

## NATURALIZED RATIONALITY – A GLANCE AT BOLZANO'S PHILOSOPHY OF MIND

### ABSTRACT

Bernard Bolzano's philosophy of mind is closely related to his metaphysical concepts of substance, adherence and force. Questions as to how the mind is working are treated in terms of efficient (causal) faculties producing simple and complex representations, conclusive and non-conclusive judgments, as well as meta-representational attitudes such as believing and knowing.

My paper outlines the proximity of Bolzano's account of "mental forces" to contemporary accounts of faculty psychology such as Modularity Theory and Simple Heuristics. While the modularist concept of domain specificity and encapsulated mental faculties aligns with Bolzano's allotting domain specific tasks to correspondingly specified forces (*e.g.* judging to "judgmental force", inferring to "inferential force" etc.), the emphasis of Simple Heuristics on accurate "fast and frugal" processes aligns with Bolzano's considerations on cognitive resources and the importance of epistemic economy.

The paper attempts to show how Bolzano's metaphysics of the mind purports a conception of bound rationality that determines his epistemology. Combining the rationalist concern for epistemic agent responsibility in the pursuit of knowledge with a strong confidence in the reliability of causal processes to generate the right beliefs, his epistemology shows close affinities with contemporary Virtue Epistemology. According to Virtue Epistemology, obtaining the credit of knowledge requires that true beliefs are generated by reliable processes subserving a virtuous character. The assumption that Bolzano anticipates virtue epistemological considerations is corroborated by his discussion of heuristic principles that set the norms for the acquisition of knowledge. The paper explores possible relations between such principles and the presumed low-level heuristics of cognitive processes.

### 1. THE RATIONAL IDEAL AND THE EPISTEMICAL REAL

The rational ideal of the epistemological central value – knowledge – holds that knowledge of  $[q]$  can be ascribed to subject S if S's belief " $q$ " is such that it has achieved to fit the truth of  $[q]$  in a non-accidental way.<sup>1</sup> This requires that 1) the epistemic efforts S made with regard to " $q$ " satisfy the conditions of truth-conformity and that 2) these efforts and  $[q]$ 's being true are connected in a non-accidental way. In the idealist view, knowledge is fully rational, and, due to its objectively flawless grounds, infallible and indefeasible. Consequently, S's knowing that  $[q]$  requires that S can assess the truth-conformity of her judgment (assertion) " $q$ " by evaluating not only the epistemic reasons leading her to believe that  $[q]$ , but also the objective reasons for  $[q]$ 's being true. In Bernard Bolzano's approach, the achievement of knowledge is represented in the metaphor of an ascent: after having asserted  $[q]$ , S comes to know  $[q]$  by way of "ascending" through a flight of "objective grounds" to the ultimate ground of  $[q]$ . According to the rational ideal, an epistemic agent S knows  $[q]$  when she fully ascended, that

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<sup>1</sup>I use  $p, q$  to indicate state of affairs,  $[p], [q]$  to indicate propositions, and " $p$ ", " $q$ " to indicate judgments.

is when she succeeded in flawlessly singling out the right number and order of pertinent reasons, such that all the steps of ascension are fully transparent to her. The rational ideal does not usually take into consideration pragmatic constraints, or the confinement of the natural boundaries of a mind. It takes it for granted that a rational mind operates somehow in an abstract space of logical and semantic coherence where time restriction and situational constraints do not affect its work.

The epistemical real, however, looks different. Actual epistemic agents, although well intentioned and aware of their rational responsibility, rarely (if ever) ascend in the ideal straightforward way from an assertion (belief) " $q$ " through a flight of objective grounds to an ultimate ground of [ $q$ ] that would provide the added value of knowledge to their belief " $q$ ". In the epistemic reality, agent S may well start ascending, but will usually soon get lost in a host of possible grounds for [ $q$ ] that seem equally good or equally wanting for founding her belief " $q$ ". More often than not, S will feel restrictions of time, of memory, etc., which make her wonder how ever she shall decide between the available options of justifying her belief. In the best of average cases, S will arrive at a somehow acceptable level of grounding her assertion " $q$ ". In the worse scenario, rather than ascending, S actually finds herself descending, doubting now what she asserted before. The epistemical real unveils that human rationality is not unbounded rationality but restricted by the limits of its natural resources.

Against this background of the epistemical real, a number of philosophers claim that human rationality needs to be "naturalized", that is accounted for in terms of reasoning processes that are reliable enough, but also fast and frugal enough given the demands of a normal human life. It is claimed that actual minds – being embodied entities – depend on the properties of the processing systems and the informational resources of their physical supports. Therefore, the rational capacity of human minds cannot be construed in terms of an unlimited faculty, but needs to be understood as an essentially bounded faculty. As for the bounding factors, we can distinguish mainly two categories: rationality is bounded, on the one hand, by the naturally available potential of human brains and/or neural systems, and, on the other hand, by pragmatic constraints. The label "Naturalized Rationality" literally refers to the first class of constraints, suggesting that rationality must be assessed in accordance with the properties of its physical support. Naturalized Rationality encompasses, however, also considerations referring to the second class of constraints. Among these, research in the field of what has become known as "Simple Heuristics" gains growing attention. Taking into consideration

