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RETHINKING KNOWLEDGE-THAT AND KNOWLEDGE-HOW: PERFORMANCE, INFORMATION AND FEEDBACK

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ABSTRACT. This work approaches the distinction between knowledge-how and knowledge-that in terms of two complementary concepts: *performance* and *information*. In order to do so, I formulate Ryle's argument of infinite regress in terms of performance in order to show that Stanley and Williamson's counterargument has no real object: both reject the view that the exercise of knowledge-that necessarily requires the previous consideration of propositions. Next, using the concept of *feedback*, I argue that Stanley and Williamson's positive account of knowledge-how in terms of knowledge-that corresponds to the output of the comparison between an intention of action and the perceived outcome of performance. Then, I expound other theories of mind and cognition in which feedback and prediction play a fundamental role in order to explain other ways in which information intervenes in performance—i.e., information is construed as knowledge-that available at subject level that guides performance. Finally, I present some reflections on the impact of the concept of knowledge-how, and possible routes to continue our enquiry on the nature of knowledge.

Keywords: *knowledge-how, knowledge-that, information, performance, feedback.*

1. Introduction

Philosopher Gilbert Ryle firmly opposed the view that a performance can only be intelligent if the agent observes rules or criteria prior to performing. For Ryle, actions such as a clown tripping to make children laugh, a mathematician considering propositions to prove a theorem, a pianist improvising on a theme, are all intelligent performances in their own right. He proposed the distinction between

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knowledge-how and knowledge-that[1] in order to argue against what he referred to as the "intellectualist legend" (IL) or the "intellectualist doctrine", which, in Ryle's own words, amounts to the belief that:

> (IL) "A performance of any sort inherits all its title to intelligence from some anterior internal operation of planning what to do".[2]

Arguing that performance is equivalent to exercising knowledge, Ryle claims that knowledge-how is "logically prior" to knowledge-that.[3] His distinction between knowledge-how and knowledge-that seems to have been accepted uncritically until Stanley and Williamson[4] (referred to as SW henceforth) put forward a strong response asserting, first and foremost, that knowledge-how is a species of knowledge-that. In so doing, SW at the same time convincingly disproved the claim of some of Ryle's followers that these two forms of knowledge are different on linguistic grounds[5]—i.e., that sentences of the form "Hannah knows how to *F*" are grammatically different from sentences of the form "Hannah knows that *X* is the case". In *Knowing How*, SW present:

> (S1) A refutation of Ryle's argument of infinite regress against the "intellectualist legend".
> (S2) A refutation of Ryle's positive account of knowledge-how which SW take to rely on abilities.
> (S3) A positive account of knowledge-how as a species of knowledge-that.

This work is chiefly concerned with two concepts and their interplay, namely performance and information (i.e., knowledge-that in performance). Thus, I address (S1) and (S3) from different perspectives. Formulating Ryle's argument of infinite regress in terms of performance only (i.e., without resorting to the knowledge-how–knowledge-that distinction) I respond to SW showing that their

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[1] Ryle, Gilbert, "Knowing how and knowing that: The presidential address", in *Proceedings of the Aristotelian Society,* Vol. 46 / 1945, Oxford University Press, pp. 1-16; Ryle, Gilbert, "Knowing how and knowing that", in *The concept of mind*, Hutchinson University Library, 1949, pp. 26–60.

[2] Ryle, Gilbert, "Knowing how and knowing that", in *The concept of mind*, p. 31. Note that in this work, Ryle phrases consistently IL in a number of ways, for example: "Champions of this legend are apt to try to reassimilate knowing how to knowing that by arguing that intelligent performance involves the observance of rules, or the application of criteria". *Ibid*., p. 29.

[3] Ryle, "Knowing how and knowing that: The presidential address", p. 4.

[4] Stanley, Jason and Williamson, Timothy, "Knowing how", *The Journal of Philosophy 98*(*8*) / 2001, pp. 411–444.

[5] A claim referred to as "the linguistic distinction". *Ibid*., p. 417.

counterargument does not have any real object. Furthermore, I show that they too, perhaps inadvertently, reject IL—e.g., Ryle and SW's accounts agree in that exercising knowledge-that to open a closed door does not require the consideration of propositions *ad infinitum*. Next, I consider SW's positive account of knowledge-how as knowledge-that in the light of the concept of feedback. I argue that feedback is fundamental to understanding the dynamics of intentional action, and therefore of intelligent performance, and I support this argument with recent theories on cognition and intentional action, mainly from the fields of cognitive science and semiotics. Finally, I argue for the complementary nature of the concepts of performance and knowledge-that, and at the same time for the necessary role that knowledge-that, construed as *information* available at subject level, plays in guiding the subject's performance.

2. The (dis)agreements between Ryle and Stanley and Williamson

2.1 What Ryle and SW argue for

Are Ryle and SW's accounts on knowledge-how entirely incompatible? Fortunately, this is not the case since they agree in a number of important respects which will be progressively advanced. The differences and disputes between them, however, can only be made sense of by understanding their motivations. First, I shall address these motivations resorting to direct quotations; second, I present Ryle's argument of infinite regress, SW's counterargument, and an explanation of why the counterargument has no real object.

SW take the intellectualist doctrine to be "the thesis that knowledge-how is a species of knowledge-that".[6] Furthermore, they assert that Ryle only had one argument "against the thesis that knowing-how is a species of knowing-that" (i.e., the argument of infinite regress),[7] and that Ryle "presents his own positive view of knowledge-how, according to which, contra the 'intellectualist legend', it is not a species of knowledge-that" (ibid). It must be noted that Ryle never uses the expression "being a species of", and a patient reading of both his texts on the distinction between knowledge-how and knowledge-that[8] makes it clear that Ryle's

[6] *Ibid*., p. 412.

[7] *Ibid*.

[8] Ryle, "Knowing how and knowing that: The presidential address"; Ryle, "Knowing how and knowing that", in *The concept of mind*.

main concern is to refute IL in order to revalue the intelligent character of performance. Ryle's version of the intellectualist legend, namely IL, does not directly claim that knowledge-that is a species of knowledge-how, but rather unfolds into three propositions:[9]

(IL1) "Doing things is never itself an exercise of intelligence."
(IL2) Doing things is, at best, "a process introduced and somehow steered by some ulterior act of theorising".
(IL3) "Theorising is not a sort of doing".

