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Developing intellectual humility: questions, dilemmas, and future directions

Kristina Musholt[1] · Samuel Ronfard[2] · Joshua Rottman[3] · Tenelle Porter[4] · Jason Baehr[5] · Andrei Cimpian[6] · Judith Danovitch[7] · Don Davis[8] · Paul Harris[9] · Frank Keil[10] · Candice Mills[11] · Azzurra Ruggeri[12,13] · Walter Sinnott-Armstrong[14]

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Abstract

This article presents an overview and critique of current interdisciplinary research on the nature and development of intellectual humility (IH), with the aim of systematically outlining currently debated open questions. We focus on four specific areas of research: (1) theoretical questions regarding the nature of IH, (2) issues with the measurement of IH in development, (3) existing research on the development of IH and related socio-cognitive abilities, and (4) interventions to increase IH in children and adolescents. We critically review the existing empirical and theoretical literature in these areas, identify and articulate open questions, and map out directions for future research that follow from these questions. The main theoretical issues we identify concern the distinction between different features of IH (i.e., internal vs. external, self- vs. other-directed) and their relation to each other as well as the distinction between IH as a prescriptive virtue as opposed to a descriptive character trait. As we will demonstrate, taking seriously the notion of IH as a virtue raises crucial questions for its empirical study in the contexts of measurement, development, and potential interventions.

Keywords Intellectual humility · Cognitive development · Social cognition · Epistemic virtues

In recent years, the importance of intellectual humility (IH) has become increasingly recognized in psychology, educational science, philosophy, and policy-making. Believed to enable productive discussions and joint inquiries and to foster conscientious and responsible citizenship, IH is generally understood to be a virtue that cognitively and practically benefits those who possess it, the people they interact with, and society at large. Specifically, it is regarded as an *epistemic virtue*—that is, as a personal quality or character trait which, like curiosity, open-mindedness, and intellectual

✉ Kristina Musholt
Kristina.musholt@uni-leipzig.de

[1] Department of Philosophy, Leipzig University, Leipzig, Germany

[2] Department of Psychological and Brain Sciences, University of Toronto at Mississauga, Mississauga, Canada

[3] Department of Psychology, Franklin & Marshall College, Lancaster, PA, USA

[4] Department of Psychology, Rowan University, Glassboro, NJ, USA

[5] Department of Philosophy, Loyola Marymount University, Los Angeles, USA

[6] Department of Psychology, New York University, New York, NY, USA

[7] Department of Psychological and Brain Sciences, University of Louisville, Louisville, KY, USA

[8] College of Education and Human Development, Georgia State University, Atlanta, GA, USA

[9] Graduate School of Education, Harvard University, Boston, CA, USA

[10] Department of Psychology, Yale University, New Haven, CT, USA

[11] School of Behavioral and Brain Sciences, University of Texas at Dallas, Richardson, TX, USA

[12] Department of Educational Sciences, School of Social Sciences and Education, Technical University Munich, Munich, Germany

[13] Department of Cognitive Sciences, Central European University, Vienna, Austria

[14] Department of Philosophy, Duke University, Durham, NC, USA

courage, is critical to the proper pursuit and transmission of knowledge (Zagzebkski, 1996).

Despite its importance, theory and empirical research concerning the *development* of IH are still in their infancy. In this article, we present an overview and critique of current research on the development of IH, focusing on four specific areas. In so doing, we identify and articulate open questions and map out directions for future research in these areas. The goal of this contribution is thus not the establishment of settled conclusions but the identification of issues worthy of further consideration. We deliberately choose not to provide definite answers to the questions we raise. Rather, we believe that what the field can benefit from the most at present is a systematic overview of currently open questions, with the aim of opening up new research avenues.

We begin in the section on "What is IH?" with a discussion of the nature of IH, introducing different features of IH (internal vs. external, self- vs. other-directed) and examining the philosophical notion of IH as a virtue and its implications for the empirical study of IH. We also consider whether and to what extent IH may manifest differently across cultures and at different stages of development.

The following section on "How can we measure IH?" focuses on the problem of measuring the development of IH. Here, we review publications that have attempted to measure IH, surveying their content, modality, purpose, and developmental focus. After identifying the problems associated with various measurements of IH (especially those pertaining to child development), we outline priorities for future research on the measurement of IH across the lifespan.

In the section on "How might IH develop?", we examine existing approaches to studying the development of IH in childhood. Although research on IH from a developmental perspective has been limited, several socio-cognitive abilities that are relevant to IH have been studied extensively. After briefly reviewing these studies and their relation to IH, we propose a framework for understanding its development by introducing the distinction between children's propensity to display certain basic IH behaviors and the possession of reflective capacities that are part of a more mature expression of IH.

Finally, in the last section on "How can and should we intervene to increase IH?", we discuss interventions aimed at increasing IH, especially in children and adolescents. As IH appears to be a beneficial trait, one may assume that children and adolescents should be trained in its practice from an early age. As we show, however, such attempts raise important empirical and ethical questions that must be considered.

What is IH?

Before its development can be studied, a clear definition of IH is required (Leary et al., 2017). In broad terms, IH concerns the extent to which we acknowledge and act on our intellectual limitations, but this definition is too abstract to guide research. Certainly, it is both possible and desirable that a final definition will only evolve in response to new findings. Yet, a precise initial definition is necessary if researchers are to compare results and distinguish substantial disputes from those that are merely semantic. This need for a clear initial definition of IH is even more pressing when researching its development in children and adolescents, because IH may manifest differently at different stages of development. Here, we focus on two current debates regarding the nature of IH: (1) Is IH a unified construct? (2) Is IH a prescriptive virtue or a descriptive quality?

Is IH a unified construct?

We may first consider whether IH is better understood as a single feature or as a cluster of distinct features. In their systematic review and content analysis of IH questionnaires, Porter et al. (2022c) identified two continua that were included most often in measurements of IH: self vs. other and internal mental state vs. external or expressed behavior.

By relating these two dimensions to one another, Porter et al. (2022c) identified four subcategories of IH, as illustrated in Fig. 1. At the conjunction of internal mental state and self (QI), IH is associated with awareness of one's own intellectual limitations, including fallibility, ignorance, and imperfect access to evidence. At the conjunction of internal and other (QII), IH is associated with an appreciation of others' perspectives even when they conflict with one's own. At the conjunction of expressed behavior and self (QIII), IH manifests as the public admission of one's intellectual limitations and attempts to redress those limitations. At the conjunction of expressed and other (QIV), IH is displayed by listening to others, especially when they disagree or provide evidence against one's own views.

A single individual need not have features from all four subcategories to be considered intellectually humble. For example, a person may admit that they need more evidence for an opinion but fail to seek that evidence for a variety of reasons, or they may appreciate others' opinions without actively requesting their help. Thus, while these divisions offer a useful organizational framework, we must examine the relationships among these different patterns of thought and behavior. If the features of IH are a cluster, how are they related? Should we think of these features as a causally

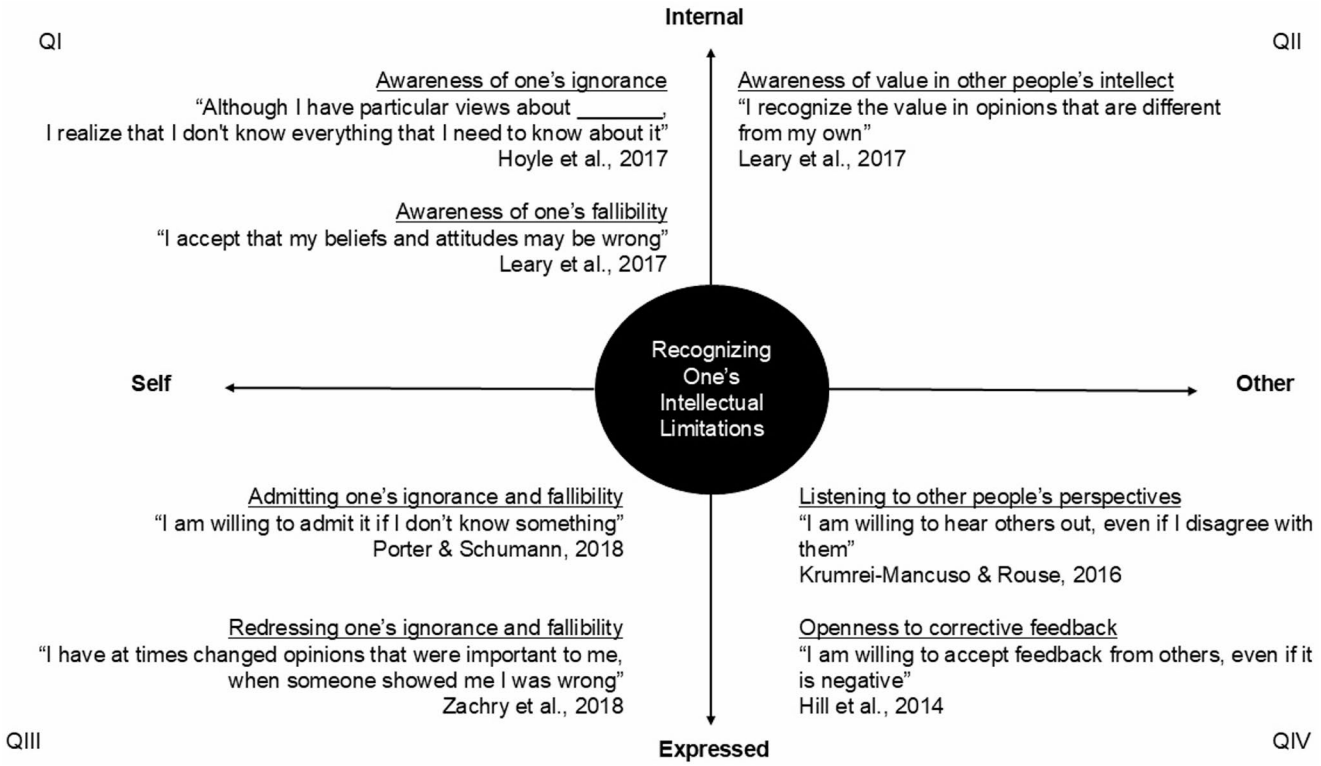

Fig. 1 Subcategories of IH. Adapted from Porter et al. (2022c), with permission. This intellectual humility classification framework depicts recognition of one's intellectual limitations as the core of intellectual humility, and instantiations of this recognition along the self-other and internal-expressed continua. Example questionnaire items that reflect these instantiations of intellectual humility are provided for each quadrant

related cluster, or as a collection with no causal relation between features? And given the separability of these features, how should we classify someone who displays some of these features but not others?

One solution is to restrict a definition of IH to one of these features. Leary et al. (2017, p. 793), for instance, identify the admission of fallibility (an internal-self characteristic) as the central feature of IH. However, their unitary definition prioritizes cognitive features over behavioral and social features that are important for some theoretical accounts, and in doing so does not account for some of the ways that IH could be expressed in the real world.

As a second option, one might limit a definition of IH to two subcategories (e.g., one might characterize IH as a combination of self-directed internal and expressed behavioral features; see QI and QIII in Fig. 1). Indeed, many accounts suggest that IH differs from most other virtues by concerning the self rather than others; as Ballantyne proposes, "IH should be seen as primarily about the person herself, not her social world" (2023, p. 204). Thus, Whitcomb et al. (2015) emphasize the attention to and ownership of one's own epistemic limitations in their definition of IH, while Hazlett (2012) argues that IH consists in a proper understanding of the epistemic status of one's own first-order beliefs, and Church and Barrett (2016) regard IH as a virtuous mean between intellectual arrogance and intellectual diffidence acquired by such understanding. In contrast, some researchers combine the virtue's other-directed features (QII and QIV in Fig. 1) to stress the social nature of IH. Roberts and Wood (2003), for instance, see a lack of regard for social status as an essential feature of IH, while Priest (2017) and Dalmiya (2016) argue that IH involves respect for one's intellectual community and the willingness to regard others as epistemic partners in the search for knowledge.

A third solution might be to define IH as characteristics bound in a causal relationship. IH could be defined as an other-directed expressed feature caused by a self-directed internal feature. In this case, someone listening to others *because* of an awareness of their own intellectual limitations would be displaying IH. In such a definition, the relations between features are as essential as the features themselves. Alternatively, one might argue that no one definition is sufficient because IH is not one thing but a collection of four related concepts, all of which must be defined separately: internal-self IH, expressed-self IH, internal-other IH, and expressed-other IH. The relations among these four concepts could then be studied without being considered parts of an empirically unified whole. Finally, one could embrace

a kind of methodological pluralism and allow for multiple approaches to defining IH. Such radical pluralism might complicate communication and comparison between studies, however.

We must also consider how IH is related to other virtues. Although some conceptual pieces (such as Spiegel, 2012) try to disentangle different virtues from one another, further conceptual and empirical research into the relationship between IH and other epistemic and moral virtues is needed (but see Leary et al., 2017). Particular attention should be given to the ways in which certain virtues may enhance or compete with IH. For instance, if a lack of curiosity prevented people from recognizing their own lack of evidence for a belief, an increase in the virtue of curiosity could also lead to increased IH. Conversely, if a desire to avoid group disagreement prevented an individual from seeking additional evidence, this would indicate competition between IH and the virtue of agreeableness.

Crucially, the relationships between different virtues are likely to vary across cultures or even across different social settings within one culture. Some cultures (or social groups) might value virtues relating to interdependence and social cohesion, for instance, while others might instead emphasize independence and individual autonomy. Although there are currently no concrete studies directly addressing variation in IH expression across cultures, cross-cultural research has demonstrated differences in cognitive style (e.g., Nisbett et al., 2001). Moreover, when judging and evaluating themselves, people from countries embracing more interdependent self-views (e.g., India, China, Japan) have been shown to assess their own knowledge more accurately and to be more aware of their own biases and limitations than people from countries embracing more independent self-views (e.g. USA, Western European countries) (Brycz et al., 2015; Cohen et al., 2007). At the same time, people with more independent self-views seem to have a particular appreciation for individual perspectives and are more likely to stand up for their beliefs. For example, adults and children from independent contexts are less likely to revise their decisions and conform to the consensus in situations in which they can be certain that their own beliefs are correct (Corriveau et al., 2013; DiYanni et al., 2015; Witkin & Berry, 1975). Put differently, IH might be located at different points of the self-other and internal-expressed continua in different cultural contexts. Thus, more cross-cultural work is important in revealing how variability in social norms or values shape the expression and value of IH. Notice also that similar variability might be found when considering other social dimensions, such as social class, gender, etc. (Brienza & Grossmann, 2017). However, research into cross-cultural differences might require alternatives to existing measurements of IH (see section on "How can we measure IH?"), as all existing IH scales were developed and validated predominantly within WEIRD (Western, Educated, Industrialized, Rich, Democratic) populations (Henrich et al., 2010; Rudnev et al., 2023).

In addition to a general definition of IH, understanding of the concept's specific application to children and adolescents is also needed because each aspect of IH is influenced by numerous factors such as social-cognitive development, personality, and sociocultural input. Metacognitive abilities are a clear developmental precursor for IH, for instance, and weak metacognitive abilities can cause a child to ignore their own cognitive limitations. In addition, social factors, such as introversion or local social norms, may preclude a child from displaying features of IH without indicating that the child lacks internal IH. We must thus compare manifestations of IH in children with those in adults to determine whether a single definition of IH holds across developmental stages (see section on "How might IH develop?" for further discussion).

Is IH a prescriptive virtue or a descriptive characteristic?

Many philosophers consider IH to be an intellectual virtue (e.g., Baehr, 2011; but see Levy, 2023, for an alternative viewpoint). The term implies a prescriptive, normative, or evaluative connotation; a virtue is not just *any* quality but a *good* quality, and so an intellectual virtue like IH is presumably a quality that better enables people to learn, understand, and grasp the truth. Similarly, a vice is not just any quality but a *bad* quality. Yet in psychology, many characteristics (such as extroversion) are taken to be neither intrinsically good nor bad but simply descriptive characteristics that can be traits (i.e., what people are typically like across different times and contexts) or states (i.e., what people are like in specific circumstances). Moreover, many psychologists are keen to remain value-neutral in their studies. Defining IH as a virtue (as most philosophical proposals do) thus presupposes that it is good or yields good outcomes—an assumption that forestalls value-free empirical inquiry into IH. Conversely, by refraining from defining IH as a virtue, we can treat its association with positive outcomes as an empirical matter. In other words, the *prescriptive virtue* of IH can be defined as a way of being that is necessarily beneficial, whereas the *descriptive trait or state* of IH need not presuppose that it is good. Virtues also typically stipulate that the relevant characteristics occur at the right times and for the right reasons, conditions that a mere trait or state need not meet. Although IH can legitimately be defined and studied either way, it is crucial for anyone writing about IH to specify explicitly whether they are talking about IH as a prescriptive virtue or as a neutral, descriptive trait or state.

If we take the prescriptive approach favored by philosophers, we must also determine exactly what makes IH a virtue. Aristotle defines a virtue as a disposition that lies at the right point—the "golden mean"—between extremes (for psychologists' perspectives on this, see Fowers, 2021, and Ng & Tay, 2020). For Aristotle, to possess a given virtue, one must engage in its characteristic activity at the right time, in the right amount, toward the right persons, and so on. To miss this mark is to land in a state of excess or deficiency. Thus, to possess the virtue of courage, one must face danger or take risks at the right time and in the right amount. If one takes too few risks, one will be cowardly (deficiency). If one takes too many risks, one will be foolhardy (excess). Following the Aristotelian definition, Church and Barrett (2016) regard IH as a virtuous mean between intellectual arrogance and intellectual diffidence achieved by accurately tracking the epistemic status of one's own beliefs. A person possessing IH does not focus on the search for truth to such an extent that they neglect avoiding error (leading to a vice of credulity), nor do they focus on avoiding error to such an extent that they neglect to seek truth (leading to a vice of servility, skepticism, or lack of commitment to anything).

Yet the multifaceted nature of IH offers various extremes or vices to avoid. In self-directed manifestations of IH, undervaluing the self leads to the vice of self-deprecation, while overvaluing the self leads to arrogance. In other-directed manifestations, undervaluing others leads to dogmatism, while overvaluing leads to gullibility. IH would then be the ability to focus on one's own and others' strengths and limitations to a prescriptively proper extent.

Since the golden mean is the best or proper point in all situations, we must next ask how it can be determined across these situations (Simmons et al., 2023). Should our determination of the golden mean be based on accuracy in self-assessment, or on the consequences of exercising IH in each situation (e.g., in terms of personal flourishing, success in gaining knowledge, or social cooperation)? If accurate ratings of one's own and others' strengths and limitations were the sole criteria for determining the golden mean, then one's IH would correspond directly to one's accuracy regardless of the consequences. There may be little difference if accuracy could be assumed to result in better consequences for inquiry, but this does not appear to always be the case. If an individual could accurately assess their own intellectual limitations but became unable to continue inquiry or followed others' opinions too readily, then their accurate beliefs could still have problematic consequences for intellectual inquiry. Similarly, some degree of "blind faith" in others' capacities might be required for successful cooperation, as in cases where we must trust the judgment of experts without being able to independently assess its accuracy. Thus, context affects whether an accurate assessment of our own and others' limitations will have beneficial consequences for intellectual inquiry, which might have implications for our identification of the golden mean.

Indeed, IH itself may be useful in some contexts (e.g., when you need information from others) but not in others (e.g., when you must authoritatively communicate your expertise to others). Aristotle uses the term "practical wisdom" (phronesis) to describe the ability to determine which behavior is prescriptively proper in a given context. Specifically, a person of practical wisdom can reliably identify the golden mean with respect to specific virtues and situations: they have good judgment about which virtues are relevant to which situations and the manner and extent to which these virtues should be exercised. Accordingly, some measure of practical wisdom will also be required to perform intellectually humble behaviors appropriately in each particular situation (Fowers et al., 2021; Ng & Tay, 2020). Such wisdom will allow an individual to determine the situational appropriateness of an internal focus on one's intellectual limitations or the external expression of those limitations. At times, it will even indicate that other virtues (e.g., intellectual courage, intellectual autonomy, or agreeableness) should be prioritized over IH. Again, notice how differences in cultural background, social class or gender might also come into play when thinking about how to identify the golden mean of IH (see sub-section on "Is IH a unified construct?").

In sum, we face several challenges when thinking about IH as a virtue. First, it is hard to see how to determine which point is the golden mean, who has practical wisdom, or how much deference or confidence is too much in a particular context without significant and potentially controversial assumptions about what is and what is not valuable. Thus, if psychologists want to study IH as prescriptive quality or virtue, we need to ask whether this kind of psychology can (or even should) be value-free at all. Second, if IH is a prescriptive virtue, we also must determine what makes it good in various situations and how this can be measured. We will consider this question in more detail in the next section on "How can we measure IH?".

How can we measure IH?

Without reliable measurements, we have no systematic, replicable way to determine the presence of IH, the relative amount possessed by a given subject, or any qualitative changes across time or contexts. But any measurement of IH, particularly when related to its development, presents "special challenges to researchers" (Tangney, 2000, p. 75). In this section, we review publications on the measurement of IH, surveying their content, modality, purpose, and

developmental focus. We then outline priorities for future research on measurement of IH across the lifespan.

Note that existing measurements aim at measuring IH as a *descriptive* character trait rather than as a *prescriptive* virtue. Accordingly, if a person scores highly on such a measurement of IH, they will be described as having IH, even if their degree of IH is too high to be good for them or others, such as when they inordinately lack self-confidence. As discussed in the previous section, to measure IH as a prescriptive virtue would require an assessment of its value and some way to measure how close a person is to the "golden mean" or the prescriptively proper point, which poses additional challenges to the development of measures of IH (see sub-section on "Measuring IH as a virtue" for further discussion).

Brief review of published measures of IH

Empirical research on IH has expanded dramatically in recent years. Twenty measures, including 16 IH questionnaires, have been published within the past ten years (Porter et al., 2022c). Existing measures can be organized by content, modality, and purpose. We discuss each of these categories in turn.

Content

In terms of content, IH measures vary significantly. Criteria assessed in IH questionnaires include recognition of intellectual fallibility and partial knowledge, appreciation for others' intellect, motivation to learn, concerns about personal status, feelings and beliefs about disagreements, and excessive preoccupation with intellectual limitations (Porter et al., 2022c). Researchers have also measured IH by reported attitude change (Jarvinen & Paulus, 2017) or reported absence of self-serving bias (Reis et al., 2018). Some measures assess only cognitive aspects (Hoyle et al., 2016; Leary et al., 2017), whereas others identify a combination of cognitive and behavioral features (e.g., Alfano et al., 2017; Krumrei-Mancuso & Rouse, 2016); some assess emotional features such as feelings or motivations (e.g., Haggard et al., 2018). This wide array of content reflects the field's lack of consensus on the definition of IH (see section on "What is IH?").

Despite these differences, measures of IH do share some common features. All measures include at least some assessment of recognition of one's intellectual limitations and many measures also index appreciation of other people's intellect (Porter et al., 2022c).

Modality

In measuring IH, researchers have relied almost exclusively on self-report questionnaires, likely owing to questionnaires' predictive capacity and cost-effectiveness. Such methods may be reliable as people do appear capable of reporting on their IH with some degree of accuracy; self-reported IH positively correlates with peer-reported IH and objective behaviors including information-seeking, cognitive flexibility, and argument evaluation (Leary et al., 2017; Meagher et al., 2021; Porter & Schumann, 2018; Zmigrod et al., 2019). Nonetheless, all self-report questionnaires are subject to reporting biases such as recall, self-enhancement, acquiescence, and group reference bias. Self-reporting IH encounters special difficulties, given that predispositions toward intellectual humility likely contribute to underreporting high IH, while predispositions toward intellectual arrogance likely contribute to overreporting IH (e.g., Ballantyne, 2023; Porter et al., 2022a). Perhaps for this reason, self-reported IH is not reliably correlated with well-calibrated intellectual confidence, suggesting that the validity of self-reported IH may be suspect (Costello et al., 2025).

Peer-report questionnaires are another way to assess IH (McElroy et al., 2014; Meagher et al., 2015, 2019, 2021). These compensate for some limitations of self-reporting but are also subject to reporting biases. Furthermore, some features of IH are poorly suited to peer-report; a peer would likely have difficulty reporting on purely cognitive features of IH (e.g., awareness of fallibility and partial knowledge) because these features refer to mental processes that might not manifest in observable behavior. In contrast, an observer should report more easily on the expressed behavioral features of IH (e.g., admitting mistakes or asking questions to fill gaps in one's knowledge). Indeed, the unobservability of some features of IH may explain why some studies have struggled to achieve consensus among peers' ratings (Meagher et al., 2015, 2019).

Researchers have also measured IH through performance tasks, situations designed to elicit meaningful differences in a particular kind of response. This is particularly relevant when it comes to measuring IH in development, as questionnaires are likely to pose particular problems when it comes to children (see sub-sections on "Measurement across development", on "Next steps for measuring IH across development" and section on "How might IH develop?" for further discussion). In one instance, researchers had children play a game where the goal was to answer questions correctly and measured how often children chose to delegate questions to more knowledgeable individuals—a behavioral indication

that the children realized their own knowledge was incomplete (Danovitch et al., 2019). In another instance, researchers investigated at what age children were willing to recheck the evidence for a current belief when faced with peer disagreement (Helmig et al., 2024). The ability to take into consideration the opinion of a peer in appropriate circumstances indicates an awareness both of the limitations of one's own and of the value of another's perspective. Performance tasks such as these capture actual behavior, so their scores do not depend on subjective judgments; they also put all individuals in the same situation with the same opportunity to exhibit IH, unlike questionnaires, which may vary depending on respondents' opportunities to be intellectually humble in daily life. Yet these tasks can assess cognitive features of IH only indirectly and are usually less suited to capturing typical or externally valid behavior—that is, behavior as it would be exhibited in a real-world situation. In addition, they can be less efficient, are more difficult to administer and score, and problematically infer the presence of a stable trait from one instance of behavior. Finally, performance tasks tend to focus on one specific indicator and therefore may be less suited to assessing multiple features of IH.

Thus far, performance tasks have been used less frequently than questionnaires in IH assessment. Although there are currently not many promising alternatives to questionnaires, especially for assessing trait IH rather than state IH, we advocate for much more work on this front, as there are good reasons to suspect that behavioral measures will assess IH more accurately than self-report, especially when it comes to children (see section on "How might IH develop?" for further discussion).

Purpose: trait versus state measures

Studies measuring IH also differ according to how they approach the nature of IH. While some studies treat IH as a stable *trait* (that is, what people are typically like across different times and contexts), others treat it as a temporary *state* (that is, what people are like only in specific circumstances). Put differently, trait measures allow researchers to investigate IH across various situations and contexts, while state measures are used to determine IH with respect to a specific issue or situation. Both measures have unique strengths and limitations. Trait measures are not particularly good at detecting change or variability and are therefore less suited to studying fluctuations in IH across situations or in response to an intervention. In contrast, state measures are less useful at assessing a person's average IH or how one typically thinks and acts.

Different measures may need to be tailored to specific issues because a person's level of IH varies by issue (Hoyle et al., 2016); a person could be intellectually humble concerning their beliefs about gun control, for example, but have no IH concerning vaccine mandates, or vice versa. IH also seems to fluctuate during daily life (Zachry et al., 2018). Accordingly, some have suggested that repeated assessments of IH states—through methods such as experience sampling or repeated administration of a behavioral task—would provide more valid measurement of a dispositional tendency toward IH than a global self-report questionnaire (Porter et al., 2022a; Zachry et al., 2018).

Moreover, while treating IH as a trait or state are not mutually exclusive options (indeed, most psychological phenomena can be studied at both a state- and a trait-level of analysis), each one has implications for potential interventions. Should we understand IH to be a trait, interventions would seek to encourage or maintain an intellectually humble disposition in an individual, and success would be measured via longitudinal studies examining multiple situations. Consideration of IH as a state, on the other hand, would entail shaping IH in the short term for individual situations. Although it is certainly possible that fostering short term IH behaviors on a case-by-case basis could lead to the development of a more enduring character trait, we cannot know this without further study (Porter et al., 2022b). We will address the problem of intervention in more detail in the section on "How can and should we intervene to increase IH?".

Measurement across development

Several developmental psychology studies have analyzed concepts commonly included in definitions of IH (e.g., Danovitch et al., 2026; Ghetti et al., 2013; Good & Shaw, 2022; Hagá & Olsen, 2017; Langenhoff et al., 2022; Lockhart et al., 2018; Mills & Keil, 2004; Schleihauf et al., 2022; Helmig et al., 2024). Although a full review of the relevant literature is beyond this paper's scope (but see section on "How might IH develop?" for a more detailed discussion), these studies can offer important insight into the development of IH, partly because the methods used to study IH in adults are often not appropriate for very young children. Effective measurement of IH in children will thus require a change in methods; incidentally, this may also improve our ability to measure IH in adults. However, to our knowledge, only two published studies have sought to directly measure IH in participants under the age of 18 years. Of the two studies, one used a self-report questionnaire to measure IH in adolescents aged 15 years on average (Porter et al., 2020); the other used a combination of self-report and performance tasks with children aged 6–8 years (Danovitch et al., 2019).

We have recently undertaken the design of a self-report scale usable from childhood to adulthood (Ronfard et al.,

under review). This brief measure is anchored on existing theoretical frameworks, such as the one proposed by Porter et al. (2022c) (see Fig. 1), in addition to extensive concept mapping. As the items and response options were first designed for children, and then subsequently tested with adults, we have been able to take children's cognitive and behavioral limitations into account. For instance, given children's metacognitive limitations, we believe a self-report scale may be feasible only for children 6 years old and above (see section on "How might IH develop?" for a discussion of these limitations; but see Harris et al., 2018; Muradoglu et al., 2024). In our adult sample, we have also tested this novel scale alongside existing IH scales and related constructs, thus ensuring that it is functioning similarly to other adult IH scales (i.e., correlating in similar ways). We expect that applying this new measure in future studies will provide data about whether and in what ways IH in children is similar to adult IH. We will turn to developmentally specific capacities for IH in the section on "How might IH develop?".

Next steps for measuring IH across development

Here, we survey the key questions and priorities for future research on measuring IH across the lifespan.

Conceptual clarity

A clear priority for consistent measurement of IH is a greater consensus about its defining features. The many different conceptualizations of IH mean that it suffers from the jingle fallacy, in which the common phrase "intellectual humility" is used to describe different phenomena (Thorndike, 1904). A coherent knowledge base cannot be developed for a phenomenon that different research labs define and measure differently. A developmental perspective may encourage us to first conceptualize the fully developed form of IH in adults and then consider how such a form may emerge and take shape earlier in life (see section on "How might IH develop?").

Measuring multiple components of IH

If we were to define IH as a multi-featured construct, we would need to determine the best ways to measure each of these multiple features separately. Empirically, conceptually distinct features (e.g., self-focused vs. other-focused components, mental vs. behavioral) could be correlated parts of a higher-order construct, but they may still be better measured as a single feature or as many weakly-correlated features. Thus far, most IH researchers have used a single measure to assess many different features of IH (e.g., cognitive, behavioral, self-focused, other-focused, emotional, and motivational components), computing the average of these features as a global score of IH. A limitation of such global scores is that two people with markedly different sets of features could still receive the same global score. As such, it may be better to measure different features of IH independently, which could reveal how these discrete features relate to one another, develop over time, and shape outcomes. Alternatively, the use of person-centered analyses (i.e., approaches that focus on identifying distinct patterns of characteristics within individuals, rather than relationships between variables across a population) could provide more information on how various features of IH coalesce within individuals and how different combinations promote different outcomes.

Measuring IH in children

As mentioned, relatively little research has intentionally measured IH among children and youth. Self-report questionnaires—the dominant approach among available measures—appear potentially viable for studies of adolescents, and new research suggests that it may be possible to adapt self-report measures for children as young as 4 or 5 years (e.g., Harris et al., 2018; Muradoglu et al., 2024). Indeed, as mentioned above, a new IH scale for children ages 6 and older is currently under development (Ronfard et al., under review). However, children may also need more age-appropriate alternatives to self-report. These alternatives could include behavioral tasks, informant-report questionnaires from teachers or parents, and observational measures. They may also involve additional training or child-friendly modifications such as the use of picture-based Likert scales. To facilitate comparisons of IH across different ages and stages of development, measures should be invariant across age groups, clearly assessing the same construct regardless of the participant's age, but also developmentally appropriate; a participant's inability to respond to a measure may otherwise indicate an error in study design rather than an absence of IH.

As researchers consider how to measure IH in children, attention should be paid to whether IH should be measured at the level of state or trait for their particular research questions. Indeed, it is quite possible that children's IH may look different depending on the scope of what they are being asked to judge as well as their beliefs about what others might want them to do. Connected to this, Porter et al. (2022a) noted that adults can sometimes be tempted to report that they are high in IH because they think it is desirable to have IH in general, but their responses appear less biased when they are asked to think about IH in specific situations instead of more general ones (Brienza et al., 2018). When

measuring IH in children, then, measures could be adjusted to evaluate children's IH in general or at a state level. For example, a self-report measure of IH that talks more generally about IH (e.g., "I listen to other people's ideas because they might know things that I don't know") could be modified to focus on a specific domain (e.g., "I listen to other people's ideas about ___ because they might know things that I don't know"). One behavioral measure might focus on IH in action when learning about a specific topic (e.g., a historical conflict), which would be a state-like measure of IH, but examining patterns of IH across many different topics or tasks might give a sense of IH as a general trait.

Measuring IH as a virtue

Although philosophers typically view IH as an intellectual virtue, psychologists have focused less on IH's status as a virtue (see section on "Is IH a prescriptive virtue or a descriptive characteristic?"). As discussed previously, unlike descriptive character traits or situationally dependent states, virtues must be exercised for the right reasons and in an amount appropriate to a given situation (Ng & Tay, 2020). Hence, people who display IH must do so intentionally by choosing to act in accordance with a set of epistemic values that encourage them to perform intellectually humble behaviors. Though they may not explicitly consider their actions in terms of "intellectual humility", they would still need to understand which acts are valuable in this framework so that they would choose to perform those acts for that reason. Measurement of IH as a virtue would therefore require analysis of IH itself, including an assessment of its value, its situational context, and the assessed person's motivations. While the virtue perspective complicates the task of measuring IH, several methodological approaches could make such assessment feasible.

One promising approach involves applying established frameworks from motivation science to assess the underlying reasons why someone engages in IH behavior. For example, researchers could use Elliot and McGregor's (2001) widely-validated 2 × 2 achievement goal taxonomy to distinguish between different motivational orientations: Is the person displaying IH because they sincerely want to get closer to truth (a so-called mastery-approach goal)? Because they want to avoid believing falsehoods (a mastery-avoidance goal)? Because they want to look good in front of others (a performance-approach goal)? Or because they want to avoid looking bad in front of others (a performance-avoidance goal)? Existing survey instruments, which typically target motivation in classroom and workplace contexts, could be adapted to assess these motivational underpinnings of IH behaviors among both adults and children.

Moreover, if IH is assumed to be a trait virtue rather than a state virtue, each of the additional dimensions of IH as a virtue (including motivations) would require repeated analysis across multiple situations. Some scholars have described how this type of measurement might be accomplished in adults (Fleeson & Jayawickreme, 2015; Ng & Tay, 2020), but the measurement of virtuous traits that last over time in children and adolescents has received relatively little attention.

How might IH develop?

Here, we focus specifically on the development of IH. Because IH has rarely been studied from a developmental perspective, we propose a general framework for the study of the development of IH, emphasizing the distinction between children's basic capacities to display IH behaviors and their reflective endorsement of the value of thinking and acting in intellectually humble ways. Before introducing this framework, we first explain why the development of IH should be studied and ask whether children can be considered intellectually humble to begin with.

Why study IH from a developmental perspective?

Broadly understood as the ability to recognize and act on the limits of one's knowledge, IH can be seen as an important catalyst for learning and innovation at both the individual and societal level. It allows for productive discussions and fosters conscientious and responsible citizenship. Fostering and supporting IH is thus immensely important to parents, teachers, and policymakers alike, especially given the hyper-polarization of beliefs engendered by the information age and the advent of fake news. Without knowledge of how IH forms, we cannot create intervention programs to effectively foster IH.

Notice that what catalyzes learning and innovation and what parents, teachers, and policymakers want to foster in children (and adults) is the *prescriptive* virtue of IH. Their aim cannot be to make people (children or adults) underestimate their intellectual abilities or lack self-confidence to such an extreme degree that they cannot learn or innovate. While the latter would be compatible with a higher degree of descriptive IH, it would be incompatible with the assumed positive effects of IH.

Because of this target, some studies of the development of IH characterize children as overconfident or underconfident, and some talk about whether children seek help from others when they should. These studies then seem to be discussing IH as a prescriptive virtue; they are not value neutral. In contrast, other developmental studies of IH focus on

when various descriptive aspects of IH appear in early years rather than on whether children achieve the golden mean of IH. They track the emergence of descriptive IH over time and seek to understand why behaviors that are associated with IH emerge when they do. Yet their findings can still be useful in devising ways to help bring children closer to the prescriptive virtue of IH, even though they remain neutral on exactly where that goal lies. We will discuss both kinds of studies in our brief review of the literature.

Can young children be intellectually humble?

Given the complexity of IH, we may wonder whether young children can be intellectually humble at all. Paradoxically, preliminary research suggests that they are simultaneously intellectually humble and intellectually arrogant. Children's IH manifests in a ready deference to experts and a willingness to seek information when they lack knowledge. Three-year-old children explore and ask questions when they are surprised, unsure, or face a gap in their understanding, and readily accept new beliefs even when those beliefs contradict earlier ones (e.g., Tizard & Hughes, 1984). Young children are quick to change their decisions after being confronted with disagreement by a peer (Hagá & Olson, 2017), and children are especially willing to revise prior knowledge when they receive information from sources seen as competent experts (Rakoczy et al., 2015). Further, a recent study demonstrated that three-year olds can already understand that they might currently be wrong and are willing to recheck their evidence for a current belief when faced with peer disagreement (Helmig et al., 2024). Thus, young children seem to display important behavioral markers of IH at an early age. They value the perspectives of others, and they are aware of their ignorance and seek information when they don't know something. These behaviors may serve as important indicators of IH development in younger children.

At the same time, young children are overconfident in their knowledge (Mills & Keil, 2004) and often fail to appreciate that knowledge is uncertain and that beliefs should be evaluated in accordance with available evidence (Kuhn et al., 2000). Until about age 7, children have fragile understandings of how people can interpret equivocal evidence in different ways (Carpendale & Chandler, 1996; Lalonde & Chandler, 2002), and they possess underdeveloped metacognitive abilities, including the ability to reflect on their own knowledge and thoughts (Flavell, 1979). Young children around 4 to 6 years of age still often fail to recognize the limitations of their own knowledge, in particular in situations in which they have only partial information (Hagá & Olson, 2017; Kloo & Rohwer, 2012; Rohwer et al., 2012). Even when children become able to understand that multiple conflicting points of view can exist, they do not always appreciate the potential legitimacy of multiple perspectives (Heiphetz & Young, 2017; Verkuyten & Killen, 2021; Wainryb et al., 2004). Furthermore, they favor people who hold beliefs like their own (Heiphetz et al., 2014), and they value outward similarity and behavioral conformity. Young children protest when conventions are violated (Schmidt & Tomasello, 2012), and older children continue to disapprove of individuals who do not act in accordance with group norms (Roberts et al., 2017) or whose beliefs deviate from typical group-based beliefs (Roberts et al., 2021). In general, children may be inclined toward negative moral evaluations of people with alternative viewpoints and thus be less likely to express IH.

As such, although young children often exhibit behaviors corresponding to IH, they also overestimate their knowledge, lack awareness of their intellectual limits, and can be dismissive of views that contradict their own. This pattern may reflect asymmetric development in their cognitive abilities, which could cause the expression of some—but not all—aspects of IH. As they develop, the maturation of children's metacognitive and social-cognitive abilities allows them to engage in more IH behaviors, to do so more consistently, and to better understand how to think in ways that are intellectually humble. This increased conceptual understanding may in turn shape children's decisions to be intellectually humble. Thus, as has been observed in other domains (Siegler, 1996), the development of IH in early childhood likely involves an increasing intentionality concerning intellectually humble behavior.

Notice that the developmental trajectory of IH might also vary depending on the socio-cultural input (also see subsection on "Is IH a unified construct?"). For instance, studies show that the age at which children begin reasoning about mental states, as well as the sequence in which these abilities develop, can differ substantially between societies, depending on the demands of the task (Dixson et al., 2018; Selcuk et al., 2018; Shahaeian et al., 2011). For instance, in tasks requiring children to make explicit judgments about others' mental states, those from cultural backgrounds where references to the mind are less frequent show pronounced delays in providing accurate false-belief reports (Dixson et al., 2018; Mayer & Träuble, 2015). First results from a study investigating meta-cognitive development in a small-scale society also indicate potential differences with regard to children's abilities to report their own knowledge state (Kim et al., 2018).

Implications for studying the development of IH

Once core behaviors of IH have been identified, we can empirically determine their early manifestations in development. By studying the timing of these manifestations in a culturally sensitive manner, we can begin to develop hypotheses about the reasons for this timing. The ability

to display appropriate deference, for example, may first require the capacity to reflect on and compare one's own knowledge with that of other people. This approach should help to explain why children display some IH behaviors but not others and indicate whether children appear to lack IH in certain circumstances because they *cannot* act in an intellectually humble way or, instead, because they *choose* not to act in that way.

The development of IH may first manifest in children's ability to (unintentionally) display IH behaviors. Between the ages of 4 and 8, children rapidly improve their capacity to reflect on their own knowledge and the knowledge of other people and to seek out and evaluate evidence (e.g., Goddu & Gopnik, 2022; Ronfard et al., 2018; Selmeczy & Ghetti, 2020). However, they are still in the process of developing their epistemological understanding at these ages (e.g., Shtulman & Walker, 2020; Zimmerman & Klahr, 2018). This timeline suggests that subsequent developmental milestones may include a better understanding of the value of IH and an eventual decision to endorse and act upon that value. As discussed above, philosophers who see IH as a prescriptive virtue have often argued that valuing IH and intentionally seeking it are necessary for possessing the virtue of IH. Adolescence might thus be a particularly critical point in the development of IH as a virtue because children then become able to understand the value of IH and to choose to act virtuously—that is, they become capable of possessing the virtue of IH.

In conclusion, research into the development of IH is critical to our understanding of IH. By determining whether IH in children differs in some ways from that in adults, we can learn which elements are common and essential to IH at all ages and thus refine our definition of this complex concept. At the same time, an understanding of IH's development is essential if we are to foster IH through interventions. To continue advancing in this work, we must first consolidate what we already know about the development of IH behaviors, children's motivations to engage in these behaviors, and the relationship between the development of IH and that of other socio-cognitive abilities as well as the impact of socio-cultural norms and values.

How can and should we intervene to increase IH?

In this final section, we discuss interventions designed to increase IH, especially those targeted at children and adolescents. The goal of these interventions is presumably to increase the prescriptive virtue of IH. It would not be achieved if people became extremely lacking in self-confidence or always followed others, so the goal cannot be to increase descriptive IH as much as possible. Interventions are instead aimed at bringing people closer to the "golden mean" of the prescriptively proper level of the relevant character traits. Hence, training programs assume that such prescriptive IH will benefit both individuals and society. They also often assume that early interventions are usually more effective than delayed ones. These assumptions suggest that it would be reasonable for parents and teachers to begin training children in IH at an early age.

In general, however, we are cautious about the scientific steps that would be required to move towards applied research that would integrate IH interventions into schools, particularly k-12. We are aware of some private schools that focus on IH-related themes and other intellectual virtues as core aspects of their teaching philosophies. In general, in many cases, epistemic norms underlie approaches to policy and to learning. However, as we have argued, the field is in a very early stage of distinguishing different approaches to even defining IH, particularly at a structural level, much less testing different approaches to increasing IH. Some research is beginning to test IH interventions in college students, even with unresolved conceptual concerns. Nonetheless, we argue that several important conceptual, empirical, and ethical questions should first be addressed before interventions can be optimized and implemented.

Which interventions work?

We must first consider whether IH in children *can* be increased through training or other interventions and, if so, how that may be accomplished. Although a handful of techniques have shown promise in increasing adults' IH for periods ranging from a few minutes to over a month (for a review, see Porter et al., 2022a), almost no research has focused on IH interventions in children or adolescents (but see Anderson et al., 2021; Porter et al., 2022b). Furthermore, the variance in how IH is defined and measured across studies limits any possible extrapolation from the data provided. Most current measures used in brief manipulation or intervention studies either combine many features of IH into one self-report measure (e.g., Porter & Schumann, 2018; Porter et al., 2020) or measure only the internal, self-directed part of IH associated with awareness of one's limited knowledge and intellectual fallibility (e.g., Grossmann et al., 2021). In studies that combine multiple features of IH in a single global measure, we cannot know which feature(s) were most affected by manipulations. In studies where only one feature was measured, we cannot know whether other features of IH were also affected. Thus, without a consensus definition of IH and its essential features, effective intervention design will be difficult. A better understanding of the interrelation among features of IH could improve our ability to design interventions as well. Hence, we must better

understand what IH is before more effective interventions can become possible.

Of course, assessing an intervention's effectiveness will also require improvements in our measurement of IH. Two different methods of intervention cannot be compared unless the same reliable measures are used for both. Proposals for IH interventions in children and adolescents thus presuppose our ability to accurately measure IH in children and adolescents.

Finally, we need to know more about the developmental trajectory for IH in children and adolescents (see section on "How might IH develop?"). If an appreciation for disparate views or a willingness to seek information from others tends to develop within a certain range of ages, interventions before or after those ages may be less effective. There are also likely to be substantial differences in IH between children in the same age range (see Danovitch et al., 2019), so interventions may need to be targeted at children showing a relative "deficit" in IH compared with their peers. Thus, effective interventions will require not only the right methods but also the right timing.

To design and test useful interventions, we must therefore gain greater knowledge about the nature, measurement, and development of IH in children and adolescents. Although the amount of information we lack might suggest that the design of actual interventions is premature, the attempt itself may reveal critical insights. If an intervention fails according to a particular metric, we can learn more about IH by precisely exploring what went wrong. Similarly, a successful intervention to increase some aspect of IH may indicate how that aspect interacts with others. Both successes and failures can teach lessons, so attempts at intervention can elucidate the foundational issues that must be settled before better interventions can be designed. All such attempts must be pursued humbly, however, with the realization that mistakes will be made and that those mistakes may impose costs.

Notably, if we conceive of IH as a metacognitive awareness that one's beliefs are not always accurate, education itself may be viewed as a form of intervention targeted at children's epistemic tendencies to make them more intellectually humble. Recent evidence suggests that how parents talk about gaps in their own knowledge is related to children's IH (Mills et al., 2025), suggesting that successful interventions might target how adults describe and model IH behaviors for children. Some school lessons, if taught successfully, can also foster children's awareness that their intuitive preconceptions about a particular topic are incorrect and that they must learn more to have a fully accurate understanding of a particular topic (Shtulman & Walker, 2020). Other lessons might specifically target aspects of IH. For example, lessons where students discuss the value of disagreement or study instances where disagreement led to scientific breakthroughs might promote openness to others' viewpoints or belief revision. Such lessons could potentially be adapted to support the development of IH even among very young students.

Should we try to increase IH?

IH has been linked to several positive cognitive, social, and personality outcomes in adults (for a review, see Porter et al., 2022a). Intellectually humble adolescents are more likely to pursue mastery when learning and to earn higher grades (Porter et al., 2020; Wong & Wong, 2021). Although IH does not appear to predict greater fluid intelligence in adults, IH is associated with a number of tendencies that likely promote learning (e.g., curiosity, open-minded thinking, intrinsic motivations for learning), and it thus predicts greater general knowledge (Krumrei-Mancuso et al., 2020). IH also encourages openness to opposing views, which could reduce political polarization and epistemic partisanship (Porter et al., 2022a). Given the strong force of homophily in social interactions, however, exposure to distinct perspectives is often rare (McPherson et al., 2001), and homogeneity of beliefs can be perpetuated further by the tendency to trust information provided by those who are demographically similar (Kinzler et al., 2011) or who conform to a group consensus (Corriveau et al., 2009). Thus, interventions are likely necessary if children are to receive evidence that conflicts with their existing beliefs and so realize that those beliefs need revision.

Despite the apparent benefits of IH, however, much of the evidence for these benefits is correlational and could be the result of confounding factors. Moreover, the possibility of increasing IH in children, who are developing a sense of their own competence and identity, raises moral and ethical concerns. We must thus determine whether any intervention would be morally permissible in the first place and, if so, how and when to test an intervention that is free from moral or ethical problems.

Our answers to these questions again depend on our definition of IH and our understanding of which kinds of IH are worth pursuing as virtues. As discussed in the sub-section on "Is IH a prescriptive virtue or a descriptive characteristic?", an awareness of one's fallibility and ignorance is a virtue if it is a mean between vices whose proper use causes cognitive, personal, and social benefits (such as true beliefs, personal flourishing, and social harmony). Viewed in this way, interventions can increase the virtue of IH only if they move people closer to this mean and enhance the relevant benefits. In contrast, IH interventions err if they increase people's self-doubts to a destructive degree. But where exactly is the "golden mean" of IH? Might it be different

at different stages of development, in different situations or contexts, or with respect to different social groups? How can we locate that ideal for different groups or contexts? If we do not know where that "golden mean" lies, we cannot know whether an intervention will help people achieve an ideal or instead make them excessively self-deprecating.

Admittedly, if people are generally inclined to over-confidence rather than under-confidence, an intervention that reduces confidence will help more people than it hurts. Nonetheless, such an intervention may detrimentally affect social groups that are antecedently inclined to be under-confident (e.g., women, marginalized ethnic and racial groups, and others who are underrepresented or have less power in a given context). Thus, an intervention could plausibly succeed in increasing IH at an aggregate level while simultaneously harming members of disadvantaged groups to a disproportionate degree. Therefore, ethical interventions will need to be tailored to the prior inclinations and circumstances of each individual or group involved; as these will be contextually determined, interventions capable of broad implementation will prove difficult to design.

Even if we could design an intervention suitable for all individuals in all circumstances, a more fundamental objection would remain. If IH is a character trait (rather than a highly variable state), an imposed intervention could undermine individuals' autonomy by requiring them to conform to others' standards rather than their own. Consider, for example, an extremely arrogant person who thinks that their views are almost always correct, that they do not need to consider further evidence for their beliefs, and that there is no value in listening to others. Although such arrogance is a clear example of the behavior that most IH interventions would seek to change, it is entirely possible that such an individual would not *want* to become intellectually humble. An adult may simply refuse the intervention, but children may not have that option, especially if the intervention is required by their school or parents. Would these groups be justified in forcing those children to change into the kind of person that they want? To be sure, children are still children, and paternalism is justified for children if it is ever justified, but we may question just how far such paternalistic intervention can justifiably go: if a parent would reasonably be criticized for forcing their child into a profession that the child detested, would it be reasonable to criticize a parent who forces their child to adopt a character trait that the child does not want?

Proponents of intervention might reply that the two situations are not equivalent; unlike a choice of profession, IH will be useful in later life regardless of profession or lifestyle. These interventions, advocates might add, do not force a person to be what others want them to be, but enable them to become whatever they themselves want to become (cf. Rawls, 1971 on primary goods). Such an argument may have some merit, but the distinction between "enabling" and "forcing" may not be evident in all contexts, and so we may not readily or accurately distinguish between forcing someone to be a particular kind of person and enabling them to be whatever they want to be.

Thus, any intervention aimed at increasing IH will need to be implemented with care and sensitivity to potential ethical problems arising from imposing IH on individuals with conflicting preferences and cultures. To reduce such risks, it will usually be advisable to consult with a wide variety of stakeholders and community members in advance before introducing any intervention in schools to increase IH. These people can then convey their perspectives on whether the proposed intervention conflicts with their values.

Individual differences vs. situational approaches

When designing interventions, IH research often adopts an "individual differences" approach; interventions target individuals and are considered effective insofar as they increase IH in those individuals. Another class of interventions takes a "situational" approach, comparing behavior in different situations. Preliminary studies suggest that these situational interventions (e.g., determining the classroom circumstances in which students display greater levels of IH) may often prove useful for children, adolescents, and even adults. Recent work by Porter et al. (2022b) found that mastery-oriented teaching practices predicted increases in middle school students' expressed IH over time. Arguably, the systematic evaluation of such "naturally occurring" interventions (i.e., interventions that are already a routine component of the curriculum for many students) may be less ethically problematic than the introduction of novel psychological procedures deliberately aimed at boosting IH. More specifically, we would do well to be better informed about the impact of current educational practices rather than assuming them to be beneficial. More generally, future research on interventions should identify situations that encourage (and discourage) IH across development and explore the extent to which situational interventions can result in long-term changes in character.

Conclusion

Describing his own foray into a novel field, the philosopher Reichenbach (1938) offered the following analogy: "We may compare our situation to that of a man who wants to fish in an unexplored part of the sea. […] I should advise him to cast the net, to take the chance at least. It is preferable to try even in uncertainty than not to try and be certain of getting nothing" (pp. 362–363).

Much like Reichenbach's fisherman, IH researchers are on a venture into unexplored territory. As this review has demonstrated, nearly every aspect of IH is still being questioned: how to measure it, how it develops, how to increase it (if at all), and even what it is, especially whether IH should be seen as descriptive or prescriptive. In this paper, we have deliberately chosen to enumerate and discuss these questions without rushing to answer them. Our hope is that the questions themselves will encourage IH researchers to keep exploring and that they will help to generate new lines of research for developmental scientists. Indeed, new discoveries depend on wading more deeply into the unknown. In doing so, we can come to appreciate—much in the spirit of IH—how little we know and how eager we are to learn.

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