Cognitive contours: recent work on cross-cultural psychology and its relevance for education

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Abstract   This paper outlines new work in cross-cultural psychology largely drawn from Nisbett, Choi, and Smith (*Cognition, 65*, 15–32, 1997); Nisbett, Peng, Choi, & Norenzayan, *Psychological Review, 108*(2), 291–310, 2001; Nisbett, *The Geography of Thought: How Asians and Westerners Think Differently...and Why*. New York: Free Press 2003), Ji, Zhang and Nisbett (*Journal of Personality and Social Psychology, 87*(1), 57–65, 2004), Norenzayan (2000) and Peng (*Naive Dialecticism and its Effects on Reasoning and Judgement about Contradiction*. University of Michigan, Ann Arbor, Michigan 1997) Peng and Nisbett (*Cross-Cultural Similarities and Differences in the Understanding of Physical Causality*. Paper presented at the Science and Culture: Proceedings of the Seventh Interdisciplinary Conference on Science and Culture, Frankfort, K. Y. 1996), and Peng, Ames, & Knowles (Culture and Human Inference: Perspectives from three traditions. In: D. Matsumoto (Ed.), *Handbook of Cross-Cultural Psychology* (pp. 1–2). Oxford: Oxford University Press 2000). The paper argues that the findings on cultural influences on inference-making have implications for teaching and education generally, and specifically for the debate on conceptions and misconceptions of Asian students studying in western tertiary institutions around the world. The position defended is that, while there seems to be compelling empirical evidence for intercultural differences in thought patterns, these patterns are, for the most part, insignificant in everyday exchanges, though language and culture might subtlety modulate our inference-making at the margins. Linguistic determinism however is not defended. Nonetheless, the evidence provides food for thought, and it needs to inform the recent debates about international students studying overseas.

Keywords   Inference-making · Critical thinking · Argument · Linguistic determinism · Linguistic relativism

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Introduction

The discipline of psychology has recently undergone something of a minor revolution. In the past it has been assumed that thinking skills are largely culturally invariant (Cole, 1996), it now appears that psychologists are taking the assumption seriously that culture *does* influence thinking patterns, and in quite interesting ways. It is, moreover, becoming clear to some, namely Nisbett (Nisbett, Choi, & Smith, 1997; Nisbett, 2003), Ji, Zhang and Nisbett (2004), Norenzayan (2001), Norenzayan, Smith, Kim, & Nisbett (2002), and Peng (1997), Peng and Nisbett (1996), Peng, Ames, & Knowles (2000) that there are significant intercultural differences in thinking patterns between Asian and Western peoples, and that these are determined to a large extent by the cultural background; and, specifically, the influence of the first language of those cultures. Clearly, if true, then there might be expected to be a corresponding influence on students' adaptation to learning and literacy and higher education. This paper will investigate the claims with particular reference to the debate on conceptions and misconceptions about Asian students studying in western tertiary institutions in countries such as the US, the UK, Australia, Canada and New Zealand.

An old chestnut: the Sapir–Whorf hypothesis

Whenever the subject of culture and language are raised in the same breath, it invariably raises an old chestnut. It is best to deal with this first. The infamous Sapir–Whorf hypothesis (Whorf, 1962b)—now widely discredited (Davidson, 1984; Devitt & Sterelny, 1997; Gellatly, 1995; Pinker, 1994)—outlined the view of *linguistic determinism:* the idea that reality was constructed, in large measure, by the language used and that language forces us to think about the world in different—culturally-defined ways. However, there are two separate theses here that need to be separated.

Linguistic determinism

Early discussions on this topic often conflate a ''strong'' and ''weak'' version of linguistic determinism. The weak version is certainly plausible, the strong version isn't. In its strongest form, linguistic determinism claims that the world is largely *identical* to language commitments about the world; in its weakest form, it simply states that language *influences* how we think about the world (this seems uncontroversial).

   We need to be clear about the differences between the strong and weak versions of this doctrine. The evidence raised later will impinge on this old debate in surprising ways. In the following infamous passage, anthropologist and linguist Benjamin Lee Whorf refers to the language and ''metaphysical commitments'' (world view) of Hopi Indians:

> I find it gratuitous to assume that a Hopi who knows only the Hopi language and the cultural ideas of his own society has the same notions, often supposed to be intuitions, of time and space that we have, and that are generally assumed

to be universal. In particular, he has no general notion or intuition of TIME as a smooth flowing continuum in which everything in the universe proceeds at an equal rate, out of a future, through a present, into a past; or, in which, to reverse the picture, the observer is being carried into the stream of duration continuously away from a past and into a future. After long and careful study and analysis, the Hopi language is seen to contain no words, grammatical forms, constructions or expressions that refer directly to what we call "time" or to past, present, or future, or to enduring or lasting, or to motion as kinematic rather than dynamic... The relativity viewpoint of modern physics is one such view, conceived in mathematical terms, and the Hopi *Weltanschauung* is another and quite different one, non-mathematical and linguistic. Thus, the Hopi language and culture conceals a METAPHYSIC, such as our so-called naive view of space and time does, or as the relativity theory does; yet it is a different metaphysics from either. In order to describe the structure of the universe according to the Hopi, it is necessary to attempt—insofar as it is possible—to make explicit this metaphysics, properly describable only in Hopi language, by means of an approximation expressed in our own language, somewhat inadequately it is true, yet by availing ourselves of such concepts as we have worked up into relative consonance with the system underlying the Hopi view of the universe. In this Hopi view, time disappears and space is altered, so that it is no longer the homogeneous and instantaneous timeless space of our supposed intuition or of classical Newtonian mechanics (Whorf, 1962b).

It is fairly easy to see that Whorf is endorsing the strong thesis of linguistic determinism here. Moreover, he makes several points that, on the face of it, seem surprisingly lacking in either rigour or evidential support. His argument can be broken down into five separate claims.