References to the "intellectualist legend" that are consistent with this account abound in Ryle's chapter *Knowing How and Knowing That* in his book *The Concept of Mind*.[10] Thus, we see that SW and Ryle have different agendas. SW articulate their work in terms of arguing that knowledge-how is a species of knowledge-that, while Ryle first posed the distinction between the two to argue that the intellectualist legend (IL) "is false and that when we describe a performance as intelligent, this does not entail the double operation of considering and executing".[11]

2.2 Ryle's argument of infinite regress

In order to disprove the intellectualist legend, Ryle put forward an argument that aims at showing that accepting the premises of the intellectualist legend leads to an infinite regress. The fact that in his own account of the argument Ryle refers to the regress as "vicious", already indicates that he does not hold regress to be tenable, and therefore he rejects at least one of the premises of the argument. One version of Ryle's regress argument goes as follows:[12]

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[9] Ryle, "Knowing how and knowing that: The presidential address", p. 1.

[10] The intellectualist doctrine "tries to define intelligence in terms of the apprehension of truths, instead of the apprehension of truths in terms of intelligence", in Ryle, "Knowing how and knowing that", in *The concept of mind*, p. 27. In another formulation, the intellectualist doctrine states that "the agent must first go through the internal process of avowing to himself certain propositions about what is to be done ('maxims') 'imperatives' or 'regulative 1 propositions' as they are sometimes called); only then can he execute his performance in accordance with those dictates. He must preach to himself before he can practise", in *ibid*., p. 29. Or, yet another example: "The absurd assumption made by the intellectualist legend is this, that a performance of any sort inherits all its title to intelligence from some anterior internal operation of planning what to do", in *ibid*., p. 31.

[11] Ryle, "Knowing how and knowing that", in *The concept of mind*, pp. 29-30.

[12] *Ibid.*, p. 30, my emphasis.

The consideration of propositions is itself an *operation* the execution of which can be more or less intelligent, less or more stupid. But if, for any operation to be intelligently executed, a prior theoretical operation had first to be performed and performed intelligently, it would be a logical impossibility for anyone ever to break into the circle.

A more elaborate version of the argument, proposing a two-directional regress is the following:[13]

I argue that the prevailing doctrine leads to vicious regresses, and these in two directions. (1) If the intelligence exhibited in any *act*, practical or theoretical, is to be credited to the occurrence of some ulterior act of intelligently considering regulative propositions, no intelligent act, practical or theoretical, could ever begin. If no one possessed any money, no one could get any money on loan. This is the turn of the argument that I chiefly use. (2) If a deed, to be intelligent, has to be guided by the consideration of a regulative proposition, the gap between that consideration and the practical application of the regulation has to be bridged by some go-between process which cannot by the presupposed definition itself be an exercise of intelligence and cannot, by definition, be the resultant deed. This go-between application-process (...) must again be subdivided into one bit which contemplates but does not execute, one which executes but does not contemplate and a third which reconciles these irreconcilables. And so on for ever.

One can see that the first version corresponds to case (1) of the second version. In general, regress in this case takes place because an act/operation will always require a previous operation, *ad infinitum*. It is this case (which SW refer to as "more clear")[14] that SW analyze and refute, while leaving the second case out of their discussion. The second case points to the fact that the intellectualist legend requires a mediation between the "intelligent act" (the consideration of propositions) and the "non-intelligent act" (performance itself), but since the mediator can not be any of the two, the mediator in turn has a threefold structure of the form {intelligent act–mediator–performance}. Ryle's point is straightforward: if we regard an act to be intelligent, it is because the intelligence is in the act itself, not because it is endowed of intelligence by a previous act which is to consider regulatory propositions. In presenting his argument, Ryle makes no explicit mention of knowledge-how or knowledge-that.

[13] Ryle, "Knowing how and knowing that: The presidential address", pp. 2-3.
[14] Stanley and Williamson, *Knowing how*, p. 412.

2.3 SW's counterargument

SW contest Ryle's regress argument claiming that: (1) regression misfires, (2) Ryle's positive account of knowledge-how in terms of dispositions is not the case, (3) in their positive account of knowledge-how, knowledge-how is a species of knowledge-that.

According to SW, Ryle's argument has two premises:[15]

(X1) If one *F*s, one employs knowledge how to *F*.
(X2) If one employs knowledge that *p*, one contemplates the proposition that *p*.

Furthermore:[16]

If knowledge-how is a species of knowledge-that, the content of knowledge how to *F* is, for some φ, the proposition that $\varphi(F)$. So, the assumption for reductio is:

RA: knowledge how to *F* is knowledge that $\varphi(F)$.

Furthermore, let '$C(p)$' denote the act of contemplating the proposition that *p*. Suppose that Hannah *F*s. By premise (1), Hannah employs the knowledge how to *F*. By RA, Hannah employs the knowledge that $\varphi(F)$. So, by premise (2), Hannah $C(\varphi(F))$s. Since $C(\phi(F))$ is an act, we can reapply premise (1), to obtain the conclusion that Hannah knows how to $C(\varphi(F))$. By RA, it then follows that Hannah employs the knowledge that $\varphi(C(\varphi(F)))$. By premise (2), it follows that Hannah $C(\varphi(C(\varphi(F))))$s. And so on.

SW's argument continues by realizing that (X1) can only apply to *intentional actions*, and this excludes involuntary actions such as digesting food, or accidental actions such as winning the lottery. They continue by denying that "manifestations of knowledge-that must be accompanied by distinct actions of contemplating propositions".[17] They take as an example the action of opening the door by exercising *knowledge that* first one must turn the knob, and then push it. They argue that the only way of saving (X2) would be to argue that knowledge-that is being employed unintentionally, but this would render (X1) false. Thus, the truth values of (X1) and (X2) seem to be mutually exclusive.

[15] Stanley and Williamson, "Knowing how", p. 414.
[16] *Ibid*.
[17] *Ibid*., p. 415.

2.4 Reconsidering infinite regress: look out for performance

Whereas at first it may appear that SW have given a definite blow to the regress argument, I will show that *performance* is the key concept on which to defend and actually understand the regress argument. What is a performance? It is a doing, an operation, an act, an exercise of knowledge, as used in Ryle's and SW's writings.[18] Performing can be defined as the bringing about of a change in the state of affairs that is in accord with the agent's intention to do so. Thus, opening the door, contemplating propositions,[19] playing basketball or calculating my next move in chess are all examples of performances.

