The Illusion of Sufficiency: Is Critical Thinking Skill Enough?

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Abstract

This is the third and final article in the trilogy 'The Illusion of Sufficiency'. The two earlier articles tested two content areas of critical thinking, logical fallacies and cognitive biases. They showed that knowing the names of these patterns, without applying them, does not cure the ignorance of our age. This article turns to critical thinking itself, as current training programmes use the term. It separates two recognised components: 'skill' (the capacity to analyse, to evaluate arguments and to infer) and 'disposition' (the lasting inclination to apply those same skills impartially).

Drawing on Stanovich's research programme on 'dysrationalia', the article argues that, at the level of intervention, the two components differ only slightly, and that this difference can be called real only with caution (Abrami's meta-analysis: $g = 0.30$ for skill, against $g = 0.23$ for disposition). Two explanations are plausible: the domain-dependence of skill (Willingham) and the evolutionary function of reasoning, which serves the defence of a position more than the discovery of truth (Mercier and Sperber).

The gap also has a social consequence. The charge of 'lacking an epistemic disposition' can become a tool for weaponising identity, and reasoning skill itself can shield a person's own beliefs instead of exposing them. The article also explains why skill, which looks discrete, is easy to package and market, while disposition, which is continuous and long-term, is not.

Finally, the article reviews the opposing evidence. It concludes that disposition can be taught, but that the evidence is limited. The only intervention that targeted disposition directly showed an effect, and any claim to cultivate disposition needs a measure that does not rely on self-report. Most current critical thinking programmes offer neither direct targeting nor such a measure.

Keywords: Ignorance studies; critical thinking; skill-disposition gap; epistemic disposition; dysrationalia; vice-charging; actively open-minded thinking

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Introduction: Where This Article Sits in the Trilogy

The two earlier articles in this trilogy each tested one specific content area. The first article showed that knowing logical fallacies is not enough, on its own, to counter the ignorance of our age. The second showed the same for knowing the names of cognitive biases. In both cases, the object of critique was a 'content': a list of patterns that people usually assume, once they know the names, will make them immune to errors of perception and judgement. This article is of a different kind.

Its subject is not a third content area. It criticises the methodological umbrella under which those two areas sit: ‘critical thinking’.

As we saw in the introduction to the first article, the specialist literature divides critical thinking into two separate components. This literature runs from Facione’s Delphi consensus report (Facione, 1990) to Ennis, Halpern, and Paul and Elder (Ennis, 1991; Halpern, 1998; Paul & Elder, 2006). The two components are:

• ‘skills’, such as interpretation, analysis, evaluation and inference;

• ‘dispositions’ (as the literature defines them), meaning ‘stable orientations’ (traits) such as truth-seeking, open-mindedness and impartiality.

This division shows that the critical thinking literature itself counts disposition as part of critical thinking. So this article does not criticise the full concept of critical thinking. It criticises the training and assessment programmes that, in practice, are built around the skill component and assume that strengthening it will also strengthen disposition. The article’s claim concerns that assumption.

Consider a person who can analyse a political statistic correctly. They check the source, criticise the sampling, separate correlation from causation, and so on. This ability is ‘skill’.

Yet when statistics come out from the person’s favourite party, that person may not use this skill at all. They have not lost the skill or the ability. Rather, ‘something’ in that moment has not moved them to apply it impartially. On this article’s view, that something is the epistemic disposition, the stable orientation that should have taken root in their mind. The gap between ‘being able’ and ‘switching on at that moment’ is the core of this article.

On this basis, the question of this article is as follows. Suppose a person has the skills in their full, academic sense (not the reduced, list-like version criticised in the two earlier articles). Is that enough? And where does ‘disposition’ fit?

The article’s answer to the first question is no. This answer does not repeat the two earlier articles. They showed that, even when a person can recognise a pattern, the content on which this skill operates covers only a closed and incomplete set. This article does the opposite. It sets ‘content’ aside and goes straight to ‘the skill itself’. In other words, suppose the skill is fully available to a person, with no limit of coverage. What remains to guarantee that they apply it, at the moment of action, impartially?

On this article’s view, what must exist and be cultivated in this situation is ‘epistemic disposition’. Having the skill alone does not guarantee that it will be applied impartially.