pragmatic constraints of rationality, Simple Heuristics deal with the epistemic principles rational agents apply when they have to decide between  $[p]$  or  $[q]$  under pressure of time and other constraints of urgency. Suppose that S asserts " $q$ ", where  $[q]$  stands for [*There is immediate danger for S*]. Given such a content of her assertion, S cannot quietly deliberate on the reasons that warrant her asserting  $[q]$  in an idealized rational space. In this emergency situation, rationality requires to draw on selective principles that provide the needed justification in a way that is "fast and frugal" enough to confront the danger in due time and with proper means. Throughout their existence, embodied minds find their rationality subject to multiple restrictions that are inflicted on them by the conditions of their natural kind. Therefore, it seems appropriate to deflate the notion of rationality by adapting its conditions of application to the factually given. In the field of naturalized epistemology, it is Virtue Epistemology that attempts to key an externalist position on justification to internalist normative requirements. The notion of a virtue understood in terms of a praiseworthy personal property licenses applications both to physical excellences and skills and to character traits. Responsibilist epistemologies take the justificatory relevant virtues to be character traits for the development of which a subject is responsible. Therefore, failing to display character virtues makes a subject blameworthy, while lacking physical excellences and skills does not have the same ethical consequences. As essentially value-oriented properties, virtues motivate agents to take certain measures to attune a situation to a given pattern of values. The methods chosen may be standard or non-standard, driven by norms or not. Accordingly, an epistemically responsible agent's path to knowledge is not primarily norm-governed but rather value-driven. According to one account, for instance, it is the virtue of her love of truth that motivates an agent to apply the most reliable methods in her pursue of knowledge. It is assumed that reliable processes recruited to the relevant virtues will deliver results that bear the credentials of knowledge. For Virtue Epistemologists, knowledge claims are bound by the cognitive equipment subserving agentic responsibility.

## 2. THE NATURAL MIND: 'FACULTY PSYCHOLOGY'

In the following, I shall point out some features of theories that attempt to naturalize rationality and the mind. I will concentrate on so called "faculty psychology" as represented in accounts of Mind Modularity and Simple Heuristics. The aim thereby is to show how these features align with certain topics in Bolzano's philosophy of mind. Commitments to faculty psychology and bound rationality influence the position one takes in epistemological

questions. They favor reliabilist accounts of knowledge which traditionally are seen as opposed to the ideals of a rationalist epistemology. In view of his achievements in the development of logical semantics and analytic methodology in philosophy, Bolzano is usually taken as a full blown rationalist concerning epistemological requirements. Focusing on his seminal work on the properties of objective propositions and a variety of logical relations between them, one might too easily think that Bolzano's emphasis on, say, the famous "deducibility" implies his commitment to a rationalist notion of knowledge, understood in terms of perfect deduction. This is not the case. The tendency in Bolzano's epistemology is rather to naturalize rationalism, which results in a position that anticipates contemporary responsibilist reliabilism. This move is not motivated by a lack of appreciation for the values of rationalism, but rather by taking into account a metaphysics of the mind that is essentially monist and explains mental performance in terms of causal efficacious forces. His "naturalizing" view of the mind strongly impregnates Bolzano's epistemology which emphasizes the processual aspects of epistemic states. In his epistemology, Bolzano appears to be a reliabilist who navigates between the poles of absolute reliability (ideal rationality) instantiated in inferences leading from true premises to true conclusions in accordance with the properties of deducibility – and low-level reliability instantiated in the spontaneous choice of options that may draw on "quick and dirty" heuristic principles (bound rationality). Furthermore, Bolzano's epistemological interest is not restricted to the question of what kind of justification makes a belief count as knowledge proper, but rather focuses on how to explain that a given  $[q]$  is true and how to expand a given body of knowledge. In Bolzano's approach, matters of justification or warrant imply explanatory and heuristic principles, which are not independent of the mechanisms steering mental processes.

Mental Modularity is a term introduced by Jerry Fodor who characterizes his book *The Modularity of Mind* (1983) as "An Essay on Faculty Psychology". Fodor's modularism is a theory of the architecture of the mind, according to which the mind's cognitive processing is accomplished by a host of functional input-output systems subserving a central system of reasoning. The processing systems are modular in the sense that they are domain-specific and work in relative independence of each other. With regard to domain-specificity, the idea of mental modularity corresponds to the traditional idea of the mind being constituted of different "faculties" eligible to carry out specific tasks. Contemporary modularity accounts mainly relate domain-specificity to the idea of a division of labor that enables embodied systems to efficiently deal with abundant information flows. Fodor claims that the need to

consider any arbitrary item of information in the course of processing would require arbitrarily complex algorithms that risk overburdening the system's resources. Being not computationally tractable, arbitrary complexity cannot be handled nor can it be mapped in any model or theory of the mind. Therefore, mental processes need to be construed in terms of encapsulated units whose operational range is limited. Encapsulation as the main hallmark of a mental module "concerns the class of representations that it can use as a resource" once it has been activated by the proprietary data exhibiting its input-specificity (Samuels 2005, 112). "Paradigmatically, encapsulation concerns the information encoded in memory that the mechanism is able to consult in the course of providing solutions to the particular inputs that it receives" (*ibid.*). Information-frugality of mental modules is supposed to be supplemented by processing-frugality of algorithms tailored to the demands of their task-specificity. Reducing expensive search and assessment procedures, domain specificity and encapsulation enhance fast and mandatory processing. Being relatively autonomous, mental modules are dissociable and exhibit specific breakdown patterns. Examples of task-domains assigned to distinct mental modules are the recognition of faces or the representation of three-dimensional objects.<sup>2</sup>