Contrasting Ryle's formulation of the regress argument (Section 2.2) with SW's formulation in their counterargument, we notice that SW, and not Ryle, introduce the distinction of knowledge-how and knowledge-that into the argument. Let us leave aside this distinction and reformulate case (1) of the regress argument as follows: Let $C(p)$ denote the act (i.e., the performance) of contemplating a proposition p, and let $\varphi(F)$ denote the proposition that must be contemplated in order to F. Therefore, $C(\varphi(F))$ denotes contemplating the proposition required for F-ing. Then, Ryle's argument can be restated in three premises without resorting to the distinction of knowledge-how and knowledge-that, relying on the notion of performance only:

(Y1) F is an intelligent performance,
(Y2) A performance G is intelligent if and only if before G one performs $C(\varphi(G))$,
(Y3) $C(p)$, for any p, is an intelligent performance.[20]

Substituting (Y1) in (Y2) we get that performing F will previously require performing $C(\varphi(F))$, but given (Y3) we have that $C(\varphi(F))$ in turn requires $C(\varphi(C(\varphi(F))))$, and so on to infinity. Thus we end up with an identical expression to the one presented by SW without resorting to the knowledge-how vs knowledge-that distinction. Since the argument is posed to illustrate the "vicious regress" that results from endorsing IL, we know that Ryle must reject at least a premise of the argument. It can not be

[18] Ryle, "Knowing how and knowing that: The presidential address", 1945; Ryle, Gilbert, "Knowing how and knowing that", in *The concept of mind*, 1949; Stanley and Williamson, Knowing how, 2001.

[19] When Ryle says that "the consideration of propositions is itself an operation the execution of which can be more or less intelligent, less or more stupid", given that he uses "operation" and "performance" interchangeably, he makes it clear that he regards considering propositions as a performance. See "Knowing how and knowing that", in *The concept of mind*, p. 30.

[20] Notice that in asserting (Y3), Ryle is denying (IL3): considering propositions is taken as a sort of doing/performing.

(Y1), for the view that some *F*-ings are intelligent are what led Ryle to advance the concept of knowledge-how—as SW point out, intelligent *F*-ings would correspond to intentional actions.[21] Neither can it be (Y3), for Ryle explicitly says that considering propositions is an intelligent performance.[22] The proposition Ryle rejects is (Y2), which is compatible with SW's rejection of (X2). This is illustrated with clarity in SW's example of opening a door:[23] Opening the door requires us to *know that* the door is there, and *that* it can be opened by turning the knob and pushing it. SW rightly point out that this exercise of knowledge-that (i.e., this intelligent performance) can be performed automatically and unaccompanied of a previous consideration of propositions. This does not disprove Ryle's regress argument in any way; if anything it reinforces it, for Ryle would say that in general, exercising knowledge-that is a case of intelligent performance, and therefore does not require any ulterior act of considering propositions—contrary to the IL claim. Thus we have that SW in their counterargument inadvertently refute IL when performance comes to the exercise of knowledge-that. Their counterargument, however, does not necessarily compromise their view that knowledge-how is a species of knowledge-that.

3. A semiotics of performance: intentional action and feedback

This section will engage in understanding performance and intentional action from the standpoint of Algirdas Julien Greimas's semiotics, relating it to the concept of *feedback*. The next section will strengthen this account drawing from cognitive science and current theories of mind and cognition.

Greimas's approach to intentional action is interesting because it is developed on an entirely different empirical basis than that of analytic philosophy—it is based on the study of fairy tales, stories, films and in general any object or collection of objects that can be thought of in narrative terms. Yet, it continues to have a large import in current semiotic theories such as cognitive semiotics.[24]

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[21] Stanley and Williamson, "Knowing how", p. 415.

[22] See footnote 19 in p. 6.

[23] Stanley and Williamson, "Knowing how", p. 415.

[24] Paolucci, Claudio. "Social cognition, mindreading and narratives. A cognitive semiotics perspective on narrative practices from early mindreading to Autism Spectrum Disorder", *Phenomenology and the Cognitive Sciences* 18.2 / 2019, pp. 375-400; Brandt, Per Aage. "What is cognitive semiotics? A new paradigm in the study of meaning", Signata. Annales des sémiotiques/Annals of Semiotics 2 / 2011, pp. 49-60.

Greimas's schema of the *subject on a quest* is a model of how action processes take place in narratives in general.[25] It is a refinement of the models proposed by Vladimir Propp (constructed after studying a vast corpus of fairy tales) and Levi Strauss's model of the *mytheme* (based on his anthropological studies of mythologies).[26] The schema of the subject on a quest combines four ordered stages (manipulation, competence, performance and sanction) which are given by the interaction of six actants.[27] The actants, grouped into pairs, are Subject and Object, Helper and Opponent, and Sender and Receiver. The schema will be best understood taking Shakespeare's play *Hamlet* as an example.

In *Hamlet*, Prince Hamlet (the Receiver) seeks out the Ghost of King Hamlet (the Sender) who in turn manages to persuade him of avenging him so that he may rest in peace by killing his uncle, King Claudius. *Manipulation*, i.e., the process of interaction between Sender and Receiver where the former persuades the latter, corresponds to the first stage. The outcome of manipulation is that Prince Hamlet accepts the Ghost's bidding and in so doing becomes a Subject on a quest for an Object of value; that is, he acquires an intention of action (avenging his father) which can be formalized in terms of wanting-to-do or having-to-do. Hamlet now enters the second stage, *competence*, which corresponds to the process of acquiring external and internal means in order to fulfill his intention—these are formalized in terms of the modalities being-able-to-do and knowing-how-to-do, respectively. In the case of Hamlet, faking madness is an important Helper, for it gets him into the situation of being-able-to-kill Claudius. This process of building competence can also be thought of as the progressive fulfillment of conditions that enable the third stage: *performance*. When Hamlet engages in duel with Laertes all of the conditions necessary for performance have been met. Next Hamlet performs: even when weakened by Laertes's poisoned sword he manages to thrust Claudius. Then comes the next stage, *sanction*, by which Claudius dies and thus the Ghost of King Hamlet is avenged. The outcome of sanction is that Prince Hamlet, even if dead, is said to be *realized* or *conjoined* with his Object of desire, and so is the Ghost of his father, the Sender. A fictional alternative ending, and not a very merry one, would have been that Claudius does not die even if thrust by Hamlet's sword because it turns out that he has superpowers, and Claudius kills Hamlet instead, leaving King

[25] Greimas, Algirdas Julien, *On meaning: Selected writings in semiotic theory*, translated by Paul J. Perron, University of Minnesota Press, 1987.

[26] Schleifer, Ronald, and Alan Velie. "Genre and Structure: Toward an Actantial Typology of Narrative Genres and Modes." *MLN* 102.5 / 1987, pp. 1122-1150.

[27] Greimas, Argirdas Julien. "Reflexiones acerca de los modelos actanciales", in *Semántica estructural: investigación metodológica*, 1987, pp. 263-293; Martin, Bronwen and Ringham, Felizitas, *Dictionary of semiotics,* Bloomsbury Publishing, 2000, p. 11.