We must separate this claim from a stronger but false one. The article does not say that skill and disposition have no correlation. It says that any such correlation is imperfect, and that no guarantee of sound judgement or sound evaluation of claims can be built on it. In short, a gap lies between skill and disposition. As we shall see, the psychology of rational thinking has a similar, neighbouring concept, which Stanovich formulated as ‘dysrationalia’. The theoretical basis of this article rests not on Facione’s philosophical document but on Stanovich’s empirical research programme on ‘the assessment of rationality’ (Section 1). To examine this thesis, the article proceeds as follows:

Section 1 formulates the theoretical framework of the skill/disposition gap more precisely.

Section 2 examines the mechanism of non-transfer at the level of intervention.

Section 3 examines how the label ‘lacking an epistemic disposition’ is weaponised in identity conflicts.

Section 4 shows the asymmetry of the attention market.

Section 5 reports the opposing evidence.

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1. Theoretical Framework: The Gap Between Skill and Disposition

In the introduction, we defined the two concepts of ‘critical thinking skill’ and ‘epistemic disposition’ for this article as follows.

• ‘Critical thinking skill’ is the set of capacities that Facione and his followers list: interpretation, analysis, evaluation of arguments, inference, explanation and ‘self-regulation’ (the capacity to monitor one’s own reasoning, not the inclination to apply that monitoring in every situation), in the full, academic sense.

• By ‘disposition’, this article means a person’s stable inclination to apply those same skills impartially.

To assess these two concepts precisely, we must first separate two levels of claim. This lets us weigh the evidence for each level properly later.

• The first level (the trait level) is a claim about a trait: does the degree of a person’s skill predict the degree of their disposition?

• The second level (the intervention level) is a claim about intervention: does training that strengthens skill also strengthen disposition in the same proportion?

This article mainly tests the second claim, because we can observe and quantify it directly (Section 2). It presents the first claim only as the more plausible theoretical background, not as something that this article tests directly.

This does not mean that skill is useless, or that disposition can never be taught (the subject of Section 5). What the article rejects is the assumption of a linear connection between the two: the belief that strengthening skill, by itself, also strengthens disposition.

As noted in the introduction, Stanovich formulated the distance between the two concepts, in the psychology of rational thinking, as ‘dysrationalia’: an inability to think and behave rationally despite adequate intelligence. He first proposed the term in 1993, by analogy with ‘dyslexia’ (Stanovich, 1993), and later developed it in a book for general readers (Stanovich, 2009).

One clarification is needed here. The gap of dysrationalia lies between ‘intelligence’ (what an IQ test measures) and ‘rationality’. It is not exactly the gap between ‘critical thinking skill’ and ‘disposition’ that concerns this article. In Stanovich’s own framework, critical thinking skill is closer to ‘mindware’ than to ‘intelligence’. What this article borrows from dysrationalia is not full equivalence but a similar ‘structural pattern’. In both cases, a high ‘cognitive capacity’ (intelligence, or critical thinking skill) does not guarantee another capacity (rationality, or epistemic disposition). To make the intelligence/rationality gap concrete, Stanovich gives the example of a person with a very high IQ who nonetheless makes plainly irrational decisions, just as an intelligent person can also be ‘dyslexic’.

On the same basis, in 2016 Stanovich, West and Toplak introduced a tool for the empirical assessment of 'rationality' (not only intelligence): the 'Comprehensive Assessment of Rational Thinking', or 'CART' (Stanovich, West & Toplak, 2016).

This tool is a set of nearly twenty performance subtests. In them, participants must actually decide in simulated situations, not merely 'comment' on the right decision. Alongside the subtests, a supplementary scale of 'intellectual disposition', called 'Actively Open-Minded Thinking' or 'AOT', is also measured. It correlates with most of the subtests and explains part of the variation in performance beyond intelligence.

Here, however, we must note that CART has no structure that separates errors caused by a 'lack of mindware' from errors caused by a 'lack of disposition' in a causal way. What the tool provides is a 'statistical correlation between performance and intellectual disposition', not a 'structural separation of the sources of error'. This correlation does not prove complete independence between them either, and this article does not build on it. What the article really needs (and presents in Section 2) is the claim at the 'intervention level'.

Even so, the claim at the 'trait level' is not without support. West, Meserve and Stanovich showed in 2012 that higher cognitive sophistication does not reduce the 'bias blind spot': more intelligent people, like everyone else, see their own bias less than they see the bias of others (West, Meserve & Stanovich, 2012). A year later, Stanovich, West and Toplak showed that 'myside bias', the tendency to evaluate evidence and arguments in favour of one's existing beliefs, is also largely independent of intelligence (Stanovich, West & Toplak, 2013).

These two findings concern intelligence and bias, not critical thinking skill and disposition. So they offer only an analogy to the 'trait-level' claim. The analogy is instructive, though: higher intelligence reduces neither the bias blind spot nor myside bias. In other words, greater cognitive capacity, by itself, does not build an inclination towards impartiality. We should see this gap as deeper than a simple one-way relationship.

It is worth adding that this empirical framework, although more precise and more measurable than Facione's concept, is not a full replacement for it. It is an empirical refinement of the same 'skill/disposition' distinction that the critical thinking literature has known since the 1990s.

If this distinction is right, it follows that no test or course that only measures or strengthens skill can, on its own, guarantee that a person will act impartially at the moment of real action. One question remains: why does strengthening skill not, by itself, lead to strengthening disposition? That is the subject of the next section.

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2. Why Having Skill Does Not Necessarily Lead to Epistemic Disposition

The previous section formulated the gap at the conceptual level. This section asks: what trace does this gap leave in practice?

What follows draws on two independent lines of evidence. It does not offer a single, unified, proven mechanism that explains the gap at its root. As we shall see, each line has its own limits. Their value lies in their partial convergence, not in the certainty of either one alone.

2.1. Domain-Dependence of Transfer

In 2007, Daniel Willingham published an influential article in American Educator, 'Critical Thinking: Why Is It So Hard to Teach?' (Willingham, 2007). He argues that critical thinking is

not, as people commonly assume, a general, transferable skill. It is deeply 'domain-dependent'. A person's ability to spot a faulty argument in one domain does not transfer automatically to another domain, unless the person also has enough background knowledge in the second domain. According to Willingham, the reason lies in how memory works. Recognising that 'this situation calls for this kind of analysis' is itself a 'pattern recognition' in memory, and such a pattern forms only through earlier experience of similar situations in the same domain. So dependence on experience is not a rival explanation to the memory account. It is the same mechanism: without experience in that specific domain, memory has nothing to recognise.

To illustrate Willingham's claim, consider a radiologist who may have a very high 'analytical skill' in reading the patterns of a medical image. Yet when the same person faces statistics about a nuclear or economic policy, they no longer show that analytical precision, because they lack the background knowledge that this unfamiliar domain requires.

On its own, this finding still says nothing about 'epistemic disposition'. Its subject is the transfer of the skill itself. Its link to this article's thesis is not a logical inference but an analogy and a warning, and we must state the reason for the analogy precisely:

Skill is relatively procedural knowledge that people can practise. Disposition is a stable trait, not a separate technique that people can practise. So we would expect skill to transfer from one domain to another more easily than disposition. If even skill does not transfer easily without domain-specific background knowledge, optimism about the automatic transfer of disposition has no support.

This is an analogical argument, not a proof. The premise that 'skill transfers more easily than disposition' has no direct evidence itself, and the difficulty of transferring skill does not logically guarantee a difficulty of transferring disposition. It only weakens the optimistic expectation.

Here we must add that Willingham's claim of domain-dependence has no unified consensus in the field. The disagreement between McPeck and Ennis shows this. In 1981, well before Willingham, McPeck had already made a similar argument that critical thinking depends on the domain (McPeck, 1981). Later, Ennis replied to McPeck's argument and proposed a different, middle position (Ennis, 1989).

According to Ennis, McPeck's claim is neither entirely right nor entirely wrong, and we must distinguish two groups of components of critical thinking. Some, such as the logical evaluation of an argument (judging whether a conclusion follows properly from its premises, or whether a fallacy is at work), are relatively general and transferable.

Others, such as knowing what kind of evidence counts as valid in a given field (medicine, law or physics, for example), are inherently domain-dependent. This disagreement shows that the claim of complete domain-dependence remains contested.

Besides these, in the 1990s Perkins, Jay and Tishman proposed a three-part framework for 'disposition' itself (Perkins, Jay & Tishman, 1993). We must note, however, that these three are not three parallel parts standing beside disposition. They are the three components that make up disposition. In other words, on these researchers' view, disposition is not something separate from the three but the result of combining them:

• 'ability';

• 'inclination': the momentary motivational pull that we mentioned earlier;

• ‘sensitivity’: the capacity to recognise that this moment is a moment for applying critical thinking.