1. He asserts that it is a gratuitous assumption that the Hopi think and view reality as we do. This seems reasonable. However, he then makes an equally gratuitous assumption that the Hopi have a *different* conception of the reality of time from our own (this surely requires further argument).
2. He then claims that absence of appropriate temporal terms in the Hopi language is evidence of this (without argument).
3. He then goes on to claim that it is *only by means of the Hopi language* is it possible to "make explicit" the metaphysical views of the Hopi (regarding the concept of time).
4. Elsewhere, Whorf claims that the languages Hopi and English cannot be "calibrated" (Whorf, 1962a) and yet he uses English to outline the differences. As Davidson has reminded us, claims such as these belie an underlying paradox. The assumption of different conceptual schemes takes for granted 'a common coordinate system on which to plot them' (Davidson, 1984).
5. Finally, Whorf asserts that, for the Hopi, there are significant ontological consequences of having such a temporally-deprived language, and that there is not only a difference in language use, but a corresponding difference in *reality*. For the Hopi (and not us Newtonian-educated English speakers) time "disappears" and space is "altered".

Linguistic determinism can be defined formally as follows: *Strong version:* The theory that language (1) determines how we *think* about the world; and (2) one's experience is identical to language commitments about the world. For Whorf the temporally-deprived language of the Hopi leads to a temporally deprived world-view. *Weak version:* The theory that language *influences* how we think about the world. Whorf clearly adopts the strong version of linguistic determinism. He thinks that Hopi metaphysics results in quite a literally different "universe" for the Hopi, but he offers very little in the way of argument to accept this claim.

Linguistic relativism

A second view about the relationship between language, culture and the world that is often confused with linguistic determinism is the theory of *linguistic relativism*. This is the view that different cultures have different conceptual frameworks and these frameworks *shape* our view of reality, but do not shape reality itself. Different languages convey different theoretical views of reality and the world because they are informed by different conceptual frameworks which are particular to given languages. In other words, some concepts are relative to the language one expresses them in (I am reminded of Robert Dessaix's example of the bilingual Russian writer, Andrei Markin, who, when asked—in French—how many friends he had in Paris, replied "scarcely any *amis*". When asked the same question in Russian: "How many *druzya* do you have in Paris?", replied that he had many more!) (Dessaix, 1998).

Linguistic relativity assumes two main claims: (1) languages differ significantly in their interpretations of experience—both what they select for representation and how they arrange it; and (2) these interpretations influence thought when they are used to guide or support it (Wilson & Keil, 1999). Obviously linguistic determinism and linguistic relativism are closely connected doctrines because both concepts influence thought and both are an influence on language, and our view of the world beyond language.

However, note that linguistic relativity is not as strong as the strong version of linguistic determinism. The former thesis (i.e., linguistic relativism) makes no claim that the world is different *because* of differences in language commitments. There is no serious suggestion in Dessaix's example that Markin *literally* had *more* friends in Paris in Russian than in French. It is suggested that the concept of "friend" is different (more inclusive perhaps) in Russian than that concept of "friend" in French (I am monolingual and don't know if this is true.) Linguistic relativism states that how we view the world is informed by our concepts; which, in turn, are influenced by our language. Compare this with the example provided by Whorf. It is being seriously suggested here that because the Hopi have few temporal terms that the reality of time is different for them (Compare: employment status is *influenced* by level of education; employment status *is* level of education).

Note also that it is possible to support either view independently. For example, one can believe that aboriginal Australians have a different view of reality because they have different concepts of the genesis of animals and plants (linguistic relativism). However, it doesn't follow that aboriginals are *forced to think about and live in a different world* from the rest of us. However, this latter view is precisely what Whorf seems to believe about the Hopi Indians (linguistic determinism).

It is clear that Whorf's views are committed to *both* linguistic determinism *and* linguistic relativism. For him, the linguistic relativity of the Hopi commits them to concepts which result in a different view of reality. What relevance do these views have to education debates, especially concerning those of Asian students studying in western tertiary institutions? I will return to answer this after another brief digression.

Conceptions and misconceptions about international students

There has recently been a great deal written and published on the issue of international students studying in western educational institutions and a parallel discussion on the alleged decline of academic standards. Most of the literature I am familiar with concerns the Australian context.

These debates in the higher education literature are part of the torrent of recent material in the popular press about the decline in academic standards generally, the bleak employment future for graduates (owing to declines in the sector overall), and the explosion of ''cappuccino'' courses to cater to student demand—such as Surf Science, Brewery Studies and Makeup courses for Drag Queens.[1] Other topics cover the commercialisation of the education sector, implications of commercialisation for academic standards, the parlous future of ''pure'' research and the decline of what has been called the ''amateur spirit'' (research and pursuit of knowledge for its own sake) (Aitkin, 1997, 1999; Allen, 1999; Bradley, 2005; Biggs & Davis, 2002; Christaudo, 2002; Davies, 1999, 2000; Davis, n.d.; Ewins, 2001; Fullerton, 2005; Healy, 1999; Hinde, 1999; Illing, 2002; Jackson, 1999; Keays, 1997; Kelly, 2000; Mageean, 1996; May, 1996; McGuinness, 1999; Moritz, 2001; Olsen, 1999; Osborne, 2003; O'Reilly, 1999; Paltridge, 1999; Proctor, 2000; Puleston, 2001; Sanders, 2003; Sharrock, 2002; Smart, 1998; Smellie, 1997; Thorp, 1999; Tyre, 1999; Way, 2000). Similar debates are being held in other western countries (Clare, 1998; O'Reilly, 1999). This issue has entered the domain of the professions; in particular the Economists' Society of Australia and the Certified Practising Accountancy Society, who have both published reports on the issue (Abelson, 2004; Birrell & Rapson, 2005); the Economists Society explicitly linking the low English standards of international students and declining standards in the sector overall (Abelson, 2004). The issue has also been the subject of an Auditor-General's report (Maslen, 2002).