Hamlet's Ghost without redemption. In this case we would say that Prince Hamlet as a Subject ends up being disjoined from his Object of desire (the intention of action). The alternative ending of *Hamlet* highlights the fact that performance and the sanction of performance are two distinct processes.

There are some key points to draw from the application of the schema of the subject on a quest.

1. *Intention* functions as the subject's *projection towards a desired state of affairs* (i.e., attaining an Object of desire). *Performance*, therefore, constitutes the subject's *means* to realize an intention, and not an end in itself. In Shakespeare's narrative, Hamlet does not thrust Claudius for the sake of thrusting him, the purpose/intention that drives the thrusting (and the sequence of Hamlet's actions that precede it) is to avenge his father. In fact, we see that intention biases/conditions/guides the subject's actions to pursue especially those that are relevant to performance, and to pursue a performance that is relevant to intention. In the case of *Hamlet*, this is evinced by the fact that Prince Hamlet abandons the good name he had among his people, and even the love of Ophelia, in order to realize his intention.

2. In intentional action, the realization of an intention presupposes performance, but performance does not presuppose the realization of intention (it does not guarantee it, as it were), hence the distinction between *performance* and *sanction* in Greimas's theory. Sanction requires *perceiving* the outcome of performance and *comparing* it with intention: the subject's performance has an outcome, it is sanctioned favorably (and thus the Subject becomes conjoined with the Object) if the perceived outcome of performance corresponds to the intention that motivated it. Note that perception in this case is *not* being restricted to sense-perception only, but to the Subject's impression or awareness of the changes in the state of affairs brought about by performance. Thus, thrusting Claudius may or may not be enough to avenge King Hamlet. It is the narrator at the end of the story that provides the reader with the information that Claudius in fact dies from the thrust, which realizes Hamlet's intention. In other narratives, the figure of the Sender reappears to perceive the outcome of performance and sanction the Subject accordingly; for example when the king sends a prince to perform several stunts and in the end judges the prince to be worthy of a price.

3. The double intervention of intention in motivating the quest and intervening in the comparison process at the end gives intentional action (as described by Greimas) the form of a feedback loop.[28] Although not explicit in the narrative of Hamlet, given the outcome or sanction of the performance, the subject may be able to consider

[28] Miranda Medina, Juan Felipe, "Competence, Counterpoint and Harmony: A triad of semiotic concepts for the scholarly study of dance", *Signata. Annales des sémiotiques/Annals of Semiotics* 11 / 2020.

adjustments in performance and perform again. In fairy tales, the hero suffering a temporal defeat in a qualifying test may adjust his strategies and train harder. Note, however, that the required adjustments follow from the comparison between intention and the perception of performance. The contrary case would lead our hero to modify his performance erratically, which goes against §1, since intention biases behavior, including adjustment.

The semiotic account exposed so far can be articulated into a systemic elementary model of intentional action in the form of a feedback loop, as shown in Figure 1. Once the subject acquires an intention (which takes the form of an envisioned and desired state of affairs), the subject performs. The performance has an outcome, that is, it affects the world (the state of affairs) in a certain way which the subject forms a perception of (again, perception in this context is *not* restricted to sense-perception only). The perceived new state of affairs is then compared to the subject's intention. The output of this comparison process (which for Greimas corresponds to sanction) is what I refer to as *assessment*, a term borrowed from education theory.[29] Assessment constitutes information that enables the subject to determine the extent to which the goals set by intention are being met so as to adjust performance in accord with intention.

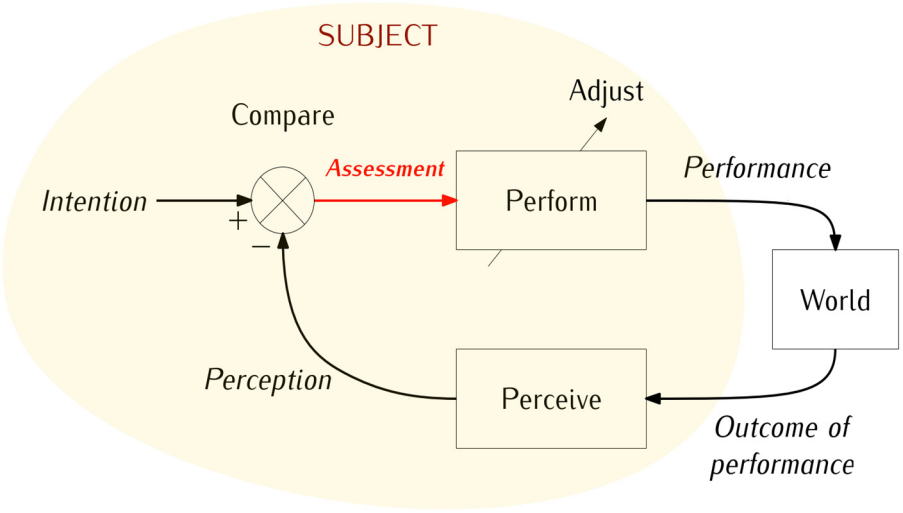

Figure 1. The feedback loop as a systemic elementary model of intentional action.

[29] Sattler, Jerome M., *Assessment of children* (3rd ed.), Jerome M. Sattler, 1988; Huba, Mary E., and Jann E. Freed. *Learner-centered assessment on college campuses: Shifting the focus from teaching to learning*. Allyn & Bacon, 2000.

4. Knowledge-that: feedback in SW's positive account on knowledge how

In *Knowing How*,[30] SW suggest several manners in which knowledge-that intervenes in performance. Let us go back to the example of opening the door, but let us imagine that it only unlocks with the digits of your year of birth input in reverse order:

1. You *know that* there is a door when you see it. *Perceptual input* thus provides you with information of what is in your environment. However, you must remember your year of birth to open it (i.e., you also require cognitive input). Both perceptual and cognitive inputs provide you with information (i.e., with knowledge-that) so that you may, from previous experience, identify possibilities of action respect to these inputs.

2. Once you form the intention of opening the door, from previous experience you devise a *plan* on how to realize your intention by means of performance, or of a series of performances:[31] You know that a certain kind of door can be opened in a certain kind of way. There may be cases, however where you do not have such a plan, or your plan fails. For example, this door is controlled by a sophisticated digital interface that may take you a while to figure out until, by intelligent trial and error (i.e., using feedback) you *learn how* to open the door. This applies to the case of *Hamlet* as well. Prince Hamlet did not formulate a precise plan on how he would avenge his father, but each action opened new possibilities of action for him to pursue further his quest for vengeance—in Section 5, I explain how this can be understood as navigating affordances.

