Interfaces

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Tuesday, 3rd November 2026

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1. Intro

1.1. Pacherie's Two Problems

> 'in order to account for the connection between prior intentions and intentions in action [=motor representations][1], it is necessary to explain how a subject can possess action concepts and how, when a prior intention causes an intention in action, the conceptual content of the prior intention can be converted into the non-conceptual content of an intention in action.' (Pacherie 2000, p. 423)

1.2. Interface Problems

Where two kinds of representation have contents that can match (or not), and where those representations are not inferentially integrated, but the representations do sometimes non-accidentally match: How is the non-accidental matching possible?[2]

1.3. Matching

> 'Two collections of outcomes, A and B, match in a particular context just if, in that context, either the occurrence of the A-outcomes would normally constitute or cause, at least partially, the occurrence of the B-outcomes or vice versa.' (Butterfill & Sinigaglia 2014, p. 131)

1.4. Inferential Integration

As I will use the term, for kinds of state to be *inferentially integrated* means that in the absence of obstacles such as time pressure, distraction, motivations to be irrational, self-deception or exhaustion, any states of these kinds can jointly feature in a single process of inference or practical reasoning in such a way that arbitrary rational relations between their contents appropriately influence how the process unfolds.[3]

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[1] 'The reason for equating Searle's intentions in action with Jeannerod's motor representations is that they are assigned the same function in both models, i.e. they are the proximal causes of actions and they play a continuing causal role in shaping the action, guiding and monitoring it until completion.' (Pacherie 2000, §5)

[2] 'The interface problem is the problem of explaining how, some of the time, there could be non-accidental matches between outcomes variously specified by intentions and motor representations.' (Butterfill & Sinigaglia 2014, §5)

[3] By 'arbitrary rational relations', we mean that there is no fixed restriction on which rational relations may influence how the process unfolds. We take the notion of inferential

1.5. The Interface Problem Isn't a Problem

> 'We should dissolve, not solve, the interface problem.' (Burnston 2017, p. 248)

> 'recent evidence indicates that the 'broad brushstrokes' view of the interface is not correct, and this evidence also contradicts several of Butterfill & Sinigaglia's assumptions. This requires us to reformulate the problem and raises questions about existing solutions.' (Christensen 2021, p. 548)

> 'the approach set out below works by dissolving the problem rather than solving it. There is in fact no mismatch of formats between intention and motor representations that needs to be reconciled or aligned.' (Levy 2025, p. 9)

> 'I want to embrace and assert the claim that concepts serve as an interface but to cancel the implication that there is an interface problem.' (Shea 2025, §Motivations)

1.6. Selected Objections to Reference by Deference

1.6.1. Awareness:

> 'In general, demonstratives require a perceptual-attentional link to their referents [...] whatever states one attends to or perceives must be ones that one is capable of being aware of in some way, and motor representations do not meet this criterion. They are subpersonal states that are inaccessible to awareness' (Mylopoulos & Pacherie 2016, p. 327)

But also:

> 'motor representations affect the content and subjective character of experiences of acting, and in that way might be indirectly accessed.' (Mylopoulos & Pacherie 2019, §3)

integration from Stich (1978) but do not adopt his definition. Stich construes the notion differently: 'there is generally a huge number of inferential paths via which a given belief can lead to most any other. It is in this sense that a person's beliefs are *inferentially integrated*' (p. 506). Our formulation is loosely inspired by Fodor (1983). Where Fodor focusses on belief fixation, our notion needs to include practical reasoning; and where Fodor stresses isotropy ('everything that the scientist knows is, in principle, relevant to determining what else he ought to believe', p.~105), we require that arbitrary rational relations can be relevant.