Mental modularism is a theory of the architecture of the mind that is to be seen against the background of evolutionary psychology: mental structures and processes establish in function of low-cost strategies for the system's resources and high-yield strategies for its adaptiveness. Accordingly, encapsulation is considered diachronic in the sense that the informational closure of the mechanism essentially obtains throughout its entire history. Richard Samuels points out, however, that there also is a sense in which encapsulation is synchronic, to wit "if, at any time, there is at least some (kind of) information possessed by the organism that is inaccessible to [the mechanism]" (Samuels 2005, 112). The notion of synchronic encapsulation is weaker than that of diachronic encapsulation and allows counting "any deterministic computational device that does not engage in exhaustive memory search" as encapsulated. Furthermore, it could even be applied to a reasoning mechanism "whose access to information is mediated via a limited working memory" (*ibid.*, 113). This application of the term 'encapsulation', although it is not the one ordinarily used, seems to be at stake in Bolzano's discussion of the way how the requirements of ideal inference collide with the reality of embodied minds. For an inference to be rationally proper it is required, according to

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<sup>2</sup> The short overview on modularity theory laid out here is strongly committed to Samuels 2005 and Carruthers 2006. I would like to thank an anonymous referee whose substantial remarks made me improve this part.

Bolzano, that all the premises needed for a judgment "*q*" to be conclusive be "present to the mind" in their entirety at the moment of inferring. However, the mind's limited capacities of holding actual representations often prevent this ideal from realizing. Take the well known example of simple consistency-checking: the task of checking a candidate new belief according to rational requirements demands an epistemic system to consult more information than it can handle to reach a solution in real time. Going through the set of all stored beliefs in order to descry whether contradictory beliefs to the candidate belief are hold is obviously not feasible for human minds. The amount of time and working memory needed to complete such a task would go up exponentially with the size of the chosen belief-set. Inference in addition demands to determine which of the coherent beliefs adduce evidence for the candidate's being conclusive. Consequently, it might be the case that, due to limited working memory, either the inference is not implemented – in spite of the agent possessing the substantiating knowledge in dispositional form –, or the inference runs by dint of heuristic rules that are "quick and dirty" from the point of view of rational ideals (WL §§300.2; 308).<sup>3</sup> While the former option is obstructive to the increase of knowledge, the latter evokes the problem of determining the conditions of the warrant for knowledge. The inclusion of more frugal procedures into the credentials for true beliefs makes knowledge achievable at the price of increasing fallibility.

In contemporary cognitive science, empirical research on the means people actually use in view of a given epistemic goal led to the theory of "Simple Heuristics" framed most prominently by Gerd Gigerenzer and his team. Their approach suggests replacing "the image of an omniscient mind computing intricate probabilities and utilities" with that of "a bounded mind reaching into an adaptive toolbox filled with fast and frugal heuristics".<sup>4</sup> This mental "toolbox" is supposed to contain different kinds of rules, such as search rules, stopping rules or decision rules, which direct agents in their practical and epistemic endeavors. The somehow surprising fact is that these rules – although qualified as "quick and dirty" in comparison to the traditional principles of rationality – provide equally satisfying results in almost all experimental settings. Attractive examples for simple heuristic rules are *recognition* and *'satisficing'*. In *recognition* the directive is: select the one you recognize. If people are asked, for example, to tell which of two cities – say New York or Luzern – is bigger, their

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<sup>3</sup> I will use the code 'WL' to refer to Bolzano's *Theory of Science (Wissenschaftslehre)*. There are two partial English translations of the *Wissenschaftslehre*, both of them titled *Theory of Science* (1972. R. George (transl. and ed.). Berkeley & Los Angeles: University of California Press; 1973. J. Berg (transl. and ed.) Dordrecht & Boston: D. Reidel). Since a part of the passages I refer to are not translated in either of these books, I mention only the original *Wissenschaftslehre* (WL).

