kaspar, L., & Frick, A. (2020). Understanding of object rotation between two and three years of age. *Developmental Psychology, 56*, 261-274. DOI: 10.1037/dev0000871

Frick, A. (2019). Spatial transformation abilities and their relation to later mathematics performance. *Psychological Research, 83,* 1465-1484. DOI: 10.1007/s00426-018-1008-5 https://rdcu.be/LbPo

Möhring, W., Ishihara, M., Curiger, J., & Frick, A. (2019). Spatial-numerical associations in first-graders: Evidence from a manual-pointing task. *Psychological Research, 83,* 885-893. DOI: 10.1007/s00426-017-0904-4

Möhring, W., Frick, A., & Newcombe, N. S. (2018). Spatial scaling, proportional thinking, and numerical understanding in 5- to 7-year-old children. *Cognitive Development, 45*, 57-67. DOI: 10.1016/j.cogdev.2017.12.001

Frick, A., & Baumeler, D. (2017). The relation between spatial perspective taking and inhibitory control in 6-year-old children. *Psychological Research, 81,* 730-739. DOI: 10.1007/s00426-016-0785-y

Möhring, W., Newcombe, N. S., & Frick, A. (2016). Using mental transformation strategies for spatial scaling: Evidence from a discrimination task. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 42*, 1473-1479. DOI: 10.1037/xlm0000240

Frick, A., & Möhring, W. (2016). A matter of balance: Motor control is related to children's spatial scaling and proportional reasoning skills. *Frontiers in Psychology, 6:2049.* DOI: 10.3389/fpsyg.2015.02049

Möhring, W., Newcombe, N. S., Levine, S. C., & Frick, A. (2016). Spatial proportional reasoning is associated with formal knowledge about fractions. *Journal of Cognition and Development, 17,* 67-84. DOI: 10.1080/15248372.2014.996289

Frick, A., & Newcombe, N. S. (2015). Young children's perception of diagrammatic representations. *Spatial Cognition & Computation, 15,* 227-245. DOI: 10.1080/13875868.2015.1046988

Möhring, W., Newcombe, N. S., & Frick, A. (2015). The relation between spatial thinking and proportional reasoning in preschoolers. *Journal of Experimental Child Psychology, 132,* 213-220. DOI: 10.1016/j.jecp.2015.01.005

Frick A., Möhring, W., & Newcombe, N. S. (2014). Development of mental transformation abilities. *Trends in Cognitive Sciences, 18*, 536-542. DOI: 10.1016/j.tics.2014.05.011

Frick, A., Möhring, W., & Newcombe, N. S. (2014). Picturing perspectives: Development of perspective-taking abilities in 4- to 8-year-olds. *Frontiers in Psychology, 5:386*. DOI: 10.3389/fpsyg.2014.00386

Möhring, W., Newcombe, N. S. & Frick, A. (2014). Zooming in on spatial scaling: Preschool children and adults use mental transformations to scale spaces. *Developmental Psychology, 50*, 1614-1619. DOI: 10.1037/a0035905

Frick, A., & Wang, S. (2014). Mental spatial transformations in 14- and 16-month-old infants: Effects of action and observational experience. *Child Development, 85,* 278-293. DOI: 10.1111/cdev.12116

Frick, A., Hansen, M. A., & Newcombe, N. S. (2013). Development of mental rotation in 3- to 5-year-old children. *Cognitive Development, 28*, 386-399. DOI: 10.1016/j.cogdev.2013.06.002

Frick, A., Ferrara, K., & Newcombe, N. S. (2013). Using a touch screen paradigm to assess the development of mental rotation between 3½ and 5½ years of age. *Cognitive Processing, 14,* 117-127. DOI 10.1007/s10339-012-0534-0

Frick, A., & Möhring, W. (2013). Mental object rotation and motor development in 8- and 10-month-old infants. *Journal of Experimental Child Psychology, 115,* 708-720. DOI: 10.1016/j.jecp.2013.04.001

Möhring, W., & Frick, A. (2013). Touching up mental rotation: Effects of manual experience on 6-month-old infants' mental object rotation. *Child Development, 84,* 1554–1565. DOI: 10.1111/cdev.12065

Frick, A., & Newcombe, N. S. (2012). Getting the big picture: Development of spatial scaling abilities. *Cognitive Development, 27,* 270-282. DOI: 10.1016/j.cogdev.2012.05.004

Newcombe, N. S., & Frick, A. (2010). Early education for spatial intelligence: Why, what, and how. *Mind, Brain, and Education, 4,* 102-111. DOI: 10.1111/j.1751-228X.2010.01089.x

Frick, A., Daum, M. M., Walser, S., & Mast, F. W. (2009). Motor processes in children's mental rotation. *Journal of Cognition and Development, 10,* 18-40. DOI: 10.1080/15248370902966719

Frick, A., Daum, M. M., Wilson, M., & Wilkening, F. (2009). Effects of action on children's and adults' mental imagery. *Journal of Experimental Child Psychology*, *104,* 34-51. DOI: 10.1016/j.jecp.2009.01.003

Ebersbach, M., Luwel, K., Frick, A., Onghena, P., & Verschaffel, L. (2007). The relationship between the shape of the mental number line and familiarity with numbers in 5- to 9-year old children: Evidence for a segmented linear model. *Journal of Experimental Child Psychology, 99,* 1-17. DOI: 10.1016/j.jecp.2007.08.006

Frick, A., Huber, S., Reips, U.-D., & Krist, H. (2005). Task-specific knowledge of the law of pendulum motion in children and adults. *Swiss Journal of Psychology, 64,* 103-114. DOI: 10.1024/1421-0185.64.2.103

Book Chapters

Newcombe, N. S., Möhring, W., & Frick, A. (2018). How big is many? Development of spatial and numerical magnitude understanding. In A. Henik & W. Fias (Eds.), *Heterogeneity of Function in Numerical Cognition* (pp. 157-176). San Diego: Academic Press. DOI: 10.1016/B978-0-12-811529-9.00009-1

Frick, A. (2018). Perspective taking. In M. H. Bornstein (Ed.), *The SAGE Encyclopedia of Lifespan Human Development* (pp. 1627-1628). Thousand Oaks: SAGE Publications. DOI: 10.4135/9781506307633.n609

Lourenco, S. F., & Frick, A. (2013). Remembering where: The origins and early development of spatial memory. In P. J. Bauer and R. Fivush (Eds.), *Wiley-Blackwell Handbook on the Development of Children's Memory,* Volume I/II, John Wiley & Sons Ltd, Chichester, UK. DOI: 10.1002/9781118597705.ch16

Frick, A., Bächtiger, M. T., & Reips, U.-D. (2001). Financial incentives, personal information and drop-out in online studies. In U.–D. Reips & M. Bosnjak (Eds.), *Dimensions of Internet Science* (pp. 209-220). Lengerich: Pabst.

Doctoral Thesis

Frick, A. (2005). *Entwicklung dynamischer Vorstellungen: Zum Einfluss visueller und sensumotorischer Information auf die mentale Representation bewegter Ereignisse. [Development of dynamic imagery: Effects of visual and sensory-motor information on mental representations of physical events.* Dissertation [online], University of Zürich, Switzerland. Available: http://www.dissertationen.uzh.ch

Master's Thesis

Frick, A., Huber, S., Reips, U.-D., & Krist, H. (2001b). *Virtuelle Pendel - realistische Vorstellung? Wissen über elementare Bewegungsgesetze bei Kindern und Erwachsenen. [Virtual pendulums - realistic imagery? Children's and adults' knowledge about basic dynamic laws.]* Unpublished Master Thesis, University of Zürich, Switzerland.

Proceedings & Short Reports

Möhring, W., Ishihara, M., & Frick, A. (2016). Interaction between space and number representations in 1st-graders. In M. Hegarty, C. Hölscher, D. Montello, & N. S. Newcombe (Eds.), *Proceedings of the Spatial Cognition Conference* (pp. 12-15). Philadelphia, USA.

Frick, A., Daum, M. M., Walser, S., & Mast, F. W. (2005). Developmental changes in the interference of motor processes with mental rotation. In B. G. Bara, L. Barsalou, M. Bucciarelli (Eds.), *Proceedings of the CogSci2005 XXVII Annual Conference of the Cognitive Science Society* (pp. 720-725). Stresa, Italy.

Daum, M., & Frick, A. (2004). Cognitive effects on representational momentum: The role of knowledge about the intention of an object. *Perception, 33(Supplement)*, 165.

Frick, A., Huber, S., Reips, U.-D., & Krist, H. (2001a). Alltagswissen über Pendelschwingungen: ein Altersvergleich. In A. C. Zimmer, K. Lange, et al. (Eds.), 43. *Tagung experimentell arbeitender Psychologen* [CD-ROM]. Regensburg: Universitätsbibliothek.

Frick, A., Bächtiger, M. T., & Reips, U.-D. (1999). Financial incentives, personal information and drop-out rate in online studies [preliminary version]. In U.-D. Reips, B. Batinic, W. Bandilla, M. Bosnjak, L. Gräf, K. Moser, & A. Werner (Eds.), Current Internet science – trends, techniques, results. Aktuelle Online Forschung – Trends, Techniken, Ergebnisse [WWW document]. Zürich: Online Press. Available URL: http://dgof.de/tband99/

Presentations

Invited Talks

Frick, A. (2019). *Les changements liés à l'adolescence et leurs implications pour la cognition, le comportement et l'éducation. [Changes in adolescence and their implications for cognition, behavior, and education.]* University of Fribourg, CH, Nov. 28, 2019.

Frick, A. (2019). *Devine ce que je vois: Développement de la prise de perspective. [Guess what I see: Development of perspective taking abilities.]* University of Geneva, CH, June 19, 2019.

Frick, A. (2018). *Mental transformation abilities and math performance.* University of Lancaster, UK, Dec. 12, 2018.

Frick, A. (2018). *Development of mental representations & mathematical abilities.* Department of Psychology, University of Konstanz, DE, Feb. 5, 2018.

Frick, A. (2017). *Development of spatial and numerical skills.* iscience research colloquium. Department of Psychology, University of Konstanz, DE, Nov. 22, 2017.

Frick, A. (2017). *Entwicklung von räumlichen Vorstellungen und mathematischem Denken. [Development of spatial imagery and mathematical thinking.]* Collegium Generale, Münchenwiler Seminar. Imagination: Erkenntnisfortschritt in den Wissenschaften. Münchenwiler, CH, March 31, 2017.

Frick, A. (2016). *Development of spatial and numerical skills.* Department of Psychology, Stockholm University, Sweden, Sept. 21, 2016.

Frick, A. (2015). *Entwicklung Dynamischer Repräsentationen. [Development of dynamic representations.]* University of Graz, AT, Nov. 26, 2015.

Frick, A. (2015). *Spatial transformation abilities predict later math and geometry: A longitudinal study*. Space and Mathematics: What's the connection? Conference Sponsored by the Spatial Intelligence Learning Center (SILC), University of Chicago, Chicago, US, Nov. 17-18, 2015.

Frick, A. (2015). *What do infants know – and how do we know it?* LEAD Lecture Series, Tübingen, DE, May 11, 2015.

Frick, A. (2015). *The Origin of Abstract Thought: Geometry - Discussion*. Invited talk, Nijmegen Lectures of the Max Planck Institute for Psycholinguistics and the Radboud University Nijmegen, NL, Feb. 25-27, 2015.

Frick, A. (2014). *Einfluss motorischer Aktivität auf räumliche Kognition*. *[Influence of motor activity on spatial cognition.]* International Symposium on Multisensory Perception, Regensburg, DE, Sept. 26, 2014.

Frick, A. (2011). *The Early Development of Mental Rotation Abilities*. School of Natural Sciences, University of Stirling, Scotland, Nov. 24, 2011.

Frick, A. (2010). *Development of Spatial Transformation Abilities.* Swiss National Science Foundation, Bern, CH, June 22, 2010.