Thus we have that perceptual and cognitive inputs can be regarded as knowledge-that insofar as they are *information* that *guides performance*[32] and hence intentional action—a view that SW expose with greater clarity in later writings.[33] How SW's positive account of knowledge-how guides intentional action, however, is much less clear. I will explain their account of knowledge-how according to

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[30] Stanley and Williamson, *Knowing how.*

[31] The reader interested in further elaborations on the concept of *plans* is referred to Bratman, Michael, *Intention, plans, and practical reason*, Vol. 10, Harvard University Press, 1987; and Brand, Myles. "Intentional actions and plans", *Midwest Studies in Philosophy* 10 / 1986, pp. 213-230.

[32] A robust account on how perceptual information available from attention guides intentional action is provided by Wayne Wu: "Shaking up the mind's ground floor: the cognitive penetration of visual attention", in *The Journal of Philosophy*, 114.1 / 2017, pp. 5-32.

[33] Stanley, Jason and Williamson, Timothy, "Skill", *NOUS* 51:4 / 2017, pp. 713–726; Stanley, Jason, and John W. Krakauer. "Motor skill depends on knowledge of facts", in *Frontiers in human neuroscience,* 7 /2013), pp. 1-11.

which ascriptions of knowledge-how result in ascriptions of knowledge-that. Next, I advance the claim that SW's positive account of knowledge-how corresponds to the output of the comparison process between intention and perceived outcome of performance.

SW's positive account of knowledge-how results from applying Karttunen's semantics to propositions that ascribe knowledge-how in order to map them to propositions that ascribe knowledge-that preserving the same truth content. Take SW's favorite example:

(1) Hannah knows how to ride a bicycle.

After conducting a linguistic analysis, SW conclude that four interpretive possibilities result from (1), namely:

(1a) Hannah knows how she ought to ride a bicycle.
(1b) Hannah knows how one ought to ride a bicycle.
(1c) Hannah knows how she could ride a bicycle.
(1d) Hannah knows how one could ride a bicycle.

SW regard (1c) and (1d) to be most relevant to philosophical discussion, particularly (1c), because it is the "paradigm reading" of (1).[34] Conversely, propositions (1a) and (1b) ascribe knowledge-that to Hannah in a more explicit manner and are therefore less interesting—e.g., "how one ought to ride a bicycle" could refer to riding slowly, or carefully. Thus, relying on Kartunen's semantics, SW bring forward proposition (PA):

(PA) Proposition (1) is true "if and only if, for some contextually relevant way *W* which is a way for Hannah to ride a bicycle, Hannah knows that *W* is a way for her to ride a bicycle".

Note that for SW *ways* refers to ways of engaging in actions, or more specifically, to properties of token events.[35] PA can be colloquially phrased as: in a certain situation in which Hannah is riding a bicycle, she knows that the way in which she is doing it is a "proper" way to ride a bicycle.

Hannah might know of several different ways in which to ride a bicycle, but SW's positive account on knowledge-how does not imply that Hannah needs to know all possible ways to ride a bicycle, only some that are contextually relevant. SW further distinguish between *demonstrative* and *practical* modes of presentation.[36]

[34] *Ibid*., p. 425.
[35] *Ibid*., p. 426.
[36] *Ibid*, p. 428.

If, for example, Hannah sees John riding a bicycle and she knows that that way (i.e., John's way) is a way for her to ride a bicycle this would correspond to a demonstrative mode of presentation, while (1) interpreted as (1c) corresponds to a practical mode of presentation. This distinction is analogous to the distinction between demonstrative and first-personal mode of presentation in ascriptions of knowledge-that. In some situation John might know that a man's pants are burning (demonstrative mode), as opposed to knowing that his own pants are burning (first-person mode).

SW make some important clarifications regarding their positive account on knowledge how. First, for (1) to be true "there need be no informative sentence of the form 'I ride the bicycle by *F*-ing'".[37] That is, in their account, ascriptions of knowing-how-to-*F* to a subject do not entail that the subject must be able to provide a verbal description on how one *F*s. Second, knowledge-how can be ascribed to animals and babies in spite of being propositional,[38] for example when I say that my dog knows how to catch a frisbee, or that human babies know how to suck. Interestingly, SW suscribe to the more controversial view that basic actions in the Alvin Goldman's sense (e.g., babies sucking) are in general valid ascriptions of knowledge how.[39]

In what follows I expound on how SW's positive account of knowledge-how can be understood in terms of feedback, and in Section 5 I explain how doing so actually integrates SW's account with current theories of intentional action.

Let us first examine SW's example of a Gettier case[40] for knowledge-how:[41]

Bob wants to learn how to fly in a flight simulator. He is instructed by Henry. Unknown to Bob, Henry is a malicious imposter who has inserted a randomizing device in the simulator's controls and intends to give all kinds of incorrect advice. Fortunately, by sheer chance the randomizing device causes exactly the same results in the simulator as would have occurred without it, and by incompetence Henry gives exactly the same advice as a proper instructor would have done. Bob passes the course with flying colors. He has still not flown a real plane. Bob has a justified true belief about how to fly. But there is a good sense in which he does not know how to fly.

The first question to answer is: why does Bob have a justified true belief about how to fly? From SW's example the most plausible reply would be that it is because "Bob passes the course with flying colors". Thus we see that, in Greimas's terms, there has been a process of sanction (i.e., comparison) by which someone

[37] *Ibid*., p, 432.
[38] *Ibid*., p. 438.
[39] *Ibid*., p. 440-441.
[40] Gettier, Edmund L., "Is justified true belief knowledge?", *Analysis* 23.6 / 1963, pp. 121-123.
[41] Stanley and Williamson, *Knowing how*, p. 435.

determined that Bob should pass the course, most likely on the basis of Bob's successful performance in the flight simulator. Given his success in the flight simulator, Bob knows that his way to fly in the simulator is a way to fly. In relation to the feedback loop (see Figure 1), this corresponds to the *output of the comparison process* between Bob's intention to fly and the perceived outcome of his flying in the simulator, in other words, it is an *assessment* of success. Poston actually refers to this as "the success condition" for knowing-how to *F.*[42] In his argument against the possibility of Gettier cases, Poston examines SW's example and dismisses it based on the success condition: Bob can fly just as well as all the others that trained in a different simulator. Poston maintains that "one knows how to *F*, if one can intelligently and successfully *F*".[43] In this case, then, the success condition is met if the comparison between the perceived outcome of performance and the intention to fly is favorable.[44]

The assessment of success, however, is gradable, rather than binary. Consider once again the case of Hannah riding a bicycle. There are indicators of success in this task such as moving forward when riding, and that the bike is relatively stable as one rides. If Hannah, after her first days learning to ride a bicycle, rides her bicycle successfully, she comes to know that that is a way for her to ride a bicycle (a practical mode of presentation). Imagine, however, that novice as she is, Hannah manages to hop on the bicycle but advances only a few meters before falling down and hurting her knee. Would she entertain the proposition that that is a way for her to ride? Insofar as this way of riding did not comply with any criteria of success, she would not. In later publications,[45] SW and Stanley are explicit about the role that propositional knowledge plays in guiding behavior in intentional action. If Hannah thought that the way in which she rode the bicycle that led her to fall down is a way for her to ride, there is hardly any chance of Hannah learning to ride. If that were the case, the positive account of knowledge how that SW propose would fail to guide performance as they maintain it does, and as theories of intentional action posit feedback does.

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[42] Poston, Ted. "Know how to be Gettiered?", *Philosophy and Phenomenological Research* 79.3 / 2009, pp. 743-747.

[43] *Ibid*., p. 744.

[44] Although it is not central to this discussion, he seems to be right in denying the possibility of Gettier cases, since given that *F*-ing intelligently and successfully is the analogous of the justified belief condition and the truth condition in Gettier cases of knowledge-that, the intelligence and success conditions must be met in the Gettier case for it to be a Gettier case (*ibid*.).

[45] Stanley, Jason and Williamson, Timothy, "Skill"; Stanley, Jason and John W. Krakauer. "Motor skill depends on knowledge of facts".

This can be generalized to behavior in human and non-human animals alike: we need to form ways to do things in order to do them consistently, and in order to do so we need to have feedback information that allows us to know when our performance (our way of doing things) is actually achieving the intention that moved it; to know when it does not, and to know when performance requires adjustment and what sort of adjustment it can require. Imagine an intermediate scenario, were Hannah is a fast learner, but inexperienced in riding bicycles. She has managed to hop on the bicycle and starts pedaling. More than a minute has passed and she is moving forward, but she senses that the bicycle feels unstable. Then Hannah might think that that is a way for her to ride a bicycle, but a way that requires adjustments: she pedals a little faster and grabs the handlebars with a tighter grip, and thus manages to continue riding. As she gains experience, Hannah will also come to *know that* when one comes to a bumpy road a tighter grip is required in tandem with a reduction in speed—i.e., she will come to know that for a certain perceived context c_0 she can perform in a certain way W_0 (or adjust her current performance to perform in way W_0).

Next, consider knowledge ascription to babies. Why would SW endorse the view that babies knowing how to suck is legitimate knowledge-how?[46] Imagine that baby Jane is hungry and is therefore crying. Once her mother puts her breast in her mouth and she manages to suck, however, the crying stops. Baby Jane *knows that* the way in which she is sucking *is* a way to suck: she senses and enjoys the milk she was so hungry for—i.e., a criteria of success for sucking is met. If she, however, for some reason fails to extract the milk from the breast, her crying is likely to continue.

In this section I have argued that SW's positive account of knowledge how is identical to the output of the comparison process in the feedback loop that contrasts intention with perception, i.e., to *assessment*. This feedback loop corresponds to a high-order psychological level of the subject: it is used to assess whether the intention was met or not, and whether adjustments are required, as opposed to, for example, regulating lower-order sensory-motor processes. Assessment results from the comparison between current performance and intention in practical modes of presentation, but this comparison is gradable rather than binary (true or false). Thus, performing (i.e., the act of *F*-ing) may result not only in the propositional knowledge that *W* is a way for one to *F,* but that *W* is *not* a way for one to *F*, or alternatively that *W* is a way for one to *F*, but a way that requires a set of adjustments *A* in performance.

[46] Stanley and Williamson, *Knowing how*, p. 440-441, footnote 46.

5. Feedback, prediction and knowledge-that in theories of cognition and intentional action

The concept of feedback is, to the best of my knowledge, not commonplace in discussions on knowledge-how and knowledge-that, but nevertheless it has been present in theories of psychology[47] and perception[48] for several decades. Furthermore, given that feedback is extensively deployed in control engineering[49] and in the more recent discipline of signal processing,[50] and that the potential link between control theory in machines and animals was noted more than half a century ago,[51] it is rather striking that it has only recently began to make its way to theories of cognition and intentional action.[52]

Recent theories of mind rely on the principle of feedback in tandem with another concept: *prediction*. Such theories postulate that the application of both concepts is not limited to specific sensory-motor control functions, but that feedback and prediction (otherwise known as *expectation*) establish a link between decisions at the highest level (the level to which intentions correspond) all the way down to the subject's sensory systems. The combination of feedback and prediction allows for top-down and bottom-up control of intentional action.

In their study on the abnormalities in the awareness of action, Blakemore et al.[53] present a model of the motor control system that includes feedback and prediction. Their model relies on three fundamental magnitudes that result in three feedback loops:

1. The *desired state D*, which holds the instant goal of the system (where the goal is derived from intention).
2. The *estimated actual state E*, inferred from motor commands, predictions of motor commands and sensory feedback.
3. The next *predicted state P* of the system based on predictors.

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47 Dewey, John, "The reflex arc concept in psychology", *Psychological review* 3.4 / 1896, p. 357.

48 Powers, William Treval, and William T. Powers. *Behavior: The control of perception,* Aldine, 1973.

49 Altmann, Wolfgang, *Practical process control for engineers and technicians,* Elsevier, 2005.

50 Haykin, Simon, *Adaptive filter theory*, Fifth Edition, Pearson Education, 2014.

51 Wiener, Norbert. *Cybernetics or Control and Communication in the Animal and the Machine*. MIT Press, 2019. Original publication 1948.

52 Pezzulo, Giovanni, and Paul Cisek, "Navigating the affordance landscape: feedback control as a process model of behavior and cognition", in *Trends in cognitive sciences*, 20.6 /2016, pp. 414-424.

53 Blakemore, Sarah-Jayne, Daniel M. Wolpert, and Christopher D. Frith. "Abnormalities in the awareness of action", Trends in cognitive sciences 6.6 / 2002, pp. 237-242.