<sup>4</sup> Gigerenzer and Todd 1999.

decision usually draws on the name they recognize. Although this strategy is highly fallible, the success rate is surprisingly high, even in settings where the decision concerns investment policies. The expression "*satisficing*" – a neologism introduced by Herbert Simon – is used to denominate a strategy that is not striving to get the optimal solution, but, rather, a solution that *suffices* the intended goal in a *satisfying* way. An example for this strategy might be seen in the choice of a marriage mate: if Maria dreams of marrying George Clooney, she might never reach her goal of marriage. If she follows the strategy of satisficing, she will get married as soon as there is a suitable candidate who resembles George Clooney in a satisfying way. Satisficing is a stopping rule, a rule that prevents agents to get lost in infinitely complex hosts of possible options. In the practical domain, satisficing may well have contributed to the survival of our species; in the epistemic domain it is a strategy that frees reasoning from the hook of a regress into interminable quests for more and better grounds. Calling it a strategy does not imply that satisficing is deliberative thinking. Rather, it means that there are specific patterns determining which values and parameters to incorporate or to disregard in a decisional step. On the other hand, the term 'strategy' suggests that these patterns can be detected and spelled out as explicit rules. The power of strategies such as satisficing seems to lie, however, precisely in the fact that they best work on subliminal levels of mental activity. Satisficing is a strategy that subserves some of the epistemic directives that Bolzano framed in the Heuristics of his *Theory of Science*.

### 3. THE BOLZANIAN 'MIND': SOUL, SUBSTANCE AND FORCE

Let me first emphasize that in Bolzano's writings there is no clear cut distinction between the terms "soul" and "mind". One way to specify the two notions is to say that the soul is clearly characterized as being a substance, while *mind* – or, rather, the predicate *mental* – is used to denominate the main function of the soul, namely thinking.<sup>5</sup> This is not to say that the soul is nothing than a thinking thing, or that substances that are not souls do not have the ability to think. Bolzano defines substances as being simple enduring entities that have the force of representation. In Bolzano's use, the term "force of representation" subsumes under its umbrella notions for different and more specified faculties such as the "force of thinking", the "force of feeling", the "force of willing/wanting" and the "force of desiring".<sup>6</sup> This division corresponds to classical versions of faculty psychology such as Aristotle's functional division of the mind, still alive in the contemporary notions of cognitive, volitive, conative and

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<sup>5</sup> "Bolzano uses '*mind*' (or '*spirit*' [Geist]) to refer to souls that are rational" (Chisholm 1991, 208).

<sup>6</sup> Bolzano 1834, §75.2; Bolzano 1851, §51.

affective intentional modes. Although Bolzano in his logical writings uses the more specified notion of a representation as a non- or subpropositional part of a proposition, in his metaphysics and his epistemology "representation" is "the general name for an occurrence (*Erscheinung*) in our soul/mind (*Gemüt*)."<sup>7</sup> That these two uses of the expression "representation" are not unconnected is apparent in the fact that Bolzano in his "Theory of Elements" treats objective and subjective representations explicitly "in union", taking for granted that "both have the same rights to be accommodated in the teaching of logics".<sup>8</sup> Bolzano does not have an elaborated theory on the relations between representations generated by the "force of feeling" or the "force of desiring" and representations generated by the "force of thinking". His distinction between representations that are "intuitions" and representations that are "concepts" implies, however, that he adopts the idea of some kinds of thinking that are not conceptual. Bolzano's "intuitions" are defined as conceptually empty or "naked" representations that are directly caused by their object and determine their reference through the deixis of a demonstrative link. Since thinking – in a minimal sense – is the ability to produce simple representations, even the occurrence of non-conceptual representations can count as thinking.<sup>9</sup> Insofar, all substances are thinking things, since substances are defined as those simple things that have the force of representation.<sup>10</sup>

On the other hand, thinking seems to be the central function of those substances that are souls or minds. Since not all substances are souls or minds, we are confronted with a more restricted sense of "thinking" attributable to soul-substances only. Bolzano accounts for the soul in terms of a substance that is related to other substances in the specific way of "ruling" over them. In virtue of their intrinsic "forces of attraction", substances cluster into aggregates in which a certain substance can become the determining part, due to its stronger attraction forces. Such a determining or ruling substance within an aggregated complex of substances is called the "soul" of the complex, while the rest of the aggregate counts as its "body". As constituents of a body, the non-ruling body-substances are rather characterized by functions of "forces of locomotion" and "vital forces", while the soul-substance in its role as "ruler" takes

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<sup>7</sup> WL §48.3

<sup>8</sup> WL §48.1

<sup>9</sup> "Bolzano's use of the term 'Gedanke' is vastly different from Frege's. Bolzano applies it to mental events which are either judgments or subjective ideas" (Künne 1997, 207).

<sup>10</sup> "What is required, *logically*, if an individual thing is eligible to have a conscious property? And the answer is that very little is required [...]. It would be *logically* possible for a conscious property to be exemplified even if there were only one individual substance" (Chisholm 1991, 209f).

the function of the thinking part for the complex.<sup>11</sup> In this context, the term "thinking" is used in a richer sense, referring to the activities of producing simple and complex representations, as well as conclusive and non-conclusive judgments. In addition, a soul's function of thinking includes self-evaluative activities as exemplified in the cognitive meta-level attitudes of Bolzanian believing and knowing. Keeping in mind both this rich sense of thinking and the essentially relational nature of Bolzanian souls, we might define the soul in the following way:

- 1)  $x$  is a soul  $\iff x$  is the thinking thing  $S_i$  in a complex of substances  $C_S$  constituted by  $S_1, S_2, \dots S_i$ .

Given that 'thinking' means having representations and processing them in reasoning, this *definiens* of the concept 'soul' maps the conception of the mind in terms of representation and computation that is central in contemporary cognitive science. Paul Thagard, for instance, uses the shorthand notation CRUM (computational-representational understanding of mind) to express the view that thinking can best be understood in terms of representational structures and computational procedures that operate on those structures (Thagard 1998, 10).

Let me emphasize again that a substance  $S_i$  will be the dominant or the thinking part  $S_i$  in a complex of substances making up, for example, a human being, in virtue of this substance's relevantly stronger forces. In Bolzano's essentially monist understanding of body and soul, it is an important point that the notion of force accounts for the difference between soul-substances and body-substances. Accordingly, cognitive and epistemic achievements are accounted for mostly in processual terms that reflect this understanding of properties as dynamic and efficacious entities. Bolzano approaches the central elements of his epistemology under the aspect of activity, rather asking: *What is going on when agent A is judging that p?* than: *What is a judgment?* This way of proceeding aligns with the focus on processing and computing in contemporary cognitive science. It also aligns with claims in epistemology to focus more on valuable dynamics of knowledge acquisition than on mere static conceptions of justification. Such claims are pervasive, for instance, in Virtue Epistemology where deliberative and reflective processes are considered to convey epistemical value.<sup>12</sup> Bolzano's strong emphasis on the ethics of knowledge and virtuous

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<sup>11</sup> "The mental substances are identified with the ruling substances and the living substances with the organic wholes" (Berg 1976, 32 (*author's translation*)).

<sup>12</sup> "But there are other epistemic evaluations that are not static. We evaluate and regulate activities of inquiry and deliberation. I shall assume that inquiries (and deliberations) are goal-directed activities, attempts to find things out. These activities can be carried out well or poorly; and many important epistemic norms are concerned with

epistemic agency is not unconnected to his functional metaphysics of the mind, according to which different tasks of mental performance are accomplished by means of task-specific forces (faculties). Driving the necessary processes, these forces subserve an epistemically virtuous character in her striving to form beliefs that get the credentials for knowledge. Distinguishing a force of representing, a force of coming to know, a force of imagining, a force of remembering, a force of judging, a force of concluding (inferring) and many other related forces Bolzano draws near the assumption of an architectural modularity of the mind. A simple act of judging, for example, is supposed to involve at least three distinct forces:

- Imagining: brings about simple representations;
- Connecting: generates complex representations (non-propositional, propositional),<sup>13</sup>
- Asserting: enforces the assertion of the propositional complex.

A third feature that approaches Bolzano's account and contemporary prominent theories of mental achievement consists in the awareness that the limited resources of mental forces call for processing rules that combine the epistemically desirable with the cognitively feasible. This awareness we find expressed in Bolzano's discussion of heuristic principles that aligns well with a couple of results in "Simple Heuristics" on "fast and frugal" processes whose accuracy 'satisfices' epistemological desiderata.

Generally, we can say that Bolzano's metaphysical notion of mental forces relates the idea of specific task domains with the idea of processes determined by certain regularities and/or processing rules. Insofar, the metaphysics of mental forces and processing strongly calls for a reliabilist epistemology. The assumption that Bolzano's epistemology is essentially reliabilist is corroborated by the heuristic principles it defends. The strong rationalist *desideratum* Bolzano clings to makes his reliabilism take side with responsibilist versions of reliabilism that emphasize epistemic agency and responsibility. In my view, Bolzano's reliabilism incorporates the following level-properties:

- On the 'overt' epistemic level, heuristic principles *guide* the *acting* of epistemologically *responsible* agents (rational normativity);
- On a 'subliminal' epistemic level, simple heuristic rules *determine* the agents' *behavior*, warranting its adjustment to the system's resources;

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how we should carry out activities of this kind. How reflective should we be when we carry out inquiries and deliberations? What form should our monitoring reflections take? What role have the concepts of *knowledge* and *justification* in the ways in which we regulate our inquiries?" (Hookway 2003, 193f).

<sup>13</sup> Bolzano assumes the existence of some unnamed forces such as an "activity of our mind – namely connecting – that is essentially distinct from the one that generates any simple concept", which accounts for the producing of "complex concepts" (WL §287.8).

- On the physical level, these two-fold heuristics are realized in causal regularities.

In the following, I shall investigate some principles of Bolzano's Heuristics in order to support these assumptions.

#### 4. BOLZANO'S HEURISTICS AND RELIABILISM

Bolzano's epistemology is centered on the concepts of *judgment (Urteil)* and *cognition (Erkenntnis)* – corresponding to the contemporary labels *belief* and *true belief* – as well as on the concept of inference. The primary epistemic act is judging, that is asserting a given proposition, or, in Bolzano's terms, "taking it for true". Judging can be either "immediate" or "mediated" by other judgments in an inferential chain. "Believing" (*Glauben*) and "knowing" (*Wissen*), however, are terms that Bolzano applies to second-order states. Bolzanian believing and knowing are meta-attitudes taken by epistemic agents towards their own judgments (WL §321).<sup>14</sup> They are introduced as attitudes resulting from assessing the truth-conformity of one's judgments in terms of their fallibility value. While an "immediate" judgment is supposed to have fallibility 0 – or default infallibility – the fallibility of inferred judgments depends on the way they were inferred. If the inference was a "perfect deduction", starting from correct assertions and following deductive rules properly, the resulting judgment is taken to be infallible. If, on the other hand, there is uncertainty concerning the correctness of the premises asserted or proper rule following, the inferred judgment is taken to be fallible.<sup>15</sup> Consequently, the reflexive attitude towards such a judgment is Bolzanian believing, while Bolzanian knowing reflects the assessment of one's judgment as infallible:

- 2) *A knows that q* iff A asserts *q* & A *truly evaluates* her asserting *q* as *infallible*.
- 3) *A believes that q* iff A asserts *q* & A *evaluates* her asserting *q* as *fallible*.

In this perspective, it seems as if the assessment of truth-conformity in one's judgments were driven by reasons of justification only. This is not the case, at least not in Bolzano's approach that takes the desire for insight, understanding and explanation to be the engine of one's search for an assertion's objective grounds. The aim to increase knowledge widens the scope

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<sup>14</sup> "Some philosophers [...] may hold that 'knows' is a very specialized term of epistemic appraisal, with a role, perhaps, in identifying informants or reliable sources of testimony" (Hookway 2003, 201).

<sup>15</sup> Bolzano defines doubt in terms of degrees of probability of confidence, and confidence as indicating either immediacy of judgment or the truth-probability of a conclusive proposition [*q*] in relation to a set of premises.

of justification into the scope of searching for the objective grounds of the propositions asserted. It is this explanatory endeavor that plays the constitutive role in Bolzano's conception of knowledge, and it is this explanatory endeavor that requires methods that cannot warrant infallibility. The epistemic principles set out in the "Heuristics" section of the *Theory of Science* include inductive and abductive reasoning, both being roads to knowledge that are considered "inverted" – compared to the "natural" road of proper deduction – and "amiss" in that they involve "haphazardness" and the favors of "serendipity" (WL §330). But Bolzano is confident that the potential of fallibility inherent in our methods of explanation will not actualize into a substantial faultiness of judging or impossibility of knowledge. If an agent's superior aim is to achieve truth-conformity, this aim will motivate her to assume her epistemic responsibilities and to cultivate the virtues required to achieve the best available results.

Bolzano's epistemology and heuristic is pragmatic insofar as it never loses sight of the fact that epistemic agents are embodied minds, bounded by their natural resources. If "ascending to the grounds" of a given  $[q]$  is striving for its best explanation among possible competing options, this task requires abilities such as inventive talent, delight in exploration, patience, perseverance, humility and so on, that reach beyond the steadiness of strictly applying logical rules. These epistemic virtues are faculties by means of which actual epistemic agents assume their epistemic responsibility in 'real time' conditions, in a 'controlled crushing' of the rational ideal of knowledge to adapt it to epistemic reality. "Heuristics" provides a collection of rules for one's "behavior in thinking", amongst which figures, for example, the principle of "*tentative supposition*" also called the "indirect method" (rule no. 5, WL §329). This rule resumes the hypothetical method of "attempting to find truths by means of something that is not yet known to be true" (WL §329.1). Due to the involvement of the unknown in the process of explaining and coming to know a given  $[q]$ , the hypothetical method seems "artificial" and "inverted" or "indirect", compared to the "natural" method of deducing truth from known truths. Nevertheless, given the poverty of the natural method with regard to knowledge extension, epistemic virtue requires resorting to the hypothetical method, although it is "amiss" in that it involves "haphazard" and the favors of "serendipity". Successfully extending knowledge depends on mastering the art of combining "natural" and "inverted" methods in a maximally rewarding way, an art that is highly determined by epistemic skills and virtues. Bolzano emphasizes that the faultiness inherent in the application of the hypothetical method is minimized when tentative suppositions are chosen "with proper skillfulness" and their examination is performed "in all ways available to us" (WL §329.2). Epistemic skillfulness manifests in an agent's selecting propositions that are potentially expedient

as hypothetical grounds for a given statement. "Proper skills" for this task may evaluate the probability of the candidate propositions, their simplicity or their convenience for experiments with regard to the statement to be founded and the circumstances of investigation. Within the set of selected propositions, they can further establish a hierarchy that determines the order of examination (WL §329.3). The soundness of the potential *explanans* might be examined progressively by checking the truth-values of propositions entailed by it, or again regressively by applying the hypothetical method to the hypothetical grounds themselves. For general statements, induction is another appropriate method of examination that implies various epistemic and experiential skills (WL §329.8). Sometimes, so Bolzano claims, it may even suffice to "think" the proposition to be examined "as clearly as possible", including representing it "in words or signs of another kind". This may lead us to "see" its evidence or to remember other occasions when we already considered its truth or falsity. Bolzano does not exclude subjective evidence as a relevant factor for truth-conduciveness, but he shows that epistemically virtuous agents will not unconditionally rely upon it.

It is clear that the successful application of the skills mentioned draws on processes and mechanisms that are not subject to willful control and, therefore, do not properly fall in the scope of agentive responsibility. It seems, however, plausible to assume that such processes and mechanisms are not unrelated to certain normative attitudes an agent holds. Consider, for example, stopping rules such as they are exemplified in the "satisficing" strategies revealed in Simple Heuristics research. Generally, rules of this kind operate on subliminal levels of an agent's mind. They are not explicit directives of epistemic acting, although they can be spelled out and used as explicit directives. Agents might be surprised to learn that they acted on these principles when they came to believe a certain  $[q]$ . Within a merely process reliabilist epistemology, however, such agents could be properly said to know  $[q]$ , since their belief was produced by a sufficiently reliable process. In contrast, responsibilist reliabilism defends the rationalist claim according to which attributions of knowledge require the subject of knowledge to be an agent, presupposing that she is aware of her practicing epistemic activity and consciously following patterns and rules directing such activities. In this perspective, success and failures to achieve the goal of knowledge are not simply due to the external fact that certain mechanisms functioned well or broke down and disturbed the reliability of the processes liable for knowledge achievement. Rather, achievement of knowledge as well as shortcomings with regard to this aim focus on the agentive responsibility to use epistemic skills properly, that is in accordance with rational norms and rules. Therefore, the relation between agent responsibility and the reliability of knowledge-

conducive processes is accounted for in terms of motivational force. Consider, for example, the following account:

Epistemic behavior motivated by the motive for truth has value in addition to the value of the truth that is thereby attained. Success in reaching truth [...] is not guaranteed [...], but I assume that when it *is* attained, the behavior that is successful in attaining it gains value that it would not otherwise have. [...] Reliabilists are right to focus on reliability as a critical feature of the relation between believers and truth, but they are wrong if they think it is constitutive of that relation. [...] If I am right that the value of knowledge in addition to truth is that the truth is reached *because* of the motive for truth and reliable cognitive behavior, then there is a definitional connection between the two values as well (Zagzebski 2000, 120f).

Similar ideas on how to relate process reliabilist considerations with the rationalist intuition that agentive responsibility is constitutive to knowledge are found in John Greco's account of knowledge as "credit for true belief" (Greco 2003). What seems important in these accounts is that they meet the intuition that sound rational requirements for knowledge need to be reconciled with the kind of rationality proper to those epistemic agents we are acquainted with: human beings. In this respect it is worth noting that Bolzano's metaphysical claims are bound to conceptual rigidity. Substances and their faculties are subject to identical constraints in all possible worlds. There is no world conceivable in which a soul- or mind-substance could overstep its natural boundaries. Any conception of differently natured minds must clash with the concept of substances and their forces, and is, therefore, not about real entities.<sup>16</sup>

Within the frame of a naturalized conception of the mind, natural mechanisms and processes must play a decisive role in epistemic achievement. On the other hand, rationality requires accounting for knowledge in terms of justification and explanation; both of them are bound to be operated according to logical and semantic laws. Bolzano's heuristic rules attempt to point out the way in which agents 'translate' the normative requirements of rationality into viable pragmatics, making use of the resources available in the processing system upon which their rationality relies. Applying heuristic principles as epistemic guidelines involves various decisions that seem to evoke regress problems: In order to decide which supposition is worth being considered, or on whose judgments one should rely or in what circumstances experience may provide valuable reasons, more and finer grained rules and principles are needed. This conflates the epistemic task in a way that cannot be managed at the overt level of an agent's awareness. Consider, for

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<sup>16</sup> An exception might be seen in what Bolzano calls the "unconditional substance", God. Epistemically, the unconditional substance has the advantage of unlimited storing capacities for propositions and is not subject to time and urgency constraints. The unconditional substance is the ideal rational agent in that it not only knows all truths immediately, but also has the ability of indicating their grounds in ideally desirable completeness. The question is whether the notion of an unconditional substance is a coherent notion.

example, the rule stating that judgments shall be tested only in cases in which "we see that a test is possible without assuming propositions that have less reliability than they have themselves". If the latter is the case, we could at best corroborate the tested judgment but not refute it. Hence, if its eligible reasons are only less reliable propositions, we can "confidently desist from such testing" (WL §332.7). This rule strongly relies on features of the logical relations between propositions, famously laid open in the Bolzanian conceptions of "probability", "deducibility", and "ground-consequence".<sup>17</sup> From a logical or ideally rational point of view it is obvious that a proposition  $[q]$  whose probability is  $P < 1$  cannot gain a higher probability if the proof for  $[q]$  consists in propositions whose probability is  $P' < P$ . The question is how we can "see" the degrees of propositional probability that are relevant in the circumstances of reasoning. Admittedly, in many cases, evaluation of higher or lesser probability will be a matter of estimation and depend on decisions that manifest an agent's experience. Following the rules commanded by rationality involves specific evaluative agentive faculties, comparable to those by which artists apply the appropriate brushstroke or fit in the right word, or those by which wise people are aware of where to initiate or to stop certain efforts. Demonstrating such faculties rather belongs to the domain of habitual behavior than to the domain of willful action. It is typical for this kind of behavior that it cannot be explained by indicating the criteria in virtue of which the decision was reached, although it bears on reliable mechanisms and is successful in achieving the intended aim.

On the overt level of their epistemic activity responsible agents attempt to apply rules and principles commanded by laws of logics and rationality. In doing this, they use methods and skills instructed by their epistemic experience. These methods and skills are operational mainly on a subliminal level of their mental life. Responsibilist reliabilism claims that epistemic agents commission, so to say, their computational and creative resources in order to assume their responsibility towards rationality. Their endeavor in the pursuit of this aim and their diligence to apply their skills in the best possible way entitles them to regard their asserted beliefs as knowledge.<sup>18</sup> The added value of knowledge over true belief does not rest, in the first place, on the reliability of the truth-conducive processes but on the satisfaction of the agent's motivation to use them in a responsible way that is committed to the values of

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<sup>17</sup> For details on these relations see Sebestik 1992; 1999, Siebel 1996, Tatzel 2002.

<sup>18</sup> "How observant I am will influence whether relevant evidence grabs my attention; and how intellectually honest I am will influence whether I generally come to doubt propositions once presented with sufficient counter-evidence to them. [...] If we possess virtue, and we are confident that we possess virtue, the fact that various reflective questions are not raised can be seen as a symptom of our rationality rather than as a sign of our reluctance to do what epistemic responsibility requires" (Hookway 2003, 200f).

truth and goodness. If her love of truth motivates an agent to resort to her best means to reach the aim of judgments conforming to truth, it will explain why her judgments are produced by reliable processes and give them the commendation of knowledge.

Bolzano's epistemology spans the space between his logics and his metaphysics of the mind, reconciling rational requirements with the demands of physically constituted natural minds. His notion of knowledge allows for ways of evaluating truth-conduciveness that overcome the problem of regress of justificatory belief without resorting, however, to a category of foundational belief. An important category with respect to valuable epistemic evaluation is affectivity. Bolzano defends the idea of a "feeling for truth" and he claims that the concept of such a feeling is "indispensable for logic and many another science" (WL §316, Note 1). Moreover, he bestows trust and trustworthiness a most prominent place, when he not only develops a notion of "confidence" (*Zuversicht*) to distinguish a relational property of subjective propositions, but also encourages epistemic agents to trust their own epistemic faculties and those of others. It is not surprising, then, that consulting the judgments of others as well as experience figures in his "Heuristics" as rule no. 7 (WL §331). Heuristic rule no. 7 suggests that an important factor in making proper decisions regarding the ways and length of explanatory investigation is the experience from shared epistemic practices. Under the concept of "common sense" (*gemeiner Menschenverstand*), Bolzano subsumes performances of consensus and common semiotic systems that bottom out in trustworthy evaluations of judgments and explanations. One manifestation of "common sense" is consensus, considered by Bolzano as "a particular indicator of a judgment's truth", especially when "the proposition itself is not doubted in spite of dissent about its ground" (WL §315.6). The claim that a consensual assertion "*q!*" indicates its truth-conformity is admittedly pregnant in those cases where the reasons given for an assertion are not only different but conflicting. Cases of convergence in judgment in spite of diverging reasons seem to be paradigmatic for the need to search for the best explanation of the asserted truth. Insofar, reliance on consensus is not just the naïve "faith of optimists" or the contingent "fashion" of a "party spirit". Rather, Bolzano's inclusion of consensus in matters of epistemic evaluation and warrant seems to employ ideas that are similar to those worked out in the Lehrer-Wagner model of consensual trust, which depicts a structure of mutual trust and trustworthiness. In Keith Lehrer's approach to trust, the interrelations between trustworthiness, self-trust and mutual trust are supposed to play a

keystone role in accounting for reason and its involvement of individual and collective factors, as well as for epistemological concerns.<sup>19</sup>

Investigating Bolzano's epistemology and Heuristics, we will not find a precept for a hierarchal order of truth-conducive methods. Rather, there is strong emphasis that we should never insist on having infallible access to knowledge, counterbalanced by the equally strong emphasis that we have excellent reasons to trust our epistemic evaluations. That the weights of both these beams properly adjust is due to the pivot of the desire or love of truth on which they turn. If this value-directed attitude is missing, epistemically relevant processes are not backed by a motivation that guarantees the agentive responsibility appropriate to reason. The frame of Bolzano's logic and naturalist metaphysics of the mind allows – or even presupposes – that processes on a subliminal epistemic level essentially contribute to satisfying the rationality constraints of knowledge. They warrant, on the one hand, the rationality of the decisions taken in the ascending procedure, and, on the other hand, the adjustment of the procedure to the system's resources.

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<sup>19</sup> Lehrer 2001; 1997 (see chapters 1, 3, 6).

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