1.6.2. Misfire

> 'it is unclear what it would be for such a demonstrative to misfire, i.e., to "point" to the wrong motor representation, as there is of course no actual pointing gesture taking place' (Mylopoulos & Pacherie 2016, p. 328)

1.6.3. Selection

> 'the agent must have an independent grasp of which motor representation is the appropriate one to select via such deferral. But this would require a way of translating between the intention and the motor representation' (Mylopoulos & Pacherie 2016, p. 328)

> 'The charge is that the notion of demonstrative deferral at issue smuggles in something Butterfill and Sinigaglia do not explain: how the intention manages to defer to the right motor representation without any translation process.' (Shepherd 2019, §2)

> 'as several writers have pointed out, B&S' solution seems implicitly to do just that [...] For, absent some process of translation, it is unclear how the deferred reference they postulate could ever get off the ground.' (Levy 2025, §2.3)

1.7. Executable Action Concepts

> 'These concepts allow us to activate appropriate motor representations, in part because they are formed on the basis of such representations [...] We call these *executable action concepts* (Pacherie 2011). If one has an executable action concept, then one has the ability to perform the action in question.' (Mylopoulos & Pacherie 2016, p. 334)

> 'We can further add that the deployment of an [executable action concept] in the content of an intention serves as a pointer to a specific location in [long-term memory], where appropriate motor schemas for implementing the corresponding action type are stored.' (Mylopoulos 2022, p. 288)

1.7.1. Objections

> 'one wants to know more about the relationship between the action concept and the motor schema. How does the deployment of an action concept link up with a motor schema? [...] But this

> is just the joint that generated the interface problem.' (Shepherd 2019, p. 290)
>
> 'M&P's proposed solution falls prey to essentially the same flaw they (correctly) identify in B&S' proposal – viz., that of presupposing that some mechanism for translating between propositionally and motorically formatted content is in place, instead of explaining how it operates.' (Levy 2025, §2.3)
>
> 'First, although it is suggested that executable action concepts are those that 'hook up' with corresponding MRs, is not clear how this 'hooking up' is realized. Second, although it is said that these concepts allow us to activate appropriate motor representations, it is unclear how this is possible without a translation.' (Ferretti & Caiani 2019, p. 307)

1.8. Pacherie on Demonstrative Action Concepts

> 'basic action concepts are demonstrative concepts. To have the concept of a basic action is to have a concept of acting 'thus', where 'thus' denotes a property made accessible to the agent by the motor representations he is able to form.' (Pacherie 2000, p. 425)
>
> 'if the conscious motor image gives us access to the content of higher-level motor representation [...] mastery of such concepts requires that they be anchored in the content of motor images, and that a subject should not be granted possession of such concepts unless he has motor image' (Pacherie 2000, p. 425)
>
> 'Some aspects of the operation of the motor system that generate motor representations appear to be consciously accessible. They are reflected in conscious motor imagery and provide the anchoring ground for executable concepts of types of movement.' (Pacherie 2011, p. 72)

1.9. What do motor representations make accessible?

Contrast:

> 'Phonological awareness refers to one's degree of sensitivity to the sound structure of oral language.' (Anthony & Francis 2005, p. 255)

with (same article):

> 'phonemes do not have physical reality independent of each other. That is, phonemes produced in speech are acoustically inseparable because adjacent phonemes are coarticulated.' (Anthony & Francis 2005, p. 257)

background:

> 'the segmentation of the acoustic signal does not correspond directly or in any easily determined way to the segmentation at the phonemic level. [...] In bat, for example, the initial and final consonants are, in the conversion to sound, folded into the medial vowel, with the result that information about successive segments is transmitted more or less simultaneously on the same parts of the sound [...] There is, then, no acoustic criterion by which one can segment the sound into its constituent phonemes.' (I. Y. Liberman et al. 1974, pp. 203–4)

References

Anscombe, G. E. M. (1957). *Intention*. Blackwell.

Anthony, J. L., & Francis, D. J. (2005). Development of phonological awareness. *Current Directions in Psychological Science*, *14*(5), 255–260.

Balleine, B., & Dickinson, A. (1998). Consciousness—the interface between affect and cognition. In *Consciousness and Human Identity* (pp. 58–85). Oxford University Press.