The controllers that issue motor commands are adjusted on the basis of comparing *D* against *E*, and *D* against *P*. The predictors that calculate *P* are adjusted from the comparison of *E* and *P*. The model Blakemore et al. propose is attractive because it explains how specific faulty interactions between these processes result in abnormalities in the control and awareness of action, such as optic ataxia (difficuly grasping objects), "anarchic hand" sign (where the subject can not control at all the movement of the hand) and phantom limbs (feeling the presence of a limb after amputation). Although it is not straightforward to determine which processes in the motor control are actually available to awareness, it is clear that *not all* processes are available to awareness. This is particularly consequential in regards to performance, because it shows that from all of the processes that are taking place during performance, only some of them are issuing information that is available at subject-level (i.e., actual knowledge-that). For example, Blakemore et al. hypothesize that the motor commands issued to the motor system, as well as the predictors and the actual state of the system are not available to awareness. This provides compelling evidence for the case that performance can not be reduced to information about performance. Along the same line, SW themselves acknowledge that performance involves non-cognitive factors (e.g., stamina and strength for a boxer),[54] but they leave them aside arguing that, for example, stamina and strength might enable a boxer to win a match without possessing the skill to box. This is a mistake. Information is about knowing what resources are available to the agent (including the non-cognitive ones) in order to exploit them optimally in performance. The veteran Muhammad Ali defeating George Foreman, a fearfully strong and young boxer in an epic match in 1974, and Michel Jordan developing his fade-away shot to compensate for the loss of his jumping abilities are both examples of this. Hence I embrace the moto: know what you have, envision how to use it, learn how to use it, and develop it further.

The role of feedback and prediction is even more prominent in Pezzulo and Cisek's theory of intentional action.[55] In their view, the theoretical principles of feedback control "govern all biological systems".[56] Since agents are situated in dynamic yet structured environments, adaptive action control is a central paradigm to understand feedback cognition. Pezzulo and Cisek construe intentional action as the purposive navigation of an "affordance landscape", where *affordance* refers to "action possibilities

[54] Stanley and Williamson, "Skill", p. 717.
[55] Pezzulo, Giovanni, and Paul Cisek, "Navigating the affordance landscape".
[56] *Ibid*., p. 415.

provided to the actor by the environment".[57] According to the affordance competition hypothesis, the agent's cognitive system simultaneously specifies the set of desirable actions based on perceived available affordances, and opts on which behavior to pursue resolving a "competition between representations of these actions, biased by the desirability of their predicted outcomes".[58] The selected action is then executed through continuous feedback control permanently relying on sensory information on the environment as well as expected feedback to adjust and if necessary, update the ongoing action until it is completed. The affordance competition hypothesis can be extended to intentional action if one acknowledges that agents are continuously generating predictions on possibly available affordances rather than only reacting to the affordances that are readily available—e.g., as you are playing basketbal the immediately available affordance is to pass the ball, but you dedide to drible further to your right, and then you spot a new affordance: if you move fast enough you may be able to shoot a three-pointer. It must be pointed out that new research in cognitive science,[59] artificial intelligence and philosophy of mind is also propounding feedback and prediction as core components in the framework of a theory of mind and agency.[60]

But how to relate feedback and prediction to knowledge-that? As argued in Section 4, feedback at the level of intention (i.e. SW's positive account of knowledge that) provides information on the success of performance that can be used to adjust it. Prediction, i.e., opting for one possibility of action over another, however, is also a form of knowledge-that, often arising from experience. The ability to navigate the affordance landscape, i.e., the ability to design, modify or

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[57] Kaptelinin, Victor, "Affordances", in *The Encyclopedia of Human-Computer Interaction, Interaction Design Foundation*, 2014, ch. 44.

[58] Pezzulo and Cisek.

[59] Haggard, Patrick. "Human volition: towards a neuroscience of will", *Nature Reviews Neuroscience* 9.12 / 2008, pp. 934-946; Gallagher, Helen L., and Christopher D. Frith. "Functional imaging of 'theory of mind'", *Trends in cognitive sciences* 7.2 / 2003, pp. 77-83; Morris, Sarah E., et al., "Learning-related changes in brain activity following errors and performance feedback in schizophrenia", *Schizophrenia research* 99.1-3 / 2008, pp. 274-285; Bubic, Andreja, D. Yves Von Cramon, and Ricarda I. Schubotz, "Prediction, cognition and the brain", *Frontiers in human neuroscience* 4 / 2010, p. 25.

[60] Jeannerod, Marc. *Motor cognition: What actions tell the self*. No. 42. Oxford University Press, 2006; Friston, Karl, "The free-energy principle: a unified brain theory?", *Nature reviews neuroscience* 11.2 / 2010, pp. 127-138; Clark, Andy, *Surfing uncertainty: Prediction, action, and the embodied mind*, Oxford University Press, 2015; Linson, Adam, et al., "The active inference approach to ecological perception: general information dynamics for natural and artificial embodied cognition", *Frontiers* in Robotics and AI 5 / 2018, p. 21; Wiese, Wanja and Thomas Metzinger, "Vanilla PP for Philosophers: A Primer on Predictive Processing", in T. Metzinger & W. Wiese (Eds.). *Philosophy and Predictive Processing*: 1. MIND Group, 2017.

improvise a plan also corresponds to knowledge-that. Demonstrative modes of presentation can also provide the agent with valuable information (e.g., when learning from others' success and failures). Nonindexical descriptions (e.g., verbal descriptions from a teacher or coach) can also be determinant in guiding performance. As SW note, better performances result from (and result in) faster information pick-up, gathering more information as one performs, and improving the quality of information that one acquires in and for performance.[61]

As an example of how affordances, prediction and feedback may come to play in a practical scenario, imagine basketball legend Michael Jordan playing in the 1990s. He started the night driving to the basket hoping to dunk, but his expectations were denied by the intense defense of the Knicks that were not shy to foul him hard when he was close to the basket. His own feedback tells him that his intention to dunk is difficult to realize, but Jordan is intelligent, he resorts to a different action: in every chance he gets, he drives as if he were to dunk, but instead he passes the ball to his teammates enabling them to score. He takes advantage of the false predictions of the Knicks defenders to achieve his goal. In a specific situation, he is surrounded by Knicks defenders, but the lack of an immediate affordance to score does not stop him: he fakes a turn and a defender follows him, then he dribbles a crossover leaving the other defender behind and rises high up and dunks over Patrick Ewing. Jordan, however, does not only rely on the information his experience provides him with, he knows that he can jump higher and stay longer in the air than most players, hence he takes advantage of his physical qualities. Instead of passing the ball (the affordance that was most readily available), he was capable of improvising a plan that uncovered other affordances which he exploited in an emphatic slam dunk; an exquisite demonstration of intelligent performance.

Some worries may arise from the account on feedback, prediction and performance this work has provided. The first one is that the criteria for success in an intentional action might not be explicitly given, or not clear enough, which complicates ascriptions of knowledge-how to oneself or others. The first worry is legitimate in the sense that in many situations (many *F*-ings) there is no explicit criteria given for success. When learning dance by imitation, one imitates as close as possible the movements of those one takes to have knowledge of the dance, but these experienced dancers may not provide any sort of criteria or explicit information about what they are doing. Moreover, the criteria for successful performance is often context specific. A singer learning *bel canto* might be highly appraised in her city for her singing skills, but upon arriving to the conservatory receives a very

[61] Stanley and Williamson, *Skill*.

different feedback from her teachers and must almost re-learn the basics of how to sing (this is not an infrequent scenario among artists). The second worry is about the reliability of the comparison process: is it possible that comparison is faulty thus leading us to believe that we are realizing our intention but that actually our performance is lacking? This worry is well grounded. A singer might hold his skills in high esteem, but they fail to realize that he sings notoriously out of tune. Both of these worries highlight the nature of knowing how to *F* and of intentional action more generally, but do no harm to the case that ascriptions of knowledge how correspond to assessments, i.e., to the output of the comparison between intention and perceived performance. A third worry is that the feedback loop model put forward in Section 3 did not include prediction, and is thus too elementary to adequately describe intentional action. The condition for feedback is comparison, and the condition for adjustable prediction is that there is feedback. The model accounts for adjustment of performance at subject-level (i.e., at the top level of the hierarchy of intentional action), but lower level feedback and prediction processes may be incorporated based on the literature presented in Section 4. A fourth worry is that my account of feedback and prediction relies on affordance theory, which is not necessarily accepted by all philosophers or researchers. Affordance theory is an account for the role that feedback and prediction play in intentional action; other theories, such as predictive processing, may propose alternative accounts, but this does not undermine the fact that feedback and prediction are at the core of intentional action. A fifth worry is that the account of feedback I provide (represented in Figure 1) relies on the input-output model, which has lost currency in theories of mind. Even if the representation method I provided for feedback is in terms of processes interrelated by their inputs and outputs, this in no way corresponds to the input-output model of perception and action, according to which the mind passively awaits for input in the form of raw data, processes it, and rests again.[62]

6. Conclusion: performance, information and knowledge

The knowledge-how vs. knowledge-that debate is heated even today. Although the acceptance of other notions of knowledge such as knowledge-how, tacit knowledge, practical knowledge and embodied knowledge have become wider among the

[62] Clark, Andy, "2014: What Scientific Idea is Ready for Retirement?", *Edge*, https://www.edge.org/response-detail/25394 . Accessed December 8, 2020.

philosophical community in the last decade,[63] there still seems to be a predisposition to favor propositional knowledge (e.g., in newer trends of intellectualism)[64] as being prior to, or encompassing, other notions of knowledge. Ryle's concept of knowledge-how, however, has had a valuable impact, for example in Stanley and Williamson who advocate for the importance of the concept of skill in epistemology sixteen years after their first response to Ryle.[65] Nevertheless, the reliance on "truth", the view that "the goal of inquiry is to acquire knowledge of truths about the world", and that "knowing how to do something amounts to knowing truths about the world"[66] might, in my view, hinder more than favor an understanding of the nature of knowledge. In particular, engineers and computer scientists, who are playing a key role in research on mind and cognition, do not hold the notion of "truth" in any special regard. *Information* is the concept most valuable to them, and information is always relative to a system or to a process, it is more or less reliable (as given by statistics), it is useful but always subject to update and flow, and always related to the function of a system, that is, to its performance.

This would therefore be the last step in my argument: let us conceive of knowledge-that or propositional knowledge as information, so that we might free ourselves of unnoticed burdens that historical commitments to truth may bring in our new scientific and philosophical inquiries on knowledge. The result is that we step out of the knowledge-how–knowledge-that conundrum, and advocate for *performance* and *information* as two fundamental and complementary concepts. As I hope to have argued convincingly for, neither of them is reducible to the other: information guides performance, but not every aspect of performance can be encoded into information at the subject level in intentional action. Intention articulates performance and information playing a pervasive role: it is not a ballistic efficient cause, but it rather biases the perception of sensory and cognitive information, how it is potentially related to a number of performances, and it follows through performance in the form of feedback and predictions that are constantly updated. Stated otherwise,

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[63] Steup, Matthias and Ram Neta, "Epistemology", in *The Stanford Encyclopedia of Philosophy* (Fall 2020 Edition), Edward N. Zalta (ed.); Farkas, Kataline, "Know-how and non-propositional intentionality", in M. Montague, A. Grzankowski (eds)., *Non-propositional intentionality*, Oxford University Press, 2018, 95-113.

[64] Pavese, Carlotta, "Know-how, action, and luck", *Synthese* / 2018, pp. 1-23; Wallbridge, Kevin, "Subject-specific intellectualism: re-examining know how and ability", *Synthese* / 2018, pp. 1-20; Borges, Rodrigo, "Introduction to the special issue 'knowledge and justification: new perspectives'", *Synthese* / 2020, pp. 1-8.

[65] Stanley and Williamson, *Skill*.

[66] Stanley, J., *Know How*, Oxford University Press, 2011; Yale University, Department of Philosophy, K*now how,* https://philosophy.yale.edu/publications/know-how . Accessed December 8, 2020.

there is no arguing against the fact that intelligent performance requires the guidance of information in order to be intelligent; not as an anterior operation, as the intellectualist legend would have it, but as being integrated in real time with performance. Perhaps the future of epistemology lies in the understanding and development of the interplay of these two concepts, information and performance, and of the disciplines that study them. Ryle goes a step further when he says:[67]

But when I have found out something, even then irrespective of the intelligence exercised in finding it out, I can't be said to have knowledge of the fact unless I can intelligently exploit it.

That is, for Ryle, the "folk conception" of knowledge-that as facts that one can memorize and recite is useless. Knowledge is only knowledge if it has a part to play in performance, that is, knowledge is always knowledge-in-action. This view seems to continue to find support in Greimas's pragmatic semiotics and in research on intentional action. Pezzulo et al.,[68] for example, say that "the brain is a feedback control system whose primary goal is *not to understand the world*, but to guide interaction with the world". This interaction-centered view of knowledge might be more compatible with other characterizations of knowledge, for example the one being propounded by semiotics, that considers action and information as being interrelational, situated, symbolic, affective and performative;[69] or decolonial theories of knowledge[70] that seek to revalue indigenous epistemologies.

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[67] Ryle, "Knowing how and knowing that: The presidential address", p. 16.

[68] Pezzulo, Giovanni, and Paul Cisek, "Navigating the affordance landscape".

[69] Williams, James, *Process philosophy of signs,* Edinburgh University Press, 2016.

[70] Grosfoguel, Ramón, "The epistemic decolonial turn: Beyond political-economy paradigms", *Cultural studies* 21.2-3 / 2007, pp. 211-223.

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