Frick, A. (2010). *Einfluss motorischer Aktivität auf mentale Rotation. [Influence of motor activity on mental rotation ability.]* Department of Psychology, Ernst Moritz Arndt Universität Greifswald, DE, June 8, 2010.

Frick, A. (2010). *Entwicklung mentaler räumlicher Transformationen. [Development of spatial trans-formation abilites.]* Kognitive & Developmental Psychology, University of Zurich, CH, June 2, 2010.

Frick, A., (2009). *Development of Mental Rotation and Effects of Motor Activity.* Department of Psychology, Rutgers University, Camden, NJ, USA, Sept. 25, 2009.

Frick, A., Wang, S. (2009). *Mental Rotation in 14- and 16-month-olds.* Colloquium Cognitive Psychology, University of California Santa Cruz, Santa Cruz, CA, USA, April 13, 2009.

Frick, A. (2008). Development of Mental Imagery. Department of Psychology, University of Chicago, Chicago, IL, USA, Nov. 13, 2008.

Frick, A. (2007). *Spatial Thinking and Embodied Cognition in Children and Adults*. Department of Psychology, Temple University, Philadelphia, PA, USA, Sept. 6, 2007.

Frick, A. (2007). *Effects of Motor Activity on Mental Representations in Children and Adults.* Colloquium Cognitive Psychology, University of California Santa Cruz, Santa Cruz, CA, USA, May 9, 2007.

Frick, A. (2004). *Intuitives Wissen über dynamische physikalische Vorgänge. [Intuitive knowledge about dynamic physical events.]* Developmental Psychology, Justus-Liebig-Universität Giessen, DE, Nov. 10, 2004.

Selected Presentations

Kubik, V., & Frick, A. *Multitasking abilities in 7- to 10-year-old children.* Biennial Meeting of the Cognitive Development Society, Louisville, KY, USA, Oct. 17-19, 2019.

Frick, A., & Kubik, V. *Spatial abilities explain temporal monitoring of multiple tasks: Testing the spatio-temporal hypothesis in children.* Biennial Meeting of the Cognitive Development Society, Louisville, KY, USA, Oct. 17-19, 2019.

Kubik, V., & Frick, A. (2019). *Development of multitasking abilities in middle childhood.* Joint Conference of the DGP Sections Developmental Psychology & Educational Psychology, Leipzig, Sept. 9-12, 2019.

Frick, A., & Kubik, V. (2019). *Multitasking abilities between 7 and 10 years of age.* 16th Conference of the Swiss Society for Psychology (SGP/SSP), Bern, Switzerland, Sept. 9-11, 2019.

Möhring, W., & Frick, A. (2019). *Associations between Mental Rotation and Fraction Knowledge in Children.* 16th Conference of the Swiss Society for Psychology (SGP/SSP), Bern, Switzerland, Sept. 9-11, 2019.

Röthlisberger, M., & Frick, A. (2018). *The role of stereo vision and 3D presentation on infants' mental object rotation.* Talk. International Conference on Spatial Cognition. Rome, IT, Sept. 10-15, 2018.

Pedrett, S., Tschachtli-Heiniger, R., & Frick, A. (2018). *Mental rotation below age 4: Evidence from a new mirror*-image discrimination task. Poster presented at the Spatial Cognition Conference. Tübingen, DE, Sept. 5-8, 2018.

Röthlisberger, M., & Frick, A. (2018). *Infants' mental rotation and recognition of 3D objects – the relevance of stereovision.* Poster presented at the 60th Conference of Experimental Psychologists (TeaP), Marburg, DE, March 11-14, 2018.

Röthlisberger, M., & Frick, A. (2017). *Emerging stereopsis and its relation to infants' 3D object recognition and mental rotation.* Poster presented at the Biennial Meeting of the Cognitive Development Society, Portland, OR, USA, Oct. 12-14, 2017.

Möhring, W., Ishihara, M., & Frick, A. (2016). *Interaction between space and number representations in 1st-graders.* Talk. Spatial Cognition Conference. Philadelphia, USA, Aug. 2-5, 2016.

Frick, A., Möhring, W. (2016). *Spatial abilities are related to an understanding of proportions and formal fractions.* Tagung experimentell arbeitender Psychologen, Heidelberg, Germany, March 21-23, 2016.

Möhring, W., & Frick, A. (2015). *Spatial abilities are related to formal fraction knowledge: The role of geometric and proportional understanding.* Talk. 13th Congress of the Swiss Society for Psychology (SGP/SSP), Geneva, CH, Sept. 8-9, 2015.

Möhring, W., & Frick, A. (2015). *Early effects of motor experience on infant's mental rotation.* Talk. 14th European Congress of Psychology (ECP), Milano, Italy, July 7-10, 2015.

Frick, A., Möhring, W., & Newcombe, N. S. (2015). *Spatial abilities predict later mathematics achievement: A longitudinal study.* Talk. Biennial Meeting of the Society for Research in Child Development, Philadelphia, PA, USA, March 19-21, 2015.

Frick, A., Bergamo, N., Newcombe, N. S., & Möhring, W. (2014). *Mentale Rotation bei 4,5- und 6-Jährigen: Ein Vergleich von prospektiven und retrospektiven Aufgaben und die Rolle des visuell-räumlichen Arbeitsgedächtnisses.* Talk. 49. Kongress der Deutschen Gesellschaft für Psychologie (DGPs), Bochum, DE, Sept. 22-25, 2014.

Frick, A., Bayard, J. E., & Roebers, C. M. (2014). *Mental rotation and working memory capacity in 7-year-old children*. Poster presented at the Spatial Cognition Conference, Bremen, Germany, Sept. 15-19, 2014.

Baumeler, D., Roebers, C. M., & Frick, A. (2013). *The relation between spatial perspective taking and inhibitory abilities in 6-year-old children*. Poster presented at the European Conference on Developmental Psychology, Lausanne, Switzerland, Sept. 3-7, 2013.

Möhring, W., Newcombe, N. S., Levine, S. C., & Frick, A. (2013). *A sense of proportion? Spatial proportional reasoning is associated with formal knowledge about Fractions.* Poster presented at the European Conference on Developmental Psychology, Lausanne, Switzerland, Sept. 3-7, 2013.

Frick, A., Möhring, W., & Newcombe, N. S. (2013). *Picturing perspectives – the development of perspective-taking abilities in 4- to 8-year-olds.* Poster presented at the Biennial Meeting of the Society for Research in Child Development, Seattle, USA, WA, USA, April 17-20, 2013.

Möhring, W., Newcombe, N. S., & Frick, A. (2013). *Mental transformation for spatial scaling in 4- and 5-year-olds.* Poster presented at the Biennial Meeting of the Society for Research in Child Development, Seattle, WA, USA, April 17-20, 2013.

Frick, A., & Möhring, W. (2012). *Effects of manual experience on 4- to 11-month-olds' mental object rotation.* Talk. 5th International Conference on Spatial Cognition: "Space and Embodied Cognition", Rome, Italy, Sept. 4-8, 2012.

Frick, A., Newcombe, N. S. (2012). *The space between the lines: Young children's understanding of 2D diagrams of 3D objects*. Poster presented at the Spatial Cognition Conference, Seeon, Germany, Aug. 31-Sept. 3, 2012.

Frick, A., Newcombe, N. S. (2011). *Development of mental rotation in 3- to 5-year-olds*. Poster presented at the VII biennial meeting of the Cognitive Development Society, Philadelphia, PA, USA, Oct. 14-15, 2011.

Frick, A., Newcombe, N. S. (2011). *Spatial scaling abilities in 3- to 6-year-olds*. Poster presented at the biennial meeting of the Society for Research in Child Development (SRCD), Montreal, Quebec, Canada, March, 31 - April 2, 2011.

Frick, A., Newcombe, N. S. (2010). *The long and short of It: Development of spatial scaling abilities*. Poster presented at the Spatial Cognition Conference, Portland, OR, USA, Aug. 15-19, 2010.

Frick, A., Wang, S. (2010). *Round and round she goes: Effects of hands-on training on mental rotation in 13- to 16-month-olds.* Poster presented at the XVIIth Biennial International Conference on Infant Studies, Baltimore, MD, USA, March 10-14, 2010.

Frick, A., Newcombe, N. S. (2009). *Measuring mental rotation in 4-year-olds using a nonverbal touch screen paradigm*. Poster presented at the VI biennial meeting of the Cognitive Development Society, San Antonio, TX, USA, Oct.16-17, 2009.

Frick, A., Wang, S. (2009). *Round and round it goes: Mental rotation in 14- and 16-month-olds.* Talk. Biennial meeting of the Society for Research in Child Development (SRCD), Denver, CO, USA, April 2-4, 2009.

Frick, A., Rapp, A. F., & Rapinett, G. (2007). *Over rough and smooth: Development of intuitive knowledge about friction.* Poster presented at the biennial meeting of the Society for Research in Child Development, Boston, MA, USA, March 29 - April 1, 2007.

Frick, A., Daum, M. M., Hug, S. & Wilkening, F. (2006). *Entwicklung intuitiven Wissens über das Hebelgesetz.* Talk. 45. Kongress der Deutschen Gesellschaft für Psychologie (DGPs), Nürnberg, DE, Sept. 17-21, 2006.

Frick, A., & Daum, M. M. (2005). *Development of dynamic imagery: effects of sensory-motor and visual information.* Poster presented at the IV biennial meeting of the Cognitive Development Society, San Diego, CA, USA, Oct. 21-22, 2005.

Frick, A., Daum, M. M., Walser, S., & Mast, F. W. (2005). *Developmental changes in the interference of motor processes with mental rotation.* Talk. XXVII Annual Conference of the Cognitive Science Society, Stresa, IT, July 21-23, 2005.

Frick, A., Daum, M. M., & Wilkening, F. (2004). *Ein Kilo Blei ist schwerer als ein Kilo Federn! Der Einfluss sensumotorischer Information bei der Grössen-Gewichts-Täuschung.* Talk. 46. Tagung experimentell arbeitender Psychologen (TeaP), Giessen, DE, April 5-7, 2004.

Frick, A., & Daum, M. M. (2003). *How to tilt a glass of water: Dynamic imagery in children and adults.* Poster presented at the 8th Congress of the Swiss Society for Psychology (SGP/SSP), Bern, CH, Oct. 14-15, 2003.

Frick, A., & Daum, M. M. (2003). *Conservation of water level horizontality in imagined action.* Poster presented at the biennial meeting of the Society for Research in Child Development, Tampa, FL, USA, April 24-27, 2003.

Frick, A., & Daum, M. M. (2003). *Intuitives Wissen über Horizontalität bei Wasseroberflächen.* Talk. 45. Tagung experimentell arbeitender Psychologen (TeaP), Kiel, DE, March 24-26, 2003.

Frick, A., & Reips, U.-D. (2002). *The kid's experimental psychology lab: A web site for internet research with children.* Poster presented at the German Online Research Conference (GOR), Hohenheim, DE, Oct.10-11, 2002.

Frick, A. & Daum, M. M. (2002). *Intuitives Wissen über die Länge sinusförmiger Kurvenlinien.* 43. Kongress der Deutschen Gesellschaft für Psychologie (DGPs), Berlin, DE, Sept. 22-26, 2002.

Frick, A., Krist, H., Huber, S., & Reips, U.-D. (2001). *Intuitives Wissen über das Pendelgesetz: ein Zeitschätzungsexperiment in Labor und Web.* Talk. German Online Research Conference (GOR). Göttingen, DE, May 17-18, 2001.

Frick, A., Huber, S., Reips, U.-D., & Krist, H. (2001). *Wahrnehmen, Vorstellen und Urteilen: Wissen über Pendelschwingungen bei Kindern und Erwachsenen.* 43. Tagung experimentell arbeitender Psychologen (TeaP), Regensburg, DE, April 9-11, 2001.

Frick, A., Bächtiger, M. T., & Reips, U.-D. (1999). *Financial incentives, personal information and drop-out in online studies.* Talk. German Online Research Conference (GOR), Nürnberg, DE, Oct. 27-29, 1999.