Bentley, R., Hughes, J. A., Randall, D., Rodden, T., Sawyer, P., Shapiro, D., & Sommerville, I. (1992). Ethnographically-informed systems design for air traffic control. *Proceedings of the 1992 ACM conference on Computer-supported cooperative work*, 123–129. https://doi.org/10.1145/143457.143470

Bratman, M. E. (1985). Davidson's theory of intention [Reprinted in Bratman, M. (1999) *Faces of Intention*. Cambridge: Cambridge University Press (pp. 209–224).]. In B. Vermazen & M. Hintikka (Eds.), *Essays on davidson: Actions and events* (pp. 13–26). Oxford University Press.

Bratman, M. E. (1987). *Intentions, plans, and practical reasoning*. Harvard University Press.

Bronstein, A. M., Bunday, K. L., & Reynolds, R. (2009). What the "Broken Escalator" Phenomenon Teaches Us about Balance. *Annals of the New York Academy of Sciences*, *1164*(1), 82–88. https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1749-6632.2009.03870.x. https://doi.org/10.1111/j.1749-6632.2009.03870.x

Brössel, P., & Kuipers, E. (2026). Solving the interface problem: From intentions to motor representations through conceptual spaces. *Synthese*, *207*(4), 138. https://doi.org/10.1007/s11229-026-05489-x. https://doi.org/10.1007/s11229-026-05489-x

Browman, C., & Goldstein, L. (1986). Towards an articulatory phonology. *Phonology Yearbook*, *3*, 219–252.

Brozzo, C. (2021). Against the Distinction Between Intentions for the Future and Intentions for the Present. *American Philosophical Quarterly*, *4*(58), 333–346.

Bruderer, A. G., Danielson, D. K., Kandhadai, P., & Werker, J. F. (2015). Sensorimotor influences on speech perception in infancy. *Proceedings of the National Academy of Sciences*, *112*(44), 13531–13536. https://doi.org/10.1073/pnas.1508631112

Budavári, T., & Basu, A. (2016). Probabilistic CROSS-IDENTIFICATION IN CROWDED FIELDS AS AN ASSIGNMENT PROBLEM. *The Astronomical Journal*, *152*(4), 86. https://doi.org/10.3847/0004-6256/152/4/86

Buehlmann, C., Mangan, M., & Graham, P. (2020). Multimodal interactions in insect navigation. *Animal Cognition*, *23*(6), 1129–1141. https://doi.org/10.1007/s10071-020-01383-2. https://doi.org/10.1007/s10071-020-01383-2

Burnston, D. C. (2017). Interface problems in the explanation of action. *Philosophical Explorations*, *20*(2), 242–258. https://doi.org/10.1080/13869795.2017.1312504

Butterfill, S. A., & Sinigaglia, C. (2014). Intention and motor representation in purposive action. *Philosophy and Phenomenological Research*, *88*(1), 119–145. https://doi.org/10.1111/j.1933-1592.2012.00604.x

Carneiro Pereira, S., Patri, J.-F., & Vannuscorps, G. (2026). On the origin of the effect of silent articulation on speech perception. *Scientific Reports*. https://www.nature.com/articles/s41598-026-63240-5. https://doi.org/10.1038/s41598-026-63240-5

Carroll, J. M., Snowling, M. J., Hulme, C., & Stevenson, J. (2003). The development of phonological awareness in preschool children. *Developmental Psychology*, *39*(5), 913–923.

Castiglioni-Spalten, M. L., & Ehri, L. C. (2003). Phonemic awareness instruction: Contribution of articulatory segmentation to novice beginners' reading and spelling. *Scientific Studies of Reading*, *7*(1), 25–52. https://doi.org/10.1207/S1532799XSSR0701_03

Caudrelier, T., Ménard, L., Perrier, P., Schwartz, J.-L., Gerber, S., Vidou, C., & Rochet-Capellan, A. (2019). Transfer of sensorimotor learning reveals phoneme representations in preliterate children. *Cognition*, *192*, 103973. https://linkinghub.elsevier.com/retrieve/pii/S0010027719301349. https://doi.org/10.1016/j.cognition.2019.05.010

Chafouleas, S. M., Lewandowski, L. J., Smith, C. R., & Blachman, B. A. (1997). Phonological Awareness Skills in Children: Examining Performance across Tasks and Ages. *Journal of Psychoeducational Assessment*, *15*(4), 334–347. https://doi.org/10.1177/073428299701500405

Cheung, H., Chen, H.-C., Lai, C. Y., Wong, O. C., & Hills, M. (2001). The development of phonological awareness: Effects of spoken language experience and orthography. *Cognition*, *81*(3), 227–241. http://www.sciencedirect.com/science/article/B6T24-43MDMG8-3/2/db1f8497621e3095047c4

Choi, D., Bruderer, A. G., & Werker, J. F. (2019). Sensorimotor influences on speech perception in pre-babbling infants: Replication and extension of Bruderer et al. (2015). *Psychonomic Bulletin & Review*, *26*(4), 1388–1399. http://link.springer.com/10.3758/s13423-019-01601-0. https://doi.org/10.3758/s13423-019-01601-0

Christensen, W. (2021). The Skill of Translating Thought into Action: Framing The Problem. *Review of Philosophy and Psychology*, *12*(3), 547–573. https://doi.org/10.1007/s13164-020-00517-2

Cychosz, M., Munson, B., & Edwards, J. R. (2021). Practice and Experience Predict Coarticulation in Child Speech. *Language Learning and Development*, *17*(4), 366–396. https://www.tandfonline.com/doi/full/10.1080/15475441.2021.189008 https://doi.org/10.1080/15475441.2021.1890080

Cychosz, M., Munson, B., Newman, R. S., & Edwards, J. R. (2021). Auditory feedback experience in the development of phonetic production: Evidence from preschoolers with cochlear implants and their normal-hearing peers. *The Journal of the Acoustical Society of America*, *150*(3), 2256–2271. https://pubs.aip.org/jasa/article/150/3/2256/1058413/Auditory-feedback-experience-in-the-development-of. https://doi.org/10.1121/10.0005884

Dannenberg, R. B., & Raphael, C. (2006). Music score alignment and computer accompaniment. *Communications of the ACM*, *49*(8), 38–43. https://dl.acm.org/doi/10.1145/1145287.1145311. https://doi.org/10.1145/1145287.1145311

D'Ausilio, A., Pulvermüller, F., Salmas, P., Bufalari, I., Begliomini, C., & Fadiga, L. (2009). The Motor Somatotopy of Speech Perception. *Current Biology*, *19*(5), 381–385. https://doi.org/10.1016/j.cub.2009.01.017

Davidson, D. (1978). Intending. In *Essays on actions and events* (pp. 83–102). Oxford University Press. https://doi.org/10.1093/0199246270.001.0001

Dickinson, A., & Balleine, B. (1994). Motivational control of goal-directed action. *Animal Learning & Behavior*, *22*(1), 1–18. https://doi.org/10.3758/BF03199951

Durso, F. T., Batsakes, P. J., Crutchfield, J. M., Braden, J. B., & Manning, C. A. (2004). The Use of Flight Progress Strips While Working Live Traf-

fic: Frequencies, Importance, and Perceived Benefits. *Human Factors*, *46*(1), 32–49. https://doi.org/10.1518/hfes.46.1.32.30388

Ebersbach, M., & Erz, P. (2014). Symbolic versus non-symbolic magnitude estimations among children and adults. *Journal of Experimental Child Psychology*, *128*, 52–68. https://www.sciencedirect.com/science/article/pii/S002209651400116 https://doi.org/10.1016/j.jecp.2014.06.005

Ehri, L. C., & Wilce, L. S. (1980). The influence of orthography on readers' conceptualization of the phonemic structure of words. *Applied Psycholinguistics*, *1*(4), 371–385. https://www.cambridge.org/core/product/identifier/S014271640000980 https://doi.org/10.1017/S0142716400009802

Eimas, P. D., Siqueland, E. R., Jusczyk, P. W., & Vigorito, J. (1971). Speech perception in infants. *Science*, *171*(3968), 303–306.

Elsner, B., & Hommel, B. (2001). Effect anticipation and action control. *Journal of Experimental Psychology: Human Perception and Performance*, *27*(1), 229–240. https://doi.org/10.1037/0096-1523.27.1.229

Fan, D., Budavári, T., Norris, R. P., & Basu, A. (2020). Optimal probabilistic catalogue matching for radio sources. *Monthly Notices of the Royal Astronomical Society*, *498*(1), 565–573. https://doi.org/10.1093/mnras/staa2447. https://doi.org/10.1093/mnras/staa2447

Ferretti, G., & Caiani, S. Z. (2019). Solving the Interface Problem Without Translation: The Same Format Thesis. *Pacific Philosophical Quarterly*, *100*(1), 301–333. https://doi.org/10.1111/papq.12243

Flanagan, J. R., & Beltzner, M. A. (2000). Independence of perceptual and sensorimotor predictions in the size–weight illusion. *Nature Neuroscience*, *3*(7), 737–741. https://doi.org/10.1038/76701

Fodor, J. (1983). *The modularity of mind: An essay on faculty psychology*. MIT Press.

Goldstein, L., & Fowler, C. A. (2003). Articulatory phonology: A phonology for public language use. In N. O. Schiller & A. S. Meyer (Eds.), *Phonetics and phonology in language comprehension and production* (pp. 159–207). Mouton de Gruyter.

Harman, G. (1976). Practical reasoning. *The Review of Metaphysics*, *29*(3), 431–463.

Høien, T., Lundberg, I., Stanovich, K. E., & Bjaalid, I.-K. (1995). Components of phonological awareness. *Reading and Writing*, *7*(2), 171–188.

Hommel, B. (2009). Action control according to TEC (theory of event coding). *Psychological Research PRPF*, *73*(4), 512–526. https://doi.org/10.1007/s00426-009-0234-2

Hulme, C., Caravolas, M., Málková, G., & Brigstocke, S. (2005). Phoneme isolation ability is not simply a consequence of letter-sound knowledge. *Cognition*, *97*(1), B1–B11. https://www.sciencedirect.com/science/article/pii/S0010027705000 https://doi.org/10.1016/j.cognition.2005.01.002

Kalis, A., & Ometto, D. (2021). An Anscombean Perspective on Habitual Action. *Topoi*, *40*(3), 637–648. https://doi.org/10.1007/s11245-019-09651-8

Knudsen, E. I. (2002). Instructed learning in the auditory localization pathway of the barn owl. *Nature*, *417*(6886), 322–328. https://doi.org/10.1038/417322a

Krieger-Redwood, K., Gaskell, M. G., Lindsay, S., & Jefferies, E. (2013). The selective role of premotor cortex in speech perception: A contribution to phoneme judgements but not speech comprehension. *Journal of Cognitive Neuroscience*, *25*(12), 2179–2188. https://doi.org/10.1162/jocn_a_00463

Kuhl, P. K., & Meltzoff, A. N. (1996). Infant vocalizations in response to speech: Vocal imitation and developmental change. *The Journal of the Acoustical Society of America*, *100*(4), 2425–2438. https://pubs.aip.org/jasa/article/100/4/2425/5 vocalizations-in-response-to-speech-Vocal. https://doi.org/10.1121/1.417951

Levelt, W. J. M. (2001). Spoken word production: A theory of lexical access. *Proceedings of the National Academy of Sciences*, *98*(23), 13464–13471. https://pnas.org/doi/full/10.1073/pnas.231459498. https://doi.org/10.1073/pnas.231459498

Levy, Y. (2018). Why cognitivism? *Canadian Journal of Philosophy*, *48*(2), 223–244. https://doi.org/10.1080/00455091.2017.1345207

Levy, Y. (2025). The do-able solution to the interface problem. *Philosophy and Phenomenological Research*, *110*(3). https://onlinelibrary.wiley.com/doi/abs/10.1111/phpr.1313 https://doi.org/10.1111/phpr.13139

Liberman, A. M., Cooper, F. S., Shankweiler, D. P., & Studdert-Kennedy, M. (1967). Perception of the speech code. *Psychological Review*, *74*(6), 431–461. https://doi.org/10.1037/h0020279

Liberman, I. Y., Shankweiler, D., Fischer, F. W., & Carter, B. (1974). Explicit syllable and phoneme segmentation in the young child. *Journal of Experimental Child Psychology*, *18*, 201–212.

Liu, L. (2026). Using the body without thinking about it: Action-effect imagery at the interface. *Phenomenology and the Cognitive Sciences*. https://doi.org/10.1007/s11097-026-10144-4. https://doi.org/10.1007/s11097-026-10144-4

MacKay, W. E. (1999). Is paper safer? The role of paper flight strips in air traffic control. *ACM Transactions on Computer-Human Interaction (TOCHI)*, *6*(4), 311–340. https://dl.acm.org/doi/10.1145/331490.331491. https://doi.org/10.1145/331490.331491

McGuire, L. M. M., & Sabes, P. N. (2009). Sensory transformations and the use of multiple reference frames for reach planning. *Nature Neuroscience*, *12*(8), 1056–1061. https://doi.org/10.1038/nn.2357

McMurray, B. (2022). The myth of categorical perception. *The Journal of the Acoustical Society of America*, *152*(6), 3819–3842. https://pubs.aip.org/jasa/article/152/6/3819/2 myth-of-categorical-perceptiona. https://doi.org/10.1121/10.0016614

Meier, A. M., & Guenther, F. H. (2023). Neurocomputational modeling of speech motor development. *Journal of Child Language*, *50*(6), 1318–1335. https://www.cambridge.org/core/product/identifier/S0305000923000260/type/journal_ https://doi.org/10.1017/S0305000923000260

Mitchell, H. B. (2026). *Data Fusion: Concepts, Ideas and Deep Learning*. Springer. https://doi.org/10.1007/978-3-662-71023-4

Morais, J., Cary, L., Alegria, J., & Bertelson, P. (1979). Does awareness of speech as a sequence of phones arise spontaneously? *Cognition*, *7*(4), 323–331. https://doi.org/10.1016/0010-0277(79)90020-9

Möttönen, R., & Watkins, K. E. (2009). Motor Representations of Articulators Contribute to Categorical Perception of Speech Sounds. *The Journal of Neuroscience*, *29*(31), 9819–9825. https://www.jneurosci.org/lookup/doi/10.1523/JNEUROS 08.2009. https://doi.org/10.1523/JNEUROSCI.6018-08.2009

Mylopoulos, M. (2022). Oops! I Did it Again: The Psychology of Everyday Action Slips. *Topics in Cognitive Science*, *14*(2), 282–294. https://doi.org/10.1111/tops.12552

Mylopoulos, M., & Pacherie, E. (2016). Intentions and Motor Representations: The Interface Challenge. *Review of Philosophy and Psychology*, *8*(2), 317–336. https://doi.org/10.1007/s13164-016-0311-6

Mylopoulos, M., & Pacherie, E. (2019). Intentions: The dynamic hierarchical model revisited. *Wiley Interdisciplinary Reviews: Cognitive Science*, *10*(2), e1481. https://onlinelibrary.wiley.com/doi/abs/10.1002/wcs.1481. https://doi.org/10.1002/wcs.1481

Mylopoulos, M., Pacherie, E., & Shepherd, J. (2025). Motoric representational format. *Philosophical Studies*, *183*(2). https://doi.org/10.1007/s11098-025-02453-2. https://doi.org/10.1007/s11098-025-02453-2

Nielsen, K. (2014). Phonetic Imitation by Young Children and Its Developmental Changes. *Journal of Speech, Language, and Hearing Research*, *57*(6), 2065–2075. http://pubs.asha.org/doi/10.1044/2014_JSLHR-S-13-0093. https://doi.org/10.1044/2014_JSLHR-S-13-0093

Odic, D., Le Corre, M., & Halberda, J. (2015). Children's mappings between number words and the approximate number system. *Cognition*, *138*, 102–121. https://linkinghub.elsevier.com/retrieve/pii/S0010027715000177. https://doi.org/10.1016/j.cognition.2015.01.008

Ousterhout, J. K. (2018). *A Philosophy of Software Design*. Yaknyam Press.

Pacherie, E. (2000). The content of intentions. *Mind and Language*, *15*(4), 400–432. https://doi.org/10.1111/1468-0017.00142

Pacherie, E. (2006). Toward a Dynamic Theory of Intentions. In S. Pockett, W. P. Banks, & S. Gallagher (Eds.), *Does Consciousness Cause Behav-*

ior? (p. 0). The MIT Press. https://doi.org/10.7551/mitpress/9780262162371.003.0009

Pacherie, E. (2008). The phenomenology of action: A conceptual framework. *Cognition*, *107*(1), 179–217. https://doi.org/10.1016/j.cognition.2007.09.003

Pacherie, E. (2011). Nonconceptual Representations for Action and the Limits of Intentional Control. *Social Psychology*, *42*(1), 67–73. https://doi.org/10.1027/1864-9335/a000044

Pacherie, E. (2018). Motor intentionality. In A. Newen, L. De Bruin, & S. Gallagher (Eds.), *The Oxford Handbook of 4E Cognition* (p. 0). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780198735410.013.19

Pacherie, E., & Mylopoulos, M. (2021). Beyond Automaticity: The Psychological Complexity of Skill. *Topoi*, *40*(3), 649–662. https://doi.org/10.1007/s11245-020-09715-0. https://doi.org/10.1007/s11245-020-09715-0

Patel, M., Kaski, D., & Bronstein, A. M. (2014). Attention modulates adaptive motor learning in the 'broken escalator' paradigm. *Experimental Brain Research*, *232*(7), 2349–2357. https://doi.org/10.1007/s00221-014-3931-z. https://doi.org/10.1007/s00221-014-3931-z

Pavese, C. (2021). Practical concepts and productive reasoning. *Synthese*, *199*(3), 7659–7688. https://doi.org/10.1007/s11229-021-03132-5. https://doi.org/10.1007/s11229-021-03132-5

Popescu, A., & Noiray, A. (2022). Learning to Read Interacts with Children's Spoken Language Fluency. *Language Learning and Development*, *18*(2), 151–170. https://www.tandfonline.com/doi/full/10.1080/15475441.2021.1941032. https://doi.org/10.1080/15475441.2021.1941032

Read, C., Yun-Fei, Z., Hong-Yin, N., & Bao-Qing, D. (1986). The ability to manipulate speech sounds depends on knowing alphabetic writing. *Cognition*, *24*(1), 31–44. https://www.sciencedirect.com/science/article/pii/001002778690003X. https://doi.org/10.1016/0010-0277(86)90003-X

Reynolds, R. F., & Bronstein, A. M. (2003). The broken escalator phenomenon. *Experimental Brain Research*, *151*(3), 301–308. https://doi.org/10.1007/s00221-003-1444-2. https://doi.org/10.1007/s00221-003-1444-2

Rogalsky, C., Love, T., Driscoll, D., Anderson, S. W., & Hickok, G. (2011). Are mirror neurons the basis of speech perception? Evidence from five cases with damage to the purported human mirror system. *Neurocase*, *17*(2), 178–187. http://www.tandfonline.com/doi/abs/10.1080/13554794.2010.509318. https://doi.org/10.1080/13554794.2010.509318

Searle, J. R. (1983). *Intentionality: An essay in the philosophy of mind*. Cambridge University Press.

Serniclaes, W., Ventura, P., Morais, J., & Kolinsky, R. g. (2005). Categorical perception of speech sounds in illiterate adults. *Cognition*, *98*(2), B35-B44-B35–B44.

Shea, N. (2024). *Concepts at the Interface*. Oxford University Press.

Shea, N. (2025). Overview of Concepts at the Interface (2024, OUP). *Philosophical Psychology*, *0*(0), 1–6. https://doi.org/10.1080/09515089.2025.2599889

Shepherd, J. (2019). Skilled Action and the Double Life of Intention. *Philosophy and Phenomenological Research*, *98*(2), 286–305. https://doi.org/10.1111/phpr.12433

Smalle, E. H. M., Rogers, J., & Möttönen, R. (2015). Dissociating Contributions of the Motor Cortex to Speech Perception and Response Bias by Using Transcranial Magnetic Stimulation. *Cerebral Cortex*, *25*(10), 3690–3698. https://academic.oup.com/cercor/article/25/10/3690/389920/Dissociating-Contributions-of-the-Motor-Cortex-to.

Sober, S. J., & Sabes, P. N. (2003). Multisensory Integration during Motor Planning. *Journal of Neuroscience*, *23*(18), 6982–6992. https://doi.org/10.1523/JNEUROSCI.23-18-06982.2003

Sober, S. J., & Sabes, P. N. (2005). Flexible strategies for sensory integration during motor planning. *Nature Neuroscience*, *8*(4), 490–497. https://doi.org/10.1038/nn1427

Stasenko, A., Bonn, C., Teghipco, A., Garcea, F. E., Sweet, C., Dombovy, M., McDonough, J., & Mahon, B. Z. (2015). A causal test of the motor theory of speech perception: A case of impaired speech production and spared speech perception. *Cognitive Neuropsychology*, *32*(2), 38–57. http://dx.doi.org/10.1080/02643294.2015.1035702.

Stich, S. (1978). Beliefs and subdoxastic states. *Philosophy of Science*, *45*, 499–518.

Tang, K.-S., Kaski, D., Allum, J. H. J., & Bronstein, A. M. (2013). The effect of gait approach velocity on the broken escalator phenomenon. *Experimental Brain Research*, *226*(3), 335–346. https://doi.org/10.1007/s00221-013-3438-z. https://doi.org/10.1007/s00221-013-3438-z

Thompson, M. (2008). *Life and action: Elementary structures of practice and practical thought*. Harvard University Press.

Treiman, R., & Cassar, M. (1997). Can children and adults focus on sound as opposed to spelling in a phoneme counting task? *Developmental Psychology*, *33*(5), 771–80.

Tremblay, S., Shiller, D. M., & Ostry, D. J. (2003). Somatosensory basis of speech production. *Nature*, *423*(6942), 866–869. https://doi.org/10.1038/nature01710

Veenendaal, N. J., Groen, M. A., & Verhoeven, L. (2016). The Contribution of Segmental and Suprasegmental Phonology to Reading Comprehension. *Reading Research Quarterly*, *51*(1), 55–66. https://onlinelibrary.wiley.com/doi/abs/10.1002 https://doi.org/10.1002/rrq.127

Velleman, D. (1989). *Practical reflection*. Princeton University Press.

Wystrach, A., Mangan, M., & Webb, B. (2015). Optimal cue integration in ants. *Proceedings of the Royal Society B: Biological Sciences*, *282*(1816), 20151484. https://royalsocietypublishing.org/doi/10.1098/rspb.2015.1484. https://doi.org/10.1098/rspb.2015.1484