In this framework, a person may have both the skill and a ‘general inclination towards impartiality’ (two of the three components of disposition) and still fail in evaluation and judgement, because they lack the third component, ‘sensitivity’. They never noticed that the situation in front of them called for analysis and critical thinking. This third layer deepens the gap that this article discusses, and does not make it fainter.

2.2. Quantitative Evidence: The Trainability Gap

Does the gap between skill and disposition also leave a measurable trace at the ‘intervention level’ (the level that we separated from the ‘trait level’ in Section 1)? Here we can turn to the 2015 meta-analysis of Abrami and colleagues (Abrami et al., 2015). It combined 341 ‘effect sizes’ (not 341 studies; the number of underlying studies is smaller) on ‘the effect of educational interventions in critical thinking’. It reported three separate figures (not two, as it might first appear). These figures are ‘effect sizes’, or g. The larger they are, the stronger the effect of teaching (about 0.2 counts as small, about 0.5 as medium and about 0.8 as large).

The meta-analysis of Abrami and colleagues found:

• Overall effect on skill: g = 0.30.

• Effect on skill, only where the test measured exactly the content that had been taught: g = 0.57 (probably higher, in part, because the test measures exactly what was practised).

• Effect on disposition: g = 0.23.

A fair comparison sets the overall effect on skill (0.30) against the effect on disposition (0.23), not the higher figure of 0.57, which is larger only because the test matches the content of the teaching exactly. On this comparison, the difference is only about 0.07 (much smaller than the unfair comparison of 0.57 with 0.23 suggests). Interestingly, the authors of the meta-analysis are more optimistic than this article, and they even judge the effect on disposition ‘noteworthy’.

This small difference is consistent with the direction of this article’s claim, but it is not enough to prove it. The two figures say only that, on average, interventions measured on disposition had slightly less effect than interventions measured on skill. We cannot conclude from them that strengthening skill does not strengthen disposition. That claim needs evidence of a different kind (measuring skill and disposition in the same sample, before and after training), which this article does not present.

Two cautions are also needed:

First, the two figures come from two different sets of studies, not from a within-study comparison. So we cannot say with confidence that the difference is statistically significant.

Second, the authors of the meta-analysis excluded some weaker research designs. This usually makes the effect size smaller, not larger, because weaker designs often overestimate the effect.

2.3. Does the Pennycook/Kahan Tension Clarify the Mechanism of This Gap?

The first article (in Section 2.4) briefly pointed to a tension. Pennycook and Rand (2019) showed that a greater tendency towards analytical thinking goes with better discrimination between true and false news (Pennycook & Rand, 2019). Kahan and colleagues, by contrast, showed that higher

cognitive ability, on identity-linked issues, does not reduce polarisation but increases it (Kahan et al., 2017a).

The natural temptation is for this article to present the same tension as a 'mechanistic explanation' of the skill/disposition gap. A closer search, though, shows that this explanation is much less clean than it first appears.

In 2020, Tappin, Pennycook and Rand addressed exactly this question (Tappin, Pennycook & Rand, 2020). They found little evidence that greater analytical thinking leads to more biased processing of political information. On the contrary, greater analytical thinking went with posterior beliefs closer to an impartial Bayesian benchmark. This finding contradicts the common reading of Kahan (2017) directly.

Kahan's own 'motivated numeracy effect' has also not had a uniform fate in replications. Ballarini and Sloman did not reproduce it (Ballarini & Sloman, 2017). Connor, Sullivan, Alfano and Tintarev, with a European sample, reproduced the 'main effect' but found no evidence that people with higher numeracy polarise more (Connor, Sullivan, Alfano & Tintarev, 2024).

The result is that the Pennycook/Kahan tension, far from supplying a clear mechanism for the skill/disposition gap, is itself the site of a live and unresolved dispute. This article therefore does not use this tension as a 'final explanation'.

Even so, another study from Kahan's group offers a closer test of this article's thesis. In 2017, Kahan, Jamieson, Landrum, Carpenter and Helft showed that 'science literacy' (a skill) does not reduce political polarisation, but 'science curiosity' does (Kahan, Jamieson, Landrum, Carpenter & Helft, 2017b). Curiosity is closer to a disposition, because it is a lasting inclination to seek out new information, not an ability that one can test. We can regard this as the most precise direct test of the skill/disposition thesis in the existing literature. One caveat applies: this finding comes from the same research group as Kahan's other work, and it has not yet had a wide independent replication.

So the quantitative evidence of this section (both Abrami's meta-analysis and the Pennycook/Kahan tension) shows that the skill/disposition gap, if it is real, is smaller, more fragile and less uniform than first intuition or a selective reading of one study suggests. Any argument built on these data must carry the same caution.

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3. Weaponising the Disposition Label in Identity Conflicts

The previous section examined the skill/disposition gap at the level of statistical evidence: is the gap real in population data? With all the necessary caution, the answer was yes. But this statistical answer leaves another question open. It arises in everyday practice, not in the laboratory. When two people disagree on an issue, and one accuses the other of lacking 'epistemic disposition', what does the accusation do? Is it an accurate description of the other side's behaviour, or is it itself a tool for winning the quarrel?

Indirect evidence also strengthens this possibility. Kennedy and Schweitzer showed that accusing another person of unethical behaviour raises observers' trust in the accuser, regardless of whether the accusation is true (Kennedy & Schweitzer, 2018). The incentive is independent of the truth of the accusation.

3.1. From Criticising an Argument to Accusing a Disposition

Taber and Lodge showed that, in evaluating political arguments, people rate arguments that align with their own attitudes as stronger. The same argument is judged differently depending on which political side it suits (Taber & Lodge, 2006). Kahan and colleagues also showed that higher cognitive ability, on identity-linked issues, does not reduce polarisation but increases it (Kahan et al., 2017a). As we saw in Section 2.3, though, this finding is still disputed and we must read it with caution.

On this article's view, both findings, even in their most cautious versions, confirm a familiar behavioural pattern: in the 'identity field', people readily see their rivals as 'biased'. This article adds a more precise question:

When we attribute this bias to a rival, exactly what have we accused them of?

The literature on the epistemology of 'vice' gives the answer a precise name: 'vice-charging'. This means accusing another person of having an 'epistemic vice' (narrow-mindedness, epistemic indifference and, in the language of this article, a lack of truth-seeking disposition) instead of criticising the content of their argument.

Kidd formulated this concept in 2016 in The Monist (Kidd, 2016). It fits the wider classification of 'intellectual vices' that Cassam offered in 2019 (Cassam, 2019), meaning traits that 'systematically obstruct the gaining, keeping or sharing of knowledge', such as gullibility, prejudice or closed-mindedness. In 2025, Dunne developed the same concept further in Think (Dunne, 2025). It should be added that Kidd himself holds that a charge of 'vice' is not always false or made in bad faith. In his view, such a charge can sometimes be justified, even necessary, when it comes with enough evidence and due caution. This article shares this cautious position. What it criticises is the careless use of the charge, not the possibility of the charge itself.

3.2. Why This Charge Is More Dangerous than the Two Earlier Charges

In the two earlier articles of this trilogy, we saw that the labels 'fallacy' and 'bias' can become hidden tools of personal attack when people use them without specific evidence (Jussim describes this for 'confirmation bias' in an unrefereed piece; Jussim, 2019). On this article's view, though, that defect is mainly a 'defect of practice', not a 'defect of principle'. In those cases, the necessary evidence (the form of the argument, or the full distribution of the data) exists and is available for checking. The problem is only that, in practice, few people take the trouble to check. The distinction is one of degree, not of kind. The charge of 'bias' also points to an inner process. But Jussim's criterion for it (selectivity, blind spots, selective rigour) refers to patterns that, at least in part, show in the text itself.

The charge of 'lacking epistemic disposition' is different. Even if someone tries honestly and carefully to bring evidence for a charge of intellectual vice, they face this difficulty: the subject of the claim (a person's inner intention at a single moment) is by nature something that we cannot confirm or refute with certainty. In other words, any sign that the accused offers as a reason to believe in their impartiality can be reinterpreted as an inner intention or a prior motive.

We should not stretch this claim to 'disposition is in principle unmeasurable'. As Sections 1 and 5 showed, structured, multi-item tools can measure disposition to some degree at the individual level (CART is performance-based, but AOT is a self-report scale and its validity is more limited). What is not available is a measure based on a 'single behaviour'.

The key point is that such a measurement, by its nature, cannot be run in a live argument. Nobody in the middle of a heated debate sits the other person down to answer dozens of CART or AOT items. So the real gap is not an absolute lack of evidence. It lies between the evidence we need

(structured, multi-item assessment) and the evidence we use in practice (a single behaviour). This gap does not exist for fallacies, because the form of the argument is available right there, in the text of the debate itself. This very gap makes the charge of 'lacking epistemic disposition' more dangerous in everyday practice than the charge of fallacy.

This claim (that sufficient evidence is unavailable in the moment of a live argument) is not absolute either. Disposition is not directly observable. But, as we said earlier, we can cautiously infer it from a pattern of behaviour over time. What this section rejects is not every kind of inference. It rejects the charge made at a single moment, over a single position, without such a long pattern.

For example, two people are arguing about a party-political position in a heated social media debate. One says: 'The other side does not agree with this argument, so they lack an impartial disposition.' This is exactly the abuse that this section warns against. But suppose the same person, over months and across different topics, repeatedly accepts only evidence that fits their predetermined position. That pattern (and not the single debate) is far more defensible evidence.

From this perspective, before accusing anyone of 'lacking disposition', we might do well to ask ourselves: is this a single instance or a pattern over time? Only the second answer turns the charge from a likely personal attack into a defensible claim. One caveat applies: the accuser usually builds the pattern, and the accuser too is exposed to selective memory and confirmation bias. So the claimed pattern should rest on recorded, checkable instances, not on a general impression.

3.3. The Other Half of the Story: 'Skill' as a Tool of Self-Defence

In the earlier sections we saw that the charge of 'lacking disposition' can become a personal attack. But we should also consider that building and voicing such a charge itself needs 'reasoning skill'. Here, lacking skill is not the target of the accusation. Rather, it seems that reasoning skill itself can become a tool for attacking another person's disposition, and a more skilled person can make the charge look more justified and more convincing. But the other half of the story (perhaps the more dangerous half) is that the same skill can also serve as a shield for defending a person's own beliefs.

This link between higher skill and its use as a tool to attack another person's disposition has not yet been tested directly. What we have is indirect evidence from the literature on source credibility in 'persuasion research'. For example, Hovland and Weiss (Hovland & Weiss, 1951) and Pornpitakpan (Pornpitakpan, 2004) have shown that higher perceived expertise and credibility in a speaker make their message (including their claims) more persuasive, although the size of this effect is usually small and depends on context. This research concerns the perceived credibility of the speaker, not their reasoning skill, so its link to the claim above is not direct. From this general finding we can infer, though not test, that a more skilled person makes the charge of 'lacking disposition' look more justified.

Next, we should mention Mercier and Sperber. In their 'argumentative theory', they believe that the capacity to reason evolved, from an evolutionary standpoint, mainly to persuade others and to defend one's own position, not to reach the truth alone (Mercier & Sperber, 2017).

If this theory is right, the skill/disposition gap is no longer a 'random anomaly'. It is a 'default function of the mind'. The same skill that makes a person sharp in criticising a rival's argument also serves to justify that person's own beliefs, and the two uses share one root. This makes skill ambiguous rather than neutral. It also tells us that critical thinking skill, without the epistemic disposition that goes with it, is not necessarily better than having no skill at all. Sometimes it

becomes a more sophisticated tool for the same partisanship, because it makes a person more skilled at justifying themselves.

The first article gave a clear example of this pattern in its discussion of tobacco industry experts. There we see people with the highest level of methodological skill who used exactly this skill to manufacture doubt, not to reach the truth. Skill was not what they lacked. We cannot put their use of skill for doubt down only to a lack of disposition, because financial and organisational incentives and a lack of independence from vested interests were also at work. This example concerns skill used in the service of a goal other than truth. It says nothing about the disposition or intentions of particular individuals.

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4. Why Skill Can Be Packaged but Disposition Cannot

The first article of this trilogy showed why list-based knowledge of fallacies took the form of posters that people share. The reward structure of platforms favours content that is quick, visual and shareable. This article does not repeat that argument. What it adds concerns the nature of the thing to be packaged.

Skill, as training programmes present it, looks like procedural and somewhat discrete knowledge. (Willingham, as we saw in Section 2, says that critical thinking in practice is not so discrete and independent of domain knowledge. What gets packaged is the outward form of skill, not skill itself.) We can divide it into separate, named items: a fallacy, a bias, a technique for evaluating arguments. This apparent discreteness is what lets skill take the form of a list, a checklist or a poster, that is, be packageable.

Here we must be precise. Being packageable does not mean that real skill is being taught. The first and second articles showed exactly that knowing the name of a fallacy or a bias does not, on its own, build the real skill of recognising it. What this section says is something else. Whether or not packaged content builds real skill, it is the list-like format itself that turns this content into the kind that platforms prefer (quick, visual, shareable).

Disposition is of a different kind. It is not a technique that we can list. It is a stable, long-term orientation in how a person deals with evidence. We cannot fit it, in its full sense, onto a one-page poster. A ‘poster of ten signs of an open mind’ can be made. Reading it can even produce a display of disposition: readers can use the right words and pretend to have an ‘open mind’. This is in fact one of the easiest things to do. But what such a poster cannot produce is disposition itself: a stable pattern of behaviour in real situations, which does not form in a single moment of reading.

In short, the apparent discreteness of skill (which makes packaging possible) and the continuous, long-term nature of disposition (which makes packaging hard) may be part of the explanation for the current pattern in the content market. This is an explanatory and untested hypothesis. None of the figures in Section 2 confirms or rejects it, because those figures concern the effect of training, not the market.

To test the scope of this hypothesis, we should ask: is intervening in a stable attitude always ineffective?

The meta-analysis of Sisk and colleagues (Sisk et al., 2018) covered ‘growth mindset’ interventions (growth mindset is a stable attitude, not a procedural skill). It found a very small effect of the intervention on academic achievement ($d \approx 0.08$), and a weak correlation between growth mindset and achievement ($r \approx 0.10$). These figures give the effect on academic grades, not

a change in the attitude itself, and growth mindset is not an epistemic disposition. So they are indirect, analogical evidence. Even so, their direction is not inconsistent with the hypothesis that disposition cannot be packaged: short, standard interventions in stable attitudes have had negligible effects.

So, in the end, we can say that the packageability hypothesis is an acceptable explanation of the current pattern, not a law that makes every attitude unpackageable for ever. We should take it seriously to that extent and within those limits, and no further.

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5. Opposing Evidence: Can Disposition Be Taught, and Under What Conditions?

The previous section raised a hypothesis: skill is packageable and disposition is not, and this difference partly explains why one becomes poster content and the other does not. The indirect evidence of that section (growth mindset) also showed a very small effect. The natural next question is whether epistemic disposition itself, under some conditions, can be taught.

Three lines of evidence bear on this question, though none gives a definite answer.

First. When an intervention targets disposition itself directly, at least one study has reported a measurable effect.

In 2025, Biddlestone, Ziemer, Maertens, Roozenbeek and van der Linden ran two preregistered online studies (about 926 participants). They did not teach a specific technique. They targeted the 'actively open-minded thinking' style (AOT) directly, with a short message that made people aware of five 'cognitive slips' (Biddlestone, Ziemer, Maertens, Roozenbeek & van der Linden, 2025).

The intervention group discriminated real news from fake news better and shared fake news less. According to the authors, the improvement came mainly from strengthening the AOT style itself.

Several cautions are needed here. Van der Linden is the researcher who, in the first article, appeared as the designer of the game Bad News, and here he again evaluates an intervention that he designed himself. This is not necessarily a sign of bias on his part. But the absence of independent evaluation, and the fact that measurement came straight after the intervention with no long-term follow-up, are important points to bear in mind.

Second, when a programme claims to 'cultivate disposition' without an independent measurement tool, the claim remains in practice untestable.

Moreover, if a short online message changes 'disposition', what was measured is probably a temporary attitude or readiness, not the stable orientation that we defined in the introduction. And AOT is itself a self-report scale. So this evidence does not concern a change in stable disposition. It concerns the short-term effect of an intervention on a self-reported attitude and on the discrimination of news.

In this connection, Nieto and Saiz re-examined Halpern's 'structural component' with 112 students (Nieto & Saiz, 2008). No direct tool for measuring disposition had been used. The closest test (a questionnaire of beliefs and attitudes) showed no significant difference between the groups. The design was also quasi-experimental, and the instructor was the first author of the paper.

Third, when measurement is only self-report and has no control group, the result remains promising but inconclusive. For example, Thome and colleagues, in a 2025 study of 138 students, found a significant improvement in self-reported scores of critical thinking disposition after a

course. But the study had no control group and no measure other than self-report (Thome et al., 2025).

These three pictures make the picture from Abrami's meta-analysis more precise: disposition is not unteachable, but the existing evidence is limited. Only in one case (a direct intervention on AOT) has an effect been reported, and in the other two, the lack of evidence cannot be separated from a lack of effect. We must distinguish two things: what an intervention needs in order to work, and what we need in order to prove that it works. On the first, these three studies show nothing, except that the only positive evidence comes from an intervention that targeted disposition directly, and no evidence shows that teaching skill alone guarantees it. On the second, we can be firmer: a claim to cultivate disposition, without a measure independent of self-report, has no validity.

Most current 'critical thinking' programmes, which are mainly built around skill, do not meet both of these requirements at once: direct targeting of disposition, and measurement independent of self-report. This is exactly where the article's main thread reaches its conclusion:

Skill can be offered, and (at least in appearance) measured, in a course, a poster or even a short test. As for disposition, if we really want to cultivate it, the existing evidence leads us to target it directly from the start, independently of skill, not in the hope that learning skill will, by itself, bring that epistemic disposition with it.

Conclusion

The article began with a question: if a person has critical thinking skill in its full, academic sense, is that enough?

The answer built over the five sections is no. As the article stressed repeatedly, this negative answer does not mean that skill is useless, or that it is wholly separate from disposition. It means that a gap lies between the two, a gap that is neither accidental nor ignorable.

Section 1 formulated this gap in Stanovich's theoretical framework: just as high intelligence does not guarantee rationality, critical thinking skill, on its own, does not guarantee epistemic disposition.

Section 2 showed that the gap also leaves a trace in practice. It appears in quantitative data (a small difference, not tested statistically, between the training effects on skill and on disposition in Abrami's meta-analysis) and in plausible theoretical mechanisms (the domain-dependence of skill in Willingham, which shows that even skill does not transfer easily, let alone disposition).

Section 3 took the gap from the laboratory to everyday life. It showed that the charge of 'lacking disposition' (compared with the charge of fallacy, and to some degree of bias) is hard to prove or to refute decisively, and this makes it a dangerous tool of personal attack. At the same time, higher reasoning skill can both make this charge look more justified and become a shield for a person's own beliefs.

Section 4 offered an explanation of the market asymmetry between the two components. Skill, because of its apparent discreteness, can be packaged in lists and posters. Disposition, because it is continuous and long-term, cannot.

Section 5 added an honest limit to all of this: 'disposition is not unteachable'. Three lines of evidence (a direct intervention on AOT, the need for independent measurement, and the weakness of self-report) showed that only the intervention that targeted disposition directly reported an

effect, and that the validity of any claim to cultivate disposition depends on measurement independent of self-report. This finding does not refute Section 4. It limits it: the hypothesis that disposition cannot be packaged explains the current pattern in the content market. It is not a law that dooms every attempt to cultivate disposition to failure.

So we can state the article's final conclusion as follows. The gap between skill and disposition is probable and traceable in the existing evidence, with all the cautions noted above, but its fate is not fixed in advance. What probably closes the gap is not the mere passing of time or repeated training in skill. It is deliberate design that, from the start, targets disposition independently of skill and measures it by means other than self-report. The absence of such design is not a widespread moral failing. It is a programme defect in most current 'critical thinking' training, which is built mainly around skill and expects, at best, an automatic effect on disposition.

This conclusion brings the trilogy 'The Illusion of Sufficiency' to a natural end.

• The first article showed that knowing the name of a fallacy is not enough.

• The second showed that knowing the name of a bias is not enough either.

• This article has shown that even critical thinking skill itself, in full and with no limit of coverage, is still not enough.

In all three cases, what goes missing between 'knowing' or 'being able' and 'applying impartially at the moment of action' is not more content or more skill. It is a lasting inclination, which we must cultivate separately and honestly, not in the hope that learning ever more knowledge or skill will bring it with it.

And after all these discussions, one last word: knowing is not being able, and being able is not applying. Between these three lies a bridge called wanting, which belongs to a person's epistemic disposition. From this view, perhaps the ignorance of our age is explained not only by a lack of knowledge or skill but also by a lack of epistemic disposition; and we must cultivate this disposition deliberately and separately...

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