The debates in these two broad areas—international students studying in Australia, and the alleged decline of academic standards in the tertiary sector—are often implicitly linked, less often explicitly linked. It is often suggested that the decline in the higher education sector overall (the loss of funds for research, the decline in standards, the ''glut'' of underemployed doctoral and masters graduates, etc), is largely due to the commercialisation of education. This ''McDonaldization'' is, in turn, said to be driven largely by a ''race to the bottom'' by cash-strapped institutions, in an effort to capture the burgeoning market of full-fee paying international students (Biggs & Davis, 2002; Davis, n.d.; Hayes & Wynyard, 2002; Kayrooz, Kinnear, & Preston, 2001; Way, 2000).

How serious is the alleged problem? This writer has experience only of the Australian tertiary scene, but by all account, the same trends are happening in other

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[1] Conducted at Swinburne and Edith Cowan universities respectively (Davis, n.d., ''Drag queens learn tips of the trade'' 2003, ''Nelson aims the axe at 'cappuccino' uni courses'', 2003, ''Surfing Goes Up a Degree'')

western countries. However, I will confine myself to the situation I know about in what follows.

There is no doubt that tertiary institutions in Australia are moving from a predominantly publically-funded model to an entrepreneurial, ''market-driven'' model. This, at least, is not in question. Operating budgets from government funding has declined, by some accounts, at least 30% since the 1980s. This has forced universities to seek funding sources elsewhere—enter full-fee paying international students.

Owing to its geographical region and its relative low-cost, Australian universities are particularly attractive to Asian students. At last count, international students from Asia provided 15% of all Australian university revenue (Deumart, Marginson, Nyland, Ramia, & Sawir, 2005, ''Selected Higher Education Statistics: Department of Employment, Education and Training'', 2005). International students made up 24% of the student body in 2004 and fee income from students grew from $30 million in 1996 to $200 million in 2004. There has been a corresponding decline in public funding during the same period. The national target for revenue from international students in 2007 is around $270 million (Deumart et al., 2005, *Growing Esteem: Choices for the University of Melbourne*, 2005). Nation-wide, the figures are startling: education is now Australia's second largest export industry within the services sector and the fourth largest export earner overall (Simmonson, 2005). It contributes more than 6 billion dollars to the Australian economy (Davis, 2004). International students are expected to inject $38 billion into the economy by 2025 (Roach, 2003). In fact, demand for educational services to international students is expected to rise dramatically over the next 20 years when there is expected to be 7.2 million students from Asia studying here. By 2025, Australia's share of the global demand for educational services is expected to increase from 3% in 2000 to more than 8% (Bohm, Davis, Meares, & Pearce, 2002; Davis, 2004).

This change in the demographic of students, from a limited local market, to increasing numbers of international students (mainly from Asia) has naturally led to a number of dramatic changes in higher education. This includes the provision of very different kinds of courses catering to student needs (e.g., part-time students and semi-professionals, those looking for career advancement), changes in teaching styles (to more ''intensive'', high ''throughput'', lower-cost courses), and an increased marketing focus on achieving institutional recognition in international ''quality'' rankings of universities such as the *Shanghai Jiao Tong* and the *Times Higher Education Supplement* rankings (Davies, 2006b). Some have suggested that some of these changes have come at the expense of educational quality (Fullerton, 2005; Illing, 2002; Proctor, 2000; Way, 2000).

Critical thinking and Asian students

This paper is not concerned with the issue of tertiary commercialisation as such. Nor is it concerned with the wider issues that are involved. This paper does not even intend to assess the claim that the recent dramatic rise in the number of Asian students is partly responsible for the decline in academic standards. Other authors have noted this in the literature and it has become a recent topic of concern in the popular press (Atkins, 1999; Ballard, 1989; Ballard & Clanchy, 1991; Chalmers & Volet, 1997; Devos, 2003; Fullerton, 2005; Illing, 2002; Samuelowicz, 1987; Waller,

1991; Watkins, Reghi, & Astilla, 1991). The paper is really concerned with adding recent empirical research to the debate about Asian students studying in Australia, especially in relation to the area of ''critical thinking''.

What is the central issue? It is claimed that Asian students are not adequately prepared for tertiary study in Australia and that they fail to engage at a variety of levels with the requirements of academic study. These conceptions (or ''misconceptions'' for those who disagree) can be grouped according under the following headings:

1. Rote learning and memorisation styles
2. Passive learning and non-participation in class
3. Lack of willingness to mix with local students
4. Lack of skills for analysis and critical thinking
5. Inability to adjust their learning styles to that of the Australian context (Atkins, 1999; Chalmers & Volet, 1997).

It is often suggested that because Asian students rote learn, are generally non-participatory, are unwilling to mix with local students, lack critical skills and are unwilling (or unable) to adjust their learning styles that they fail to satisfy the requirements of higher degree study. This has had commercial implications and has influenced the nature of academic standards. Because the sector is increasingly dependent on income from full-fee paying international students, there has been—or so it is claimed—an inexorable ''dumbing down'' of assessment requirements and academic expectations overall (Clarke, 1998; Illing, 2001, 2002). This commercialisation has adversely effected the sector. As Davis has put it: 'while Australian public opinion firmly rejects the influx of refuge-seeking ''boat people'', it requires an influx of full-fee paying foreign students to shore up its ailing tertiary education structure' (Davis, n.d.)[2]

Whether all this is true or false is not at issue here. The issue to be assessed is whether there is any truth in the claims mentioned earlier about international (especially Asian) students. It is the fourth of these claims that is of particular interest in this paper: the lack of skills for analysis and critical thinking. This takes a precise form in this paper as lack of skills in *inference-making* for the purpose of argument and critical analysis. First I address the general issue of critical thinking, and second the issue of inference-making. Later, we look at some empirical support for the idea that there are inter-cultural differences in thinking patterns. This returns us to the Sapir-Whorf hypothesis with which we began.

What is critical thinking?

A key requirement for success in university study is to be skilled in the promotion of *reasonableness* (Ennis, 1962, 1985, 1987, 1990). Particularly, this means to be *critical* and *analytical* in one's approach to texts and/or experimental data. It is not much good being merely familiar with the *language* of the academic discourse if one

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[2] Elsewhere, in a lead article in *Business Review Weekly*, Way writes: 'Manipulating a vital flow of cash from fee paying students means universities are under pressure to ensure these students pass—a process academics concede privately, is ''dumbing down'' the system' (Way, 2000).

cannot critically evaluate the material in question. Critical thinking is central to academic success. Exactly what 'critically evaluate' and 'analytical' mean, however, are a matter of some debate, even if their desirability within the university context is not (Bailin & Seigel, 2003). Critical thinking—the ability to think critically—is clearly crucial in terms of learning for an unknown future. Indeed, a case could be made that it is *the* fundamental educational ideal (Bailin & Seigel, 2003).

Critical thinking is the essence of scholarly debating within all faculties of the university. This is something common to both the "hard" and "soft" sciences and the humanities alike. All disciplines require an ability to argue critically in essays, term papers or dissertations. The rules for using logical arguments in English are tacitly understood and applied by educators and academics when grading student work, and mastery of acceptable critical reasoning is considered to be essential for academic success and failure. Critical thinking, though hard to define, is vital for success at tertiary level (Atkinson, 1997; Bailin & Seigel, 2003; Benesch, 1991). Moreover, skills in critical reasoning are as important for educational success as is mastering linguistic genres associated with particular fields of study and vice-versa—both skills are equally necessary for good academic performance: 'Poor English and poor argument or analysis [are] inextricably linked' (Felix & Lawson, 1994).

While there is an important link between writing and arguing, the skills required to master both are clearly different. Well-written work can be poorly argued. For students, especially students from non-English speaking backgrounds (NESB) the "spectre" of critical thinking, not writing, is usually their single greatest fear (Felix & Lawson, 1994). There is some justification for this fear. All too often lecturers and supervisors of NESB students will complain that students' work is "all there, but lacking in argument" or that the work "seems to lack a clear critical focus" or, worse still, "is merely descriptive—contains no arguments at all" (Ballard & Clanchy, 1984, 1991; Barker, Child, Gallios, Jones, & Callen, 1991; Bradley & Bradley, 1984; Samuelowicz, 1987). This is so even for students who have otherwise exceptionally good English expression. Skills in argument and critical thinking are clearly difficult to acquire (Felix & Martin, 1991).

Difficulties in obtaining critical thinking skills are not restricted to international students, of course. Most students have trouble analysing and presenting arguments. But in the case of NESB students the situation is especially acute. Critical thinking requires hard intellectual work, and academic prose is—by its very nature—notoriously open-textured and vague (van Gelder, 2004). For international students struggling with a second language the challenges are enormous. But it is also true that critical thinking is hard even for students who are native speakers of English. Research has also confirmed what teachers of critical thinking already recognise—most people have seriously inadequate critical-thinking skills. In an extensive study of students and the general public, Kuhn (1991) found that people formed opinions readily and held to them strongly but that the majority could not provide any genuine evidence or arguments for these beliefs. Further, they did not realise this was a problem (Kuhn, 1991).

'Critical' does not mean attacking one's opponent; 'thinking' does not exactly amount to a synonym for being receptive to new ideas. Often some of the best critical thinking goes on when new ideas are rejected out of hand—for good reasons, of course. However, even those who criticise "critical thinking" rely on principles of critical thinking to do so (Bailin & Seigel, 2003). Critical thinking can be explained in terms of being *reasonable* or *rational*, but these concepts, in turn, require further

explanation. Despite vagueness about what constitutes the enterprise of 'critical thinking', there are some general points which can be made about it.

Critical thinking and logic

The first point is that 'being critical' *at least in part* is less a facility with language than a facility with *logic*. Language is, in some interesting sense, the *bearer* of logic—one cannot make logical moves without using a linguistic medium of some sort, though not necessarily a *natural* language. Language and logic are not equivalent notions though they are closely connected. The linguistic medium is, however, secondary to the content of the logical structure being expressed, and one can devise any number of ways of linguistically expressing such a structure without losing the main logical point. Just as the content of the statement 'it is raining' can be expressed as *Il pleut, Es regnet* etc., so a valid logical argument can be expressed with different languages, grammars and even (as is usually the case) with mathematical symbols.

The point here is: when dealing with the logic of thought, the medium is not as important as the *structure* of the thought being expressed and the *inferences* that are being made. Inferences are certainly not reducible in any explanatory sense to language.[3]

Independence of meaning

A second related point to note is that critical thinking is as much independent of meaning as it is independent of language. The following logical move:

All Masdocks are Primpletons

This X is a Masdock

Therefore, this X is a Primpleton

uses nouns that are utterly meaningless though it expresses a perfectly valid argument. Critical patterns of thought are, to some degree, independent of *meaning*, even if they may not be independent of the traditional 'parts of speech': nouns, verbs and so on. But, likewise, the 'parts of speech' in a natural language like English are not essential for critical patterns of thought either. We can remove the language operators here (the verb ''to be'', the articles, the quantifier—''all''—and the demonstrative pronouns) replace the nouns with symbols, join the symbols by mathematical connectors (Boolean operators) and the validity of the 'argument' remains unchanged. Strangely, though the premises of this argument are unsound

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[3] This claim overlooks a complex and much-debated issue. The issue is whether critical thinking is best understood as a *general* or a *specific* skill (i.e., largely independent of the language of the disciplines or embedded within them). This debate has important implications for the teaching of critical thinking. The ''generalists'' are described as those for whom critical thinking is a universal, general skill, and best taught accordingly in dedicated logic classes. The ''specifists'' are those for whom critical thinking ''is best conceived of as only a loose category taking in diverse modes of thought'' (Moore, 2004, p. 4), and best taught only within the language of the disciplines. Moore cites Robert Ennis (Ennis, 1985, 1987, 1992) as a defender of the former position and John McPeck as a defender of the latter position (McPeck, 1981, 1990, 1992). Others have argued that the debate between the generalists and the specifists amount to a fallacy of the false alternative (Davies, 2006a; Quinn, 1994).

because they are nonsensical, this fact does *not* affect the logical validity of the argument overall. That this 'X' is a Primpleton *follows* from the premises despite the premises being nonsense. And the 'conclusion' would continue to follow from the premises whether there were any Masdocks or Primpletons or not. The logic of the argument is undeniable, it seems, *regardless* of what you think about the premises. In an important sense, such argument structures and inferences are—at least partly—what it means to *do* "critical thinking". This seems to be so regardless of the content of what it is being expressed or its grammatical structure.

Having an argument and being rhetorical

What is meant by 'critical' in an academic context is to have supporting reasons for a position which *logically demonstrate* the point being made. This does not necessarily amount to being rhetorically convincing either (though a logically valid inference may *also* being rhetorically convincing). Rather, being able to logically demonstrate some point or other is to be able to devise workable *inferences* from plausible premises to plausible conclusions. It is this process of making plausible argumentative inferences—or, alternatively, being able to spot and criticise bad inferences (as opposed to just being rhetorically convincing)—that distinguishes the good student from the average or poor student. Students who can demonstrate the ability of doing this largely succeed in academic study in western academic institutions; students who cannot demonstrate this ability do not.

Can Asian students think critically?

In the higher education literature there have been debates about this issue. Some writers have noted the serious difficulties that Asian students have in demonstrating appropriate critical thinking skills, and have questioned their abilities (Ballard, 1989; Ballard & Clanchy, 1991; Becker, 1986; Samuelowicz, 1987; Waller, 1991).[4] Others have vehemently disagreed with this suggestion (Chalmers & Volet, 1997; Volet & Kee, 1993; Watkins et al., 1991). Others have argued for the importance of cultural "difference" in the debate and a distinction between "ability" and "ability to *demonstrate*" (Atkins, 1999).

In the popular literature, some Asian commentators have emphasised the issue of critical thinking in terms of explaining why Asian societies have "lagged behind" the west in terms of innovation and creativity (Mahbubani, 2002; Ng, 2001). Ng (2001) has even offered this as an explanation of why modern science—and geniuses such as Darwin, Newton and Einstein—did not emerge from Asian societies, but from the West. On the assumption that "critical thinking" and "creativity" can be closely associated, Logan and Hannas have both made the provocative suggestion that an explanation for lack of critical thinking and creativity in Asian societies, is a result of

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[4] Samuelowicz (1987) put the negative case clearest: 'In many Asian countries ... the intellectual skills of comparing, evaluating different points of view, arguing and presenting one's point of view are not developed' (cited in Chalmers and Volet, 1997, p. 93). The point has been made less charitably by Way: 'In my opinion, many overseas students ... simply aren't up to it. They're not capable of writing a thesis, or structuring arguments, of writing in an academically acceptable way. In many cases, supervisors end up acting as an interpreter' (Way, 2000).

different writing scripts (the phonetic alphabet fostering abstract thought, and the iconographic Asian scripts discouraging it) (Hannas, 2003; Logan, 1986).

I believe that that any ''deficit'' model—any suggestion that Asians lack the capacity of ''critical thinking''—has been largely misstated as an issue in the literature. The central issue is not so much that Asian students lack skills for critical thinking and analysis, but—if they can be said to lack skills at all—they might be said lack they *desired kind* of skills in critical thinking and analysis, i.e., they may lack *western* critical thinking skills, specifically of the form required to use western inferences (such as the example of *modus ponens* reasoning above). It this is this kind of critical thinking that is required for success in western tertiary institutions.

It is certainly clear that Asian students as are bright and capable as western students (they do as well, if not better in tests of pure mathematics and spatial reasoning tests for example). Non-native speakers of English do not have any obvious trouble doing such things. Asian students also perform very well—if not better—in mathematics tests (logical reasoning *par excellence*) than their Western counterparts (Brand, 1987; Murphy, 1987; although see Wong, 2002). (I will return to this later, see Section ''Objections''.) However, it might be fairly said that they are less well-inculcated in western patterns of critical thinking—specifically, the kind of inferences required—that is expected of them in western tertiary institutions.

This is to be expected. Logical errors presuppose a system of logical inference that can be evaluated in terms of consistency, coherence, soundness and validity. Not surprisingly, western logic arises from the minds of western thinkers from western culture: Socrates, Aristotle, Frege, Boole, Russell (among many others); 'Eastern logic'—if there is such a thing—is most likely influenced by Eastern thinkers as much as by intellectual traditions in the West (Davies, 2002). In the area of language education—and until recently, in psychology—it has been assumed that these patterns of logical inference are, by and large, immutable and invariant across cultures. Few question whether people from different cultures have trouble understanding 'western'-style arguments; a great deal of work concerns itself with the extent to which they pick up—or fail to pick up—the appropriate linguistic genres and academic learning styles—an approach known as *contrastive rhetoric*. Arguments, and the critical patterns of thought that underpin them, are assumed to be fairly much standard, even if cultural differences (such as approaches to learning), linguistic differences (such as grammars), paragraphing styles, etc., are non-standard and highly variable (Ballard, 1989; Kaplan, 1966; Kirkpatrick, 1994).[5] This assumption is now beginning to be questioned. It is now being seriously suggested that Asians and Westerners to some degree use different patterns of reasoning and make different inferential connections (see Section ''Evidence of differences in inference making'').

Revisiting the Sapir-Whorf hypothesis

Perhaps patterns of reasoning are, like many things, influenced by culture. Here are two ways one could run this argument.

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[5] To take one interesting example, Kirkpatrick (1994) has found that the use of ''advanced organizers'' (words like ''because'') is used differently in English and Chinese, with the words either pointing ''forwards'' or ''backwards'' in the sentence, depending on the language. This can lead to a quite different sense of information priority (Davies, 2002).

A radical view: linguistic determinism

A very radical view might be that there is radical difference in the pattern of logical inferences in their respective arguments. This view assumes that inference patterns and language use are quite different features of our respective cognitive architectures. However, this view also assumes there is a close connection between language, culture and thinking. Indeed, language *determines* how we think about the world. Growing up as a speaker in one language culture means one invariably grows up thinking in a certain way. This kind of position is of course indentical to *linguistic determinism*, famously outlined in the Sapir-Whorf hypothesis (Whorf, 1962b). I have already outlined in general terms what is wrong with the radical form of this thesis (Section 2).

A subtle view: the modulation thesis

Another possible interpretation, however, is that there are some subtle, but important cultural differences in the logical patterns used, but these differences are usually insignificant in conversational exchanges; and, for the most part, we hardly notice them. That is, cultural influences subtlety *modulate* how we understand and construct logical arguments by means of language. This seems plausible at least. Philosophers are aware that there are different ''logics'': relevance, para-consistent, modal, propositional and Aristotelian logics; and so on. Even within the same kind of logical system—Aristotle's and Frege's accounts, for example—formal systems of logic differ on important points. So there could, in principle, be situation in which two individuals share frameworks of higher order logical systems though they differ subtlety at lower levels. To avoid any association with this much maligned Sapir-Whorf hypothesis, let's call this the ''modulation thesis''. Culture might modulate thinking patterns at the margins, even though, for all practical purposes, we all share the same system of what constitutes reasonable inferences. We will see examples of this subtle modulation shortly (Section ''Evidence of differences in inference making'').

There seems to be no compelling reason to think that *profound* inter-cultural differences in inference patterns exist. Systems of logical inference are so crucial for conducting our everyday lives, that radical inter-cultural differences would result in an inability to do even the most basic things (catching a bus, for example which requires a sophisticated understanding of conditional inferences: ''If that was the 10.45 I just missed, and the 10.45 is prior to the 10.50, it follows that ...''). Non-native speakers of English do not have any obvious trouble doing such things. Hence, it is fairly plain that their thought-patterns, for Davidsonian reasons, are at least *roughly* similar to our own. Just as we need a common coordinate system to understand each other's conceptual schemes, so we need a common inferential system. This is a necessary, though perhaps not sufficient, condition for communication to occur (Davidson, 2001a).

But although there may not be radical differences, it still seems logically possible that there may be subtle, yet significant, differences. That is, the modulation thesis still could be true. It would be rather remarkable if there were no differences at all in inference patterns between speakers of other languages given the large number of other important differences that also have an important bearing on language learning. Recently it has been argued that the linguistic relativity of colour terms has some supporting empirical evidence, although radical linguistic relativity does not

(Davies, 1998a, 1998b). One's cultural background apparently subtlety modulates how we use and apply colour terms to experienced coloured patches. Perhaps something like this is true in the case of reasoning patterns. Reasoning could be, like colour grouping: ''modulated at the margins'' by cultural factors.

Inference-making: the essence of critical thinking

I am concerned in this paper with *inferential* and not *grammatical* differences in thought-patterns. There is plenty of other work being done by linguists on grammatical features of L1 languages which influence how students think, and how they learn and use English. Although the distinction between grammars and logical inferences is not as clear as it could be, it is fairly plain that inferences and grammars are connected, though not identical, influences on language use. They should not be confused. Consider the two expressions below:

1. I am a student *therefore* time is precious
2. All men are mortal and Socrates is man, *therefore* Socrates is mortal.

Both the expressions use the logical connector word ''therefore'' they could be fairly be said that both attempt to argue something. But it is fairly clear that there is an inference to a conclusion in expression (2) but there is no conclusion being drawn or inferred in expression (1). In example (1) it isn't being *concluded* that ''time is precious'' from the fact that ''I am a student''. The connector word has the force of an *explanation*, not an inference. But in example (2) it is being concluded that ''Socrates is mortal'' from the fact that ''All men are mortal and Socrates is a man''. The first example uses ''therefore'' as a grammatical device, the second example uses ''therefore'' as a logical device, and in so doing, draws an inference from premises to a given conclusion. I am concerned here with the second usage of such connector words and not the first usage.

How do we know if inferences made are computed in the same fashion by individuals from different cultures? The example just given strengthens the case for the possibility of cultural influences on thought patterns. Though there might not be large scale differences in inferences, there might be *subtle* differences in patterns of reasoning just as there are subtle differences in when we use *therefore* as a logical operator and when we do not. This issue merits investigation (see Section ''Evidence of differences in inference making'').

The finding of differences in cross-cultural inference-making patterns would be a surprising and interesting educational discovery. Understanding those inference patterns would lead to genuine practical outcomes and benefits. First, it would bring about a change in educational focus: it would mean that programs which only stress teaching the genre of critical writing—i.e., the language of critical argument—are not adopting the approach needed. Thus, educational literature on topics such as ''cultural differences in teaching and learning'' (Ballard & Clanchy, 1984; Barker et al., 1991; Challee, 1994; Hofstede, 1986) and the variety of bridging programs which try to inculcate critical thinking discourse (Cargill & McGowan, 1994) while useful, may not adequately address the deeper educational problems NESB students face in learning to be ''critical thinkers''. There is some evidence that this is true. Felix and Lawson's study, for example, showed that integrated bridging programs only show a marginal improvement in the area of students' critical argumentation

(compared to other areas of need) despite extensive tutoring in the appropriate linguistic genre (Felix & Lawson, 1994). Moffatt's research over a 2-year period and involving 1,084 students indicated that tests designed to improve critical reasoning tasks, actually made them worse, unless used very effectively (Moffatt, 1998).

A second implication of this finding is the following. It might suggest grounds for a new pedagogy for teaching Western inference patterns via an understanding of the cultural differences which inhibit learning in this area. NESB students consistently find adapting to the expectation of ''being critical'' one of the hardest transitions to make when studying in Western tertiary institutions. However, there is currently no literature focussing on the logico-structural difficulties (as opposed to grammatical/learning difficulties) such students have in making the transition, and no clear justification nor reasons given to supervisors and academics for why these skills need to be continually taught to their students despite ongoing academic bridging programs. This justifies a look at the evidence from the discipline of Psychology, specifically the emerging area of Cross-Cultural Psychology.

Evidence of differences in inference making

Recently, Nisbett, Norenzayan, Peng and others have looked at differences in Asian and Western reasoning patterns from a psychological perspective using a variety of empirical techniques (Nisbett, Peng, Choi, & Norenzayan, 2001; Nisbett, 2003; Norenzayan, 2001; Norenzayan, Smith, Kim, & Nisbett, 2002; Peng, 1997; Peng et al., 2000; Peng & Nisbett, 1996, 1999). Much of this research looks at the phenomenon of ''categorisation'' using language, though there are related studies on topics concerning background/field relationships, situational versus dispositional attitude studies, and so on. However, the central idea investigated in the studies is the idea of categorisation.

Categorisation is the ability to organise the world by means of a classification schema. The key difference found in the research appears to be a difference in *taxonomic* versus *thematic* categorisation (Ji, Zhang, & Nisbett, 2004). For example, given the three objects: *kangaroo, koala, tree*, and asked to group the objects, subjects typically either group ''kangaroo and koala'' or ''koala and tree''. The former indicates a taxonomic classification system (kangaroos and koalas are both marsupials/animals), the latter a thematic classification system (koalas climb trees). It is found that there are consistent differences in the manner in which groups of Asian and Western subjects categorise objects, though, of course, these differences do not apply to all individuals, but rather ethnic groups. The results of these studies are briefly summarised here. Implications for education are discussed in the Section ''Implications for education''.

What evidence is there that Asian students think differently from Western students? Some suggestive evidence comes from recent research in cross-cultural psychology. Nisbett (2003) has found that whereas individuals raised in ''Western'' societies tend to categorise objects and use formal deductive and inductive reasoning patterns, individuals raised in ''Eastern'' societies tend to think in terms of processes and relationships, and to use experiential knowledge rather than categories, and are less inclined to use ''formal'' reasoning patterns. This evidence is supported by others (Norenzayan, 2001; Norenzayan et al., 2002; Peng et al., 2000). Individuals raised in both societies (e.g., Asian–Americans) interestingly, are inclined to use a

little of both kinds of reasoning. This pattern of response occurs consistently for all studies involving a variety of different ethnic groups (e.g., Chinese and English, Australians and Japanese, Koreans and Americans, etc).

Deductive arguments

The following two deductive arguments were presented to groups of Koreans, European Americans and Asian Americans. This example was among a list of 20 similar examples. They were asked to assess which argument in the set was more plausible:

[1]	[2]
All birds have ulnar arteries	All birds have ulnar arteries
Therefore all eagles have ulnar arteries	Therefore all penguins have ulnar arteries (Nisbett, 2003)

The aim of the test was to measure to what extent subjects relied on formal logic and how much they rely on experience or experiential knowledge. The "blank" property ("ulnar arteries") could be anything. It is an unfamiliar category designed to avoid association with real world knowledge and examples. The example links *superordinate* categories (birds) and *subordinate* categories (eagles, penguins). The arguments have identical premises but the conclusion differs in terms of what might constitute a "typical" bird.

On the basis of formal "Western" reasoning alone one would tend to reason in either the following ways:

[1]	[2]
All birds have ulnar arteries	All birds have ulnar arteries
All eagles are birds	All penguins are birds
Therefore: All eagles have ulnar arteries	Therefore: All penguins have ulnar arteries

In doing so one would implicitly or explicitly supply the missing premise (2) in both cases. Using this form of reasoning, both arguments would be regarded as equally plausible.

Another equally legitimate way to think of the examples, however, is to use experiential knowledge and to group the cases according to "typical" or "usual" examples. In this way of understanding the examples, an eagle would be regarded as more a typical case of a "bird" than a penguin, so example [1] would be regarded as more plausible. In the 20 sets of arguments given to the participants, each had a "typical" and an "atypical" target example.

The findings indicate that Koreans consistently selected "typical" examples—i.e., made a decision about plausibility on the basis of what was close to their experience (in this case "eagles"). European Americans, by contrast, largely made a decision about plausibility on the basis of categorisation and regarded both arguments as equally plausible. Asian-American responses were in between those of European Americans and Koreans (Nisbett, 2003).

In another test sets of three arguments were presented to Koreans and Americans. They were asked to select which argument was logically valid. Each of the

arguments were logically valid though the plausibility of the conclusions varied and the degree of meaningfulness of the arguments varied. In [1] the argument is meaningful and the conclusion is plausible, in [2] the argument is meaningful and the conclusion is implausible, and in [3] the argument is too abstract to be either meaningful or plausible. Nisbett chose various kinds of argument forms to test: *modus ponens* (*If A then B, A therefore B*) and also more difficult argument forms using quantifiers ("All", "Every", "No", "Some", etc) such as in this example:

[1]	[2]	[3]
No police dogs are old	All things that are made from plants are good for health	No A are B
Some highly trained dogs are old	Cigarettes are things that are made from plants	Some C are B
Therefore: Some highly trained dogs are not police dogs	Therefore: Cigarettes are good for health	Therefore: Some C are not A

The results indicated that Americans were far less likely to use the plausibility of the conclusions as a basis for deciding on logical validity than Koreans. However, both Americans and Koreans rated valid arguments *with* plausible conclusions as valid in equal measure. Where the conclusions were implausible Americans were more likely than Koreans to rank them as valid despite the implausible conclusion. Koreans were much more influenced in determining validity on the basis of the plausibility or desirability of the conclusion. It appears that Americans were more likely to use purely logical inferences than Koreans in making their decisions.

Inductive arguments

The above examples cover the case of deductive arguments. Do similar issues arise in the case of inductive arguments? Nisbett et al. (1997) gave the following pairs of arguments to Koreans and American students among a number of other similar pairs:

Set A	Set B
[1]	[1]
Lions have enzyme Q in their blood	Lions have enzyme Q in their blood
Tigers have enzyme Q in their blood	Tigers have enzyme Q in their blood
Therefore: Rabbits have enzyme Q in their blood	Therefore: Mammals have enzyme Q in their blood
[2]	[2]
Lions have enzyme Q in their blood	Lions have enzyme Q in their blood
Giraffes have enzyme Q in their blood	Giraffes have enzyme Q in their blood
Therefore: Rabbits have enzyme Q in their blood	Therefore: Mammals have enzyme Q in their blood (Nisbett et al., 1997)

Koreans were consistently less likely than Americans to choose argument [2] in Set A, but *more* likely than Americans to choose argument [2] in Set B. What accounts for the difference?

The difference in the sets of arguments is, of course, the conclusion which supplies either a *superordinate* category ("mammals") and a *subordinate* category ("rabbits"). In Set A the superordinate category is not supplied to the participant to the test; in Set B, the superordinate category is given.

One explanation for the difference in results might be that Americans tend to supply the superordinate category of "mammals" in Set A, and in so doing note that lions, giraffes and rabbits are more *diverse* examples (species) of mammals than lions and tigers (which are more similar and less diverse) and therefore example [2] is more convincing as an inductive argument. When supplied with the superordinate category in Set B, Koreans were more likely to use this as a salient rule and to choose example [2]. For Koreans, and not Americans, it appears that the category "mammal" was not salient until explicitly mentioned in the conclusions of the arguments. Nisbett notes that: "One likely consequence of the low salience of categories for Easterners is that they do not fuel inductive inferences for Easterners as much as for Westerners" (Nisbett, 2003).

To overcome the objection that these differences in inference patterns might be a result of language influences, Nisbett tried similar tests using pictures. The test involved comparing simulcrums of "animals" from either Venus or Saturn with a new animal and asking participants to choose if the new animal was from Venus or Saturn (Nisbett, 2003). Using tacit logical rules of comparison to match the features of either Venus or Saturn animals is one method of making a decision about new cases. For example, given simulacrums of Venus and Saturn animal types in the training phase (see Diagram 1 below) one could apply the following deductive *modus ponens* argument:

P1: If an animal has two antennae, a sharp beak, a downward pointing tail and a triangular shaped body it is a Venus animal
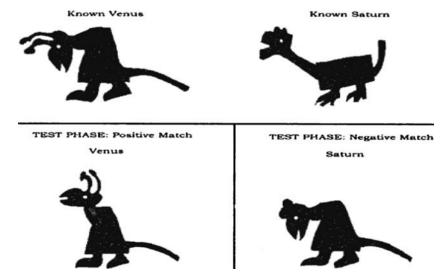

Diagram 1 From (Nisbett, 2003)

P2: The animal on the lower left has these features
C: The animal on the lower left is from Venus.

Using a strict application of the logical rule, the animal on the lower left is a positive match with a Venus animal as it meets the conditions of the logical rule applied. However the animal on the lower right does not, even though it has some of the features of a Venus animal.

There are other methods of making a decision about whether a new animal fits the simulacrum for a Venus or Saturn animal. This is to memorise the shape of the animals in the training phase and to project this memorised shape onto the new animal. This method would work well for positive matches, but less well for negative matches where it is harder to make a determination without recourse to more subtle differences that can be defined by rules. The negative match below *looks* deceptively like a Venus animal on first glance. However, application of strict criteria using rules excludes it as a Venus animal as well as a Saturn animal.

What does the evidence show? European American and Asian American participants made a decision about *negative* matches much faster than Asian participants who made twice as many classification errors that the other two groups. Both groups made decisions about positive matches at an equal rate. What accounts for the difference? One way to interpret the difference is that Asians tend to use *memorisation methods* of making distinctions more often than methods involving the application of *logical rules*.

Another suggestive example, using illustrations rather than words, is the following example of a free grouping test. Participants were asked to group any two pictures below and then to justify their decision on why the made the grouping (see Diagram 2 below). There is no "correct" answer. One could either group a chicken and a cow under the superordinate logical category of "animal" (i.e., *taxonomic* categorisation)
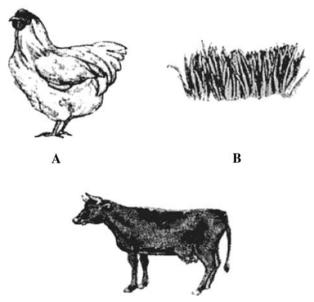

A   B

Diagram 2 From (Nisbett, 2003)

or one can group cow and grass under the subordinate category of what animals eat (cows eat grass) (i.e., *thematic* categorisation).

A statistically greater number of American participants grouped "chicken" and "cow", whereas a greater number of Asians grouped "cow" and "grass". This occurred in not one, but a large number of similar experiments. It appears once again that Americans show a preference for a "category"-based grouping whereas Asians show a preference for a "process" or "relationship"-based grouping.

Subjects were asked to explain their grouping preferences. In the example above, Americans were much more likely to justify their grouping by pointing out that both a chicken and a cow can be subsumed under the category of "animal", whereas Asians were more likely to point out that there is a thematic relationship between cows and grass and to justify their response this way. The same results are obtained outside the tertiary environment with children as subjects. In a similar task testing children involving the categories *man, woman* and *child*, American children were more likely to group "man" and "woman" and justify their decision in taxonomic terms ("the man and woman are both adults"). Chinese children, by contrast, were more likely to group "woman" and "child" and justify their choice in thematic terms ("the mother takes care of the child") (Chiu, 1972). The fact that this experiment was carried out on children suggests, perhaps, a deeply engrained, culturally-determined "thinking pattern".

Language or culture?

Studies involving visual tasks might be considered complicated by issues involving differences in visual processing and are therefore inconclusive (though a consistent number of similar responses involving a battery of such tests would suggest otherwise). It might also be argued that that the differences observed in the studies involving language mentioned earlier are a result of Davidsonian-type issