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SCIENTIFIC CONTRIBUTION

Reflection in medical education: intellectual humility, discovery, and know-how

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Abstract
Reflection has been proclaimed as a means to help physicians deal with medicine's inherent complexity and remedy many of the shortcomings of medical education. Yet, there is little agreement on the nature of reflection nor on how it should be taught and practiced. Emerging neuroscientific concepts suggest that human thought processes are largely nonconscious, in part inaccessible to introspection. Our knowledge of the world is fraught with uncertainty, ignorance and indeterminacy, and influenced by emotion, biases and illusions, including the illusion of not having illusions. Neuroscience also documents that lifelong learning processes may hone nonconscious cognition to high levels of sophistication, allowing rapid and precise perceptions, judgments and actions in complex situations. We argue that knowledge of mechanisms underlying human thought may be useful in designing educational programs to foster desired attributes such as curiosity, critical self-awareness and intuitive acumen in medical professionals. The juxtaposition of neuroscientific insights with ideas from Kant on reflective judgement, van Manen on tact, and Aristotle on phronésis, supports a concept of reflection that manifests as wise practice. We suggest that reflection in medical education should be (a) an imperative for educators seeking to guide learners to manage the complexity and "messiness" of medical practice, and (b) a role-modelling mode of medical practice characterized by self-correcting behaviors that culminate in good and right professional actions. An example illustrates reflective practice in the teaching and learning of physicianship.

Keywords Reflection · Nonconscious · Phronesis · Learning · Medical education · Early clinical contact · Clinical teaching · Medical philosophy · Illusions · Biases

Introduction

The goal of medical education is to help learners become capable professionals by helping them acquire and develop the knowledge and skills, as well as the attitudes, moral stances and habits of thought and behavior necessary for the healing professions. Medical teachers must prepare and equip their learners to determine and deploy the "good and right medical actions" that embody medicine's fundamental ethos (Pellegrino and Thomasma 1981). In the words of sociologist Merton et al. (1957, p. 7), when referring to the function of medical schools: "It is their task to shape the novice into the effective practitioner of medicine, to give him the best available knowledge and skills, and to provide him with a professional identity so that he comes to think, act, and feel like a physician."

It is widely accepted that the educational process is, in essence, one of personal development. Philosopher John Dewey proposed the following technical definition of education: "It is that reconstruction or reorganization of experience which adds to the meaning of experience, and which increases ability to direct the course of subsequent experience" (Dewey 1922, p. 89–90). How a person experiences events and environments is shaped by, and then shapes, character and personality. Paul Hirst and Richard Peters underline this formative dimension by stating that the general aim of education is "to promote desirable traits of a person,

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[involving] depth and breadth of understanding" (Hirst and Peters 1970, p. 26).

All teachers, including those in the medical field, operate on the belief that there are various categories of knowledge applicable to their practices. A classification of forms of knowledge, based in part on the work of philosophers Gilbert Ryle (1945) and Phenix (1964) has been analyzed and discussed by P.H. Hirst. He refers to: (i) knowledge of objects; (ii) knowledge as expressed in a statement with a proposition (i.e. 'knowledge-that'); (iii) knowledge of how or when to do things (i.e. 'knowledge-how'), and; (iv) existential knowledge. The second and third are also referred to, respectively, as declarative knowledge and procedural knowledge, while the fourth is a "form of experience which is not itself expressible in statements or propositions" but refers to personal dispositions such as an openness and sensitivity to reverence, aesthetic beauty, and humility (Hirst 1974, p. 57).

The dominant traditions of constructing and teaching medical knowledge are, notwithstanding their evident achievements, constrained in ways that can pose threats to the welfare of patients, learners, professionals, and society. This is evidenced by the prevalence of medical errors (Makary and Daniel 2016), decontextualized care (Weiner and Schwartz 2016), over-diagnosis (Moynihan et al. 2012), physicians' neglect of existential needs (Agledahl et al. 2011), medical students' suppression of emotion (Grochowski et al. 2014; Shapiro 2013), mental health problems and loss of empathy (Dyrbye and Shanafelt 2016; Rotenstein et al. 2016). The dominant medical epistemology and teaching methods have been frequently criticized (Hodges 2006; Cooke et al. 2010; van der Vleuten and Driessen 2014). We believe that many of these flaws are rooted in biomedicine's historical development in the nineteenth century, when it quite successfully began to adopt the mindsets of experimental science. That meant embracing contentious philosophical assumptions about human nature inherent in the modernist tradition, including a dualism that posits mind and body as belonging to different realms, the somatic and the psychic. Another assumption holds that humans can know their own minds, motives and reasons, and act sensibly, particularly when emotions are kept in check. Third, the scientific worldview is based on reductionism, the assumption that the body can be best understood by studying its most basic constituents. Reductionism diverts medicine's intellectual attention from wholes to parts, while dualism leads physicians to view disease and treatment as unrelated to the subjective characteristics of the sick person's lived life. 'Knowledge' in medical education is generally viewed as awareness and possession of objective facts—disembodied, universal, declarative and testable, independent of the persons of the physician, the learner and the teacher, and uninfluenced by the features of the knower (Benozzo and Colley 2012; Strand 2002). The quintessential paradigm of biomedicine has become one of an idealized knowledge that treats depersonalized disease. Consequently, the goal of education becomes to furnish learners with declarative biomedical knowledge, while disregarding the sources of knowledge and learning that inhere in the individual life-world perspectives of patient, student and teacher (Walseth and Schei 2011). The transformative potential of education is overlooked, and insufficient attention is given to how students and physicians learn to perceive, think and act as they develop professional identities by adapting to modelled behaviors and the perceived rewards and penalties of their learning environments (Cruess et al. 2015; Hafferty 2016, 1988a, b).

Despite shortcomings, contemporary medicine is more than ever able to improve the health of individuals and populations, which in turn reinforces the complex challenges connected with old age, chronic disease, multimorbidity, cost containment, et cetera. In this manuscript, we discuss how medical education and learning can be further improved, through increased awareness of how professionals think, learn, and learn to think. In line with others, we believe that reflection, understood as conscious and nonconscious cognitive skills and aptitudes, is of particular importance. Juxtaposing philosophical perspectives on wise judgment with current neuroscientific evidence concerning nonconscious cognition, we outline how medical education may increase awareness of the fallibility of perception and judgment, while strengthening the humility, curiosity and self-correcting intellectual and emotional dispositions needed to deal productively with uncertainty and unpredictability, flourish in complex professional environments, and even achieve clinical wisdom (Bangen et al. 2013).

We make the following arguments:

- Reflection is expressed in complex self-correcting patterns of adaptive behaviours which emerge from cognitions, conscious and nonconscious.
- Reflective competence accrues through experience, practice, dialogical feedback, and role modelling, and manifests as intellectual humility, discovery and know-how.
- Reflection is difficult to learn, partly because of resistance stemming from nonconscious illusions, biases and emotional barriers to change, that are hardwired in human brains and engrained in language and social norms.
- Reflective education can foster development of a clinical practice characterized by valid perceptions, sound judgments, and effective actions in complex, fluid, relational contexts.

- Technology, check lists and control systems are materialized instantiations of self-corrective cognition, and may be seen as *reified*[1] *reflections*.
- Acquiring a theoretical understanding of reflection is important for educators but is not a precondition for reflective practice itself.

An example of reflection is the experienced clinician's practice of *listening*—characterized by nonconscious linguistic, nonverbal, and relational skills, and the ability to learn, improvise and modify goals and approaches as the dialogue uncovers new aspects and provisional understandings of the patient's story, the medical problem, the patient, the clinician and the conversation itself. An example of a different order is the use of checklists in surgery; in this situation the lists represent a reified acknowledgement of fallibility and a surrogate for self-correcting 'know-how'.

Reflection in medical education, an ongoing debate

The term 'reflection' is frequently used to denote higher order mental processes that can be fostered to result in good professional judgments, competent action, and fewer mistakes and omissions (Dewey 1933; Brookfield 1992; Sandars 2009). How it is learned and developed and how it should be enacted in medical education and clinical practice is unclear and often debated (Mann et al. 2009; Ng et al. 2015; Nguyen et al. 2014). On the one hand, reductionist misconceptions of reflection have been blamed for "poor educational practice" including recipe following and reflection without authentic learning (Boud and Walker 1998; Ng et al. 2015). Ng et al. point out that reflection, as a new trend in medical education, is liable to be subsumed under the dominant reductionist view of teaching as knowledge transmission, whereby it becomes memorization and calculation (Ng et al. 2015). Assessment and criteria-based uses of reflection can accentuate this effect (Hodges 2015). Uncritical use of educational measures called 'reflection' has been described as "a kind of generic salve to heal all wounds: reflection is taken up to address burnout, professionalism lapses, empathy, cultural competence, well-being, diagnostic decision making, medical error, interprofessionalism, lifelong learning, tolerance of ambiguity and *on and on*"(Hodges 2015). Both these conceptions, reflection narrowly defined as a measurable behavior or a 'competency' and reflection as a comprehensive cure-all thoughtfulness, are off the mark.

Attempts to 'rescue' reflection in medical education are developing along two contrasting lines of reasoning. The first aims to operationalize the concept, initially by developing a clear definition. Quoc Nguyen (Nguyen et al. 2014) carried out a thematic analysis of the most cited literature on reflection in medical education, including Dewey's influential characterization of reflection as "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends" (Dewey 1933). The resulting definition states that reflection is a specific form of thinking, characterized by the following attributes: "Reflection is the process of engaging the self in attentive, critical, exploratory and iterative interactions with one's thoughts and actions, and their underlying conceptual frame, with a view to changing them and with a view on the change itself" (Nguyen et al. 2014). The authors emphasize that reflection is a kind of thinking that doesn't simply try to solve problems but one that also looks critically at the pre-reflective understanding revealed by the problem, the "underlying conceptual frame". The article does not discuss how the process of engaging in reflection is framed and influenced by elements of the wider educational setting, such as exams, teachers, peers, societal conditions, or the epistemological assumptions of the dominant biomedical discourse. Nor does it attend to the roles of emotion and character in reflection. In contrast, Dewey underscored the importance of wholeheartedness, directness, open-mindedness, responsibility, and courage as pre-conditions for reflection to flourish, and wrote: "Human beings are not normally divided into two parts. … There is no integration of character and mind unless there is fusion of the intellectual and the emotional, of meaning and value, of fact and imaginative running beyond fact into the realm of desired possibilities" (Dewey 1933). We believe, based on neuroscientific findings presented in this article, that Nguyen et al. overestimate the part conscious thinking plays in judgment and underestimate the inherent difficulties of understanding and correcting one's understanding (Nguyen et al. 2014).

A contrasting view of reflection in medical education has been put forward by Stella Ng and colleagues (Ng et al. 2015). They state that "the philosophical roots of reflection allow us to argue that it is fundamentally meant to exist in indeterminate spaces and not to be subject to quantifying measures". Reductionist approaches to reflection may cause strategic 'pseudo-reflection' among students as they prepare themselves for teacher assessments of their reflective abilities. Ng et al. claim that reflection denotes not so much a skill set as a theoretical approach, "a way of being and seeing", a moral and curiosity-driven engagement with the uncertainties and hidden assumptions of clinical practice, and an awareness of discursive power in medical thought and decision-making.

We hope to contribute to theory development by outlining a perspective on 'reflection' and how it can be learned that is philosophically tenable, educationally

[1] Reify: From Latin res—"thing". Make more concrete, turn a meaning into a thing, a word, a tool, a procedure, etc. (Wenger 1998).

practicable, and sufficiently flexible to accommodate valuable insights and aspirations contained in the apparently contradictory perspectives outlined above, while providing new ideas for educators to consider. We suggest that theory from evolutionary science (Sterelny 2011), psychology (Kahneman 2011) and neuroscience (Nørretranders 1998; Eagleman 2011) can support and expand an understanding of reflection contained in philosopher Immanuel Kant's notion of *"reflektierende Urteilskraft"* (reflective judgment) (Procee 2006), educationalist Max van Manen's *tact* (van Manen 1995), and Aristotle's *phronésis* (Kemmis 2012; Dunne 2001).

Integrating neuroscience, cognitive psychology and philosophy

In this paper we juxtapose neuroscientific constructs of nonconscious human cognition with philosophical precepts suggesting that the most advanced of human capacities are constituted by kinds of knowledge that are tacit, embodied, and largely learned in and expressed through experience and practice. Why combine neuroscience and philosophy in a quest to clarify reflection in medical education? We do so, in part, from a realization that medical education is notoriously resistant to change (Cooke et al. 2010; Frenk et al. 2010) and that many medical teachers, steeped in the traditional mechanistic worldview, are likely to be unimpressed by abstract philosophical arguments. Empirical neuroscientific evidence is consonant with the dominant biomedical paradigm and stands a greater chance of influencing thinking and practice. Neuroscientific research undergirds philosophies of practice with evidence that our central nervous system is hardwired for extremely intricate processing operating below awareness: memory construction, automation of complex skills, patterns of perceiving, judging, feeling, and behaving (Nørretranders 1998; Dehaene 2014; Katherine 2014; Hogarth 2001). We illustrate the latter by inviting the reader to imagine a teacher driving fast on unfamiliar roads, all the while engaged with a colleague in describing an educational innovation in convincing detail through the creative manipulation of metaphors and flawless use of symbolic sounds and gestures that constitute one's mother tongue. Neuroscience also teaches that our perceptions are fraught with biases, and that emotion and cognition are tightly interwoven (Benozzo and Colley 2012; LeBlanc et al. 2015). This highlights the need for educational institutions to support and motivate learners as they struggle to develop the strength of character required to regard the conjectures of their minds with intellectual humility, to admit fallibility, and to be open to unexpected discovery and learning (Kahneman 2011).

Knowledge as guesswork and adaptation

Knowledge emerges from the constant guesswork about reality that allows living beings, including physicians and teachers, to survive and thrive by making sense of their total environment (Evans 2008). Knowledge, technology and normative practices have value to the extent that they optimize the "fit" between practitioners' actions and the demands of their environments, as demonstrated in the ability to identify and solve relevant problems. The idea of knowledge as *fit to the environment* encourages intellectual humility. The meanings we make may, to some extent, serve us in our attempts to live good lives and as such have a predictive correspondence with the real world of which we are part. But the unavoidable imperfection of the fit creates risk, uncertainty, ignorance, and indeterminacy (Strand et al. 2010) that accompany all knowledge. To examine the "fit" of medical orthodoxy in real-life examples and to search for improvements would exemplify a reflective practice——one through which new and better understandings of the complexity inherent in goal-setting, problem-solving and decision-making, could emerge. Intellectual humility can be understood as the critical thought processes and emotional attunement that allow us to accept uncertainty as natural, acknowledge our fallibility and constantly question and revise our understanding and actions, so as to discover unexplored potentials, and avoid the illusion of control and the pitfalls of hubris.

When knowing is unknown to the knower

Knowledge, understood as fit to the environment, is not a library of facts but rather "a matter of competence with respect to valued enterprises" (Wenger 1998, p. 4). The embodied knowledge of habits, language, emotions, rote manual skills, identity, and character, is manifested in concrete practices (Eagleman 2011; Wenger 1998; Ryle 1945). These ways of knowing, that allow us through lifelong learning processes to lead a normal life and to be professionals, consist largely of nonconscious cognitions, i.e. mental operations "at a level of neuronal processing inaccessible to the modes of awareness but nevertheless performing functions essential to consciousness" (Katherine 2016).

Modernity was founded on the Enlightenment assumptions that man is rational and can know his own motives though introspection whereas emotion is "irrational" and needs to be subdued. In the early twentieth century, Freud shook the world by introducing the notion of the unconscious to the general culture, spreading the idea that psychological drives, moulded by early experiences, can govern behavior without the subject having any awareness of being driven. The insight that behavior, thought and emotion are largely the products of unconscious processes has been empirically confirmed. In their 1977 article, *Telling more than*

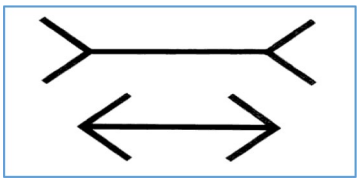

Fig. 1 The Müller-Lyer illusion

we can know: Verbal reports on mental processes, Richard Nisbett and Timothy Wilson stated that people have "little or no direct introspective access to higher order cognitive processes". Humans cannot fully access their own thought processes; instead their reports are based to a great extent "on a priori, implicit causal theories, or judgments about the extent to which a particular stimulus is a plausible cause of a given response" (Nisbett and Wilson 1977). Guessing about the nature and quality of our own motives and insights may contribute to illusory understandings. In a review, Evans asserts that "unconscious processes may control our behavior without us being aware of them doing so", and that "conscious reasoning … is often used for the confabulation of explanations for these behaviors" (Evans 2008). Confabulations are automatic mental processes, "cover stories" that make us believe that we know ourselves, our motives, and the stimuli to which we react. The confabulatory ability of the brain induces an experience of having no illusions, of seeing things as they really are (Eagleman 2011, p. 65). As noted in 1865 by the founding father of the experimental method in science, Claude Bernard: "Man is by nature metaphysical and proud. He has gone so far as to think that the idealistic creations of his mind represent reality" (Bernard 1865/1957, p. 57). Daniel Kahneman writes that our ability to quickly assess and categorize information is "a machine for jumping to conclusions" whose operative features "give rise to predictable biases and to cognitive illusions, such as anchoring, non-regressive predictions, overconfidence, and numerous others" (Kahneman 2011, p. 417). We get no warning signal when our judgment is unreliable. Some of the mechanisms that produce illusions are hardwired in the brain. A famous example is the Müller-Lyer illusion (Fig. 1). Even if we know that the horizontal lines are equally long we cannot train our brain to see it. Of greater consequence are cognitive illusions, such as our inability to correctly judge probabilities; these are generally more difficult to recognize than perceptual ones (Kahneman 2011, p. 417).

The fallibility of human thought is partly a consequence of the narrow "bandwidth" of conscious awareness. We can keep only 7–9 objects in our awareness at the same time (Nørretranders 1998). Contiguous to the field of active awareness, however, is a much larger *unconscious*[2] field that can be accessed smoothly if the need arises, as for example when someone says "Eiffel tower" or an unexpected event occurs on the road (Katherine 2014; Eagleman 2011). But the greater part of our functioning is sustained by *nonconscious* brain functions, processing a million times more bits of information per unit of time than does conscious thinking (Katherine 2016; Eagleman 2011; Nørretranders 1998). If we compare nonconscious brain activity to a tower, a kilometer high, the conscious mind represents merely a bump of a millimeter. The kilometer allows us to recognize a familiar face among millions of strangers, to think, to walk, to identify a heart murmur, to know from her voice in the telephone how Mom is doing today, to inspire a group of students, or to gain the trust of a deeply disturbed patient (Malterud 1995). We cannot readily explain how we do this, nor teach it through verbal instruction, and we can do it without knowing that or how we do it; hence it is called *tacit* knowledge (Johannessen 1992). The kilometer of nonconscious processes is able to recognize patterns too complex and subtle for the conscious millimeter to discern, to process information much faster than can the conscious mind, and to draw inferences that influence our moods and feelings, which are again interpreted by other parts of the neural circuitry that inform our behavior and help determine priorities and choices (Katherine 2016; Damasio 1999; Dehaene 2014).

The tacit and habituated character of the processes and products of meaning-making, learning and adaptation to any given environment, manifesting as gradually improving and expanding 'know-how', conceals the slow, complex changes in our individual perceptions, outlook and character that result from long-term educational experiences (Hafferty 2016; Hafler et al. 2011; Schei et al. 2018). A goal of education should be to cultivate the enormous cognitive capacity of the nonconscious kilometer through practices that support the habituation of critical and self-correcting patterns of adaptive behaviours. Pari passu, education must also endeavor to train the conscious millimeter to be critically aware of its limited ability to control learning, skills, habits, emotions, stereotypes, biases and illusions. Dewey cautions us to beware of the "fixity of habit"—of intellectual inertia and "habits which put an end to plasticity." Such habits of mind would represent a failure of education as a process of "continual reorganizing, reconstructing, and transforming" (Dewey 1922, p. 57–59). For Dewey, these failed experiences "are experiences of beginnings and cessations, but no genuine initiations and concludings" (Dewey as cited by

[2] In this paper we adhere to a nomenclature where «unconscious» designates accessible knowledge that is outside of current awareness, while "nonconscious" is an overarching concept designating both the unconscious and the deeper, largely inaccessible, cognitive mechanisms that underpin and constitute meaning-making and behavior.

(Higgins 2011, p. 125)). We suggest that they originate from a non-reflective stance.

Maintaining a curious and constructive acknowledgement of the inherent unreliability of human cognition, including one's own, is thus central to a reflective competence. Sophisticated understanding of cognition's weak spots does not, however, in itself make a good practitioner. Norman et al. have reviewed several studies that attempt to reduce diagnostic error by teaching physicians to name and identify biases (Norman et al. 2017); they show minimal effect.

There are, however, endless possibilities for change, correction and increased insight that make it possible for a person, in the right circumstances, to become able, virtuous, and even wise (Hogarth 2001; Dunne 2001).

Reflection—philosophical perspectives

What is the difference between a professional who demonstrates reflection in practice, and one who doesn't? For Kant, reflection is a faculty of mind that allows one to deal with concrete problems. A helpful illustration is the game of chess. Without grasping its rules, one would be unable to play chess at all. But learning to make a good move, rather than simply an allowed move, requires "a deep and finely tuned interpretation of the situation at hand", an aptitude learned in practice, by trial, error and feedback, through habituation and automation of patterns of perceiving and acting (Procee 2006). The ability to grasp the useful potentials in a concrete, particular situation, "without having at one's disposal a general concept or idea", is what Kant calls "reflektierende Urteilskraft", translated by Procee as "reflective judgment" (Procee 2006). "Urteilskraft" cannot be taught as theory. It is best inculcated through practice. We believe that 'reflective judgment' is a manifestation of refined nonconscious cognitions developed over a lifetime. Kant points out that even highly learned persons may be lacking in this, and hence display "stupidity", revealed as an inability to resolve real-life problems.

The pursuit of science is a medically pertinent illustration of Kant's idea. In medical education, science is often conceived as a world of facts and soluble "puzzles" (Atkinson 1984), due to a teaching tradition built on "learning strategies such as rote memorization that are inimical to scientific reasoning and inquiry" (Cooke et al. 2010). In reality, the practice of science is exploration of the uncertain and the unknown, its success depending on the scientists' *Urteilskraft*, i.e. his or her experience-based intuition, imagination and self-knowledge. Claude Bernard describes science as a practice, led by emotion and intellect, demanding a disciplined fight against illusions, biases and vanity: "In the search for truths by means of this method, feeling always takes the lead, it begets the a priori idea or intuition; reason or reasoning develops the idea and deduces its logical consequences. But, if feeling must be clarified by the light of reason, reason in turn must be guided by experiment" (Bernard 1865/1957, p. 58).

Kant's epistemology is mirrored by van Manen's concept of "tact" (van Manen 1995). "Tact" here denotes a particular kind of knowledge that allows expert teachers to act confidently in the continuously changing, unpredictable and fluid situations of a classroom, where the novice, despite advanced theoretical knowledge of pedagogy, often falls short: "What should one say in this situation? How does one enter a classroom? How does the teacher address the class? Which teaching techniques and what evaluation approaches are pedagogically more appropriate in particular circumstances? Should this difficult subject matter be taught? Should it be made easier? How easy? How much pressure is too much?" (van Manen 1995). In medicine, clinicians and teachers are similarly confronted with highly particular questions of how to act and what to say, in emotionally charged situations that lack ready-made solutions (Strand et al. 2004–2005; Croskerry et al. 2008; McWhinney 1989). Van Manen argues that Schön's theory of reflection-in-action (Schön 1983) cannot account for the fluid handling of such situations; it is too slow and cumbersome. This is also suggested by experienced physicians who demonstrate deterioration in their diagnostic performance when asked to slow down and think analytically (Pelaccia et al. 2011). Tact is, according to van Manen, neither theoretical insight nor purely practical (Smythe et al. 2014). Characteristic of this knowing is refined perceptiveness, insight, and feeling that are "instantly realized in a mode of acting that is tensed with a certain thoughtfulness or thinking attentiveness; tact could be defined as a thinkingly acting" (van Manen 1995). The description is consonant with the premise that the nonconscious possesses improvising, self-correcting cognitive abilities. Procee argues that van Manen's concept of *tact* parallels Kant's *Urteilskraft*, the reflective "faculty of mind" that allows the capable practitioner to make sense of complex, messy reality and deal with concrete and particular problems when rules are of little help (Procee 2006).

Long before Kant and van Manen, Aristotle described a similar kind of knowledge that develops and manifests through "right conduct". This knowledge, *phronésis*, the highest intellectual and moral virtue in Aristotle's teaching, is often translated as "practical wisdom". It is considered by many to be a hallmark of master clinicians (Fuks et al. 2012; Svenaeus 2003; Schei 2006). *Phronésis* is "more than what can be put into words, more than ideas"; it is not "in the heads" of practitioners, but may develop through experience "as a capacity to approach the unavoidable uncertainties of practice in a thoughtful and reflective way", writes Kemmis (Kemmis 2012). Aristotle's thinking suggests that the most advanced cognitive functioning is displayed in purposive behavior, and builds on nonconscious cognitions, learned

through guided practice in settings where role models provide examples and constructive dialogue. Kant, van Manen, and Aristotle point to practice itself as the locus of the most advanced reflective thinking, "practical wisdom", characterized by rapid, helpful and self-correcting perceptions, judgments and decisions in constantly changing contexts. Seeing all this through our neuroscientific lens, it seems that the conscious mind, the tiny "millimeter", monitors, adjudicates, and adjusts goals as a situation evolves and consequences become apparent, while the exceedingly complex nonconscious "kilometer" provides the perceptions, memories, language and motor skills, pleasures or dislikes, likelihood estimates, exemplar scenarios, micro-decisions, courage, patience and so on that allow the individual to be efficient, self-correcting, and flexibly adjusting to the situation. A challenge for higher education is to provide learning environments that facilitate the development of these capacities.

Teaching and learning reflective practice

How can medical educators catalyze and support the development of nonconscious capacities that can ultimately be expressed as heedful action—as *Urteilskraft, tact* and/or *phronésis*? Kant states that reflection "is a peculiar talent which can be practised only, and cannot be taught" [Kant, Critique of Pure Reason, B172, as cited in (Procee 2006)], and suggests that examples instead of rules should be used to develop this power. Whereas rules can be learned from others in a rather straightforward way, *Urteilskraft* is bound up with the individual: ''The power of rightly employing them (rules) must belong to the learner himself.'' When discussing how tact arises, van Manen suggests that it develops from the modes of action that we employ quite naturally in everyday life as we are constantly confronted by social situations where we must deal with people in certain ways (van Manen 1995). Further learning of tact happens through participation in practice situations and contact with proficient role models (Wenger 1998). Similarly, the conditions that allow *phronésis* to develop are those requiring a morally oriented kind of action. Kinghorn, who argues that the teaching of medical professionalism is best conceived as a project of moral formation, identifies the essential ingredient for *phronésis* as "close, on-the-ground, concrete moral mentorship" unfolding in contexts such as "clinical situations——the middle of the night, while fatigued, under duress——in which rational analysis is most unlikely" (Kinghorn 2010). Boudreau et al. (2018), in describing a curricular project that has *phronésis* as its conceptual core, also emphasize the need for a community of 'attending teachers' who embody clinical and moral excellence, provide access to authentic, increasingly complex and ambiguous clinical cases, and guide learners in their deliberations. Common to these various descriptions of reflective practice is an other-directed moral stance, and an acknowledgment that abstract precepts and universal principles, while important, are insufficient.

In order to promote reflection, assessment of student performance should not adopt the format of auditing "the correct realization", but rather of auditing the fruitful development of the student (Procee 2006). Reflection, in Kant's view, is first and foremost a searching activity, and should therefore be characterized in terms of *discovery* (Dyche and Epstein 2011; Sternszus et al. 2017), though not primarily as a means of correcting shortcomings, which might cause embarrassment and irritation, and eradicate the "wholeheartedness" of a truly reflective stance (Procee 2006). It should be understood that the embodied nature of reflections, displayed as discourse or through other forms of practice, make them a crucial aspect of an experienced identity—my "self". Therefore, rejection by others of one's thoughts and practices can be felt as a rejection of "me". Thoughtless assessment and feedback in this domain may evoke shame, self-contempt, or strategic defensiveness against perceived attacks, which in turn will quell the inclination to display independent thought and behaviour. Only in environments that balance challenge with guidance and support will students find the courage needed to reflect in the daring ways that may lead to the acknowledgment of error, to critical or unconventional statements, and to discovery.

Since the characteristics of a reflective clinical practice are largely tacit and nonconscious, it can best be taught by educators who are themselves clinicians, who in their actions and demeanor can display their embodied 'know-how'. Correspondingly, learners' abilities to enact reflective practice should be assessed by clinicians who are in a position to observe that practice. The ideal of medical practice is to achieve, in each individual case, a merging of two 'wholes': that of the patient's lifeworld (Walseth and Schei 2011), including his or her medical problem, and that of the physician's professional knowledge (Khushf 1999). There is no reason to think that theoretical studies of neuroscience, philosophy, or the phenomenon of reflection is necessary to become a reflective clinician, whose goal in practice, after all, is not to *understand* cognitive processes, but rather to *manifest* their outcomes.

If epistemological theory cannot provide the clinician with the requisite procedural knowledge, how then can it be useful in medical education? The answer is that *educators of clinicians* can, indeed, benefit from a basic understanding and an appreciation of concepts such as the embodied character of cognition, how it is influenced by emotions, and the fallibility resulting from nonconscious biases. Theoretical insight, writes Dunne (2001, p. 368), allows articulation and teaching of practical wisdom and helps resist intimidation by the apparent power and high prestige of "technicist approaches". Just as physicians need theory about disease mechanisms, teachers need theory about knowledge,

Table 1 PASKON

PASKON is a compulsory course, offered at the University of Bergen, where first-year students in groups of 4, unaccompanied, meet a seriously ill person in the patient's home. Patient and students subsequently convene in class and share stories and impressions with 80 peers, led by two experienced physician-instructors. During 20 sessions over 6 months students thus meet 20 patients. A 1 day introductory course presents students with the goals, methods and theoretical assumptions of the course, as well as demonstrations of listening skills in exploratory dialogues with sick persons.
Example A: woman 29, PhD in biology, colonic cancer, currently receiving palliative care, expecting to die within 2 months; recently married, no children.
Example B: man 89, blind after mistake made by ophthalmologist; previous small business owner; helped by wife who suffers from heart failure and light dementia.
Students prepare through roleplay and exercises in class, and with written materials. The theory and examples provided in plenary sessions highlight the importance of emotional and existential vulnerability, and the healing functions of relationships, private and professional. Core communication skills are demonstrated, while underlining that learning such skills is a process of identity formation that never ends, and that success in any individual case cannot be controlled. Before the home visit, students have to contact the patient, knowing only name, age, gender and diagnosis. Each group has a senior student supervisor who helps them prepare. After the visit they write two essays, one on what it was like to be in a professional medical role for the first time, and one on the patient's situation. The essays are commented upon by the senior student supervisor. Multiple tries are allowed.
The students are given the following task for the home visit: "Try to find out how sickness influences the patient's life". Among the learning goals for the whole course are to a) understand core features of patient-centered physicianship, b) gain an awareness of the characteristics of people as persons, and relationships between life events, psychology, physiology, and health, c) appreciate vulnerability as a phenomenon shared by all humans, and recognize and accept one's own, and d) show concern for patients and deal productively with uncertainty, compassion and discomfort in the face of pain and suffering.
Approach to teaching: To promote reflection as discovery, the instructors seek to foster courage and open-heartedness [Dewey's "attitudes that energize the endeavor to grow, personally and intellectually" (Rodgers 2002)] by normalizing emotion and making evident that not only every student, but also patients, teachers and everyone else, share vulnerability and fear of weakness, ridicule, and shame.
The instructors strive to establish rapport with the entire class of students, by learning student names, by inviting comments, reflections and questions, by using humor, admitting ignorance, and from time to time talking about their own vulnerability, fear of making mistakes, of being disliked by students, or seen as weak or not a good teacher. Annual anonymous evaluations are used to improve the quality of the teaching.
Many of the patients share emotionally laden stories of suffering, fear of death, loneliness, hope, love, or of being helped or harmed by physicians and other health care personnel. The teachers use these opportunities to acknowledge emotion as a dignified means of communication, using words, or touch, eye contact, silence and other non-verbal communication. When patients' emotions cause unease among students in the class, tension can usually be released by the instructors' respectfully allowing the patient to regain composure, calmly talking with the patient, and verbally or implicitly acknowledging the ubiquity of emotion in sickness, its importance for healing, and the feelings evoked by exposure of vulnerability in front of others.
Selected results (Publications describing PASKON's theoretical foundations, practice and results are in process): Thematic analysis of student's essays showed that students were excited and nervous at the prospect of meeting an unknown, very sick person in his or her home. They realized that no amount of preparation would ensure control of the situation or of their own or the patient's behaviour and emotional reactions. Students described a concern with avoiding embarrassment, evaluating how they talked and appeared, or fearing that they might do something inappropriate. Most students experienced relief and joy as the encounters unfolded, while others described tensions and embarrassed fumbling in their new professional role. Many dreaded inappropriate displays of emotion, such as sadness and tears, but also joy, laughter, and compassion. A common theme was the discovery of prejudice—patients with serious diagnoses were surprisingly fit and "normal".

thinking and growth. Theory can inform us that the tasks of educating must be solved in non-dogmatic, exploratory ways, and always involve acceptance of fallibility. Yet, such theory will not be sufficient for a teacher to become a reflective practitioner in the ways described above, since teaching itself is practice, which depends on the sophistication of nonconscious functions, honed through years of trial and error in a supportive environment.

To further clarify how reflection can be stimulated in medical education, we present a concrete example:

An example of teaching reflection in medical education

Table 1 describes PASKON, a course in patient contact for first-year medical students, designed and taught by the first author. For the present purpose, we highlight features of PASKON that illustrate a collective process of complex experience, discovery and emotional adaptation. It integrates heterogeneous experiences, writing exercises, dialogue with and feedback from multiple sources, including patients, peers and professional role models, along with a theoretical foundation.

PASKON illustrates that it is possible to stimulate reflection in medical students in ways that are in accordance with many of the ideas and models presented in this article. Arranging for the inexperienced students to meet a sympathetic, seriously ill person, with appropriate preparation, support, teamwork, feedback, and shared deliberation, is far less complicated than describing and analyzing the learning outcomes of such an activity. Like all experience, "meeting one's first patient" opens up the possibility of an infinite

number of potential meanings that change with time and are unique to each individual. This complex experience, in the context of learning to become a doctor, is apprehended, processed, and integrated by the students' nonconscious in ways that forge tacit understanding of health, people and medicine, and alter emotional and cognitive patterns of future professional 'praxis'—how they will see themselves, understand the mandate of medicine, act, and care for their patients. Dialogue with peers, patients, senior students and instructors, combined with feedback on written essays, allow students to learn from and imitate others. They learn to use the tools of language and collaboration to discover morsels of "the world of medicine" and of their own and their peers' different "underlying conceptual frames", to unveil prejudice, blind spots, and taken-for-granted talents. Among the discoveries are surprising stories, facts and ideas, ignorance, prejudice and misunderstandings, as well as resilience, idealism and unacknowledged capabilities.

What makes PASKON an example of *reflective* teaching? We believe the course is constructed in ways that allow, and reward, curious and critical questioning of its ideology, content and methods. An example was repeated criticism of one of us (ES) for being too directive and authoritarian in discussions with students, contradicting in practice his declared and explicit ideology of respectful exploration of perspectives. Though uncomfortable for the instructor, this feedback led to changes and the criticism disappeared in subsequent classes. The course invites multiple beliefs about what "good and right medical actions" might consist of in concrete cases, revealing again and again that good medicine is improvised through dialogical and exploratory interactions. This improvisational learning makes clear that the expertise of authorities does not reside in knowing-all, but rather in the ability to devise functional know-how and to display performative expertise in a given role, on the spot.

Assessment is a controversial topic in the literature on reflection in education. As pointed out by Ng et al. (Ng et al. 2015), reflection in its very essence concerns subjective ways of apprehending the world —— of seeing and being. If students know that their "reflective" products will be assessed and categorized in ways that influence their career, they are likely to adapt an instrumental approach, aligning their discursive language with the perceived criteria of assessment. Giving appropriate feedback on students' verbal reflections and professional behavior is essential (Watling 2014), but the response should be inquisitive and challenging in a way that acknowledges the uniqueness of each students' developmental trajectory (Hogarth 2001). In PASKON, student supervisors are mandated to discuss written essays with the authors, and to pass them if they find them honest and thorough, but not to fail them. With some help, all students are able to write texts that focus on meaningful aspects of the patient visit. The relationship between student and peer supervisor is itself a critical element. The course aims to provide a model for respectful and caring interaction and supervision.

Conclusion

From the ideas presented above emerges a concept of reflection that inheres in action and manifests as *practice*. Aristotle, Kant, van Manen and Dewey would likely agree that the virtuosic practitioner has a fluid 'know-how', as well as intellectual humility that strengthens the capacity to self-correct by expanding and refining this 'know-how' in real time, adjusting understanding and behavior as practice and its consequences unfold. Reflective know-how may manifest as prudent, critical or innovative ideas, behaviours or intellectual products, or as actions that are shortlived and subtle, typically in therapeutic or pedagogical communication. Reflective understanding aimed at avoiding or correcting error, bias and illusion are regularly reified in various forms, such as checklists, computers or curricula.

The instrumentalist misapplications of 'reflection' in medical education, documented by Ng et al., Hodges and others (Boud and Walker 1998; Hodges 2015) (Ng et al. 2015), seem to stem from several misunderstandings. Firstly, it appears that some educators are oblivious to the massive importance of nonconscious processing in human learning and expertise. Secondly, there is inadequate understanding of the complexity of knowledge as a concept, often with undue importance attributed to declarative knowledge. This situation positions 'knowledge-how' at a relative disadvantage to "knowledge-that", in academia as well as in clinics and hospitals. Thirdly, it is insufficiently appreciated that education is, at its core, personal growth. Knowing reflection as an abstract concept, including the pitfalls of heuristics and cognitive biases, is of some interest. However, it remains theoretical knowledge of a different order than the embodied and largely nonconscious reflective ability that allows a physician to do things like: expect the unexpected, make the correct diagnosis by hesitating and avoiding premature closure, say no when everybody wants to hear yes, yet convey engagement and compassion. These practical, professional abilities thrive on exposure to complex, ambiguous and contingent situations and examples and well-functioning role models. Reflective skills can emerge, and grow towards practical wisdom, through years of immersion in supportive communities of practice (Lave and Wenger 1991) that provide supervision and authentic feedback.

Though excellent practice does not depend on theoretical knowledge, theory is clearly necessary to plan and stage adequate learning opportunities for practitioners-to-be (van der Vleuten and Driessen 2014; Slavich and Zimbardo 2012; Biesta 2014). Understanding, consciously, that practitioner

excellence develops *nonconsciously*, through experience, feedback and role modelling, is indispensable for harnessing the powerful learning opportunities of the 'informal curriculum' (Hafferty 1998a, b; Goldie 2012; Dyrbye and Shanafelt 2016). Undoubtedly, theoretical knowledge of pedagogical principles, of nonconscious cognition, and of the philosophical tenets of reflection, are excellent educational tools.

Knowing how to use such tools, however, represents quite a different faculty of the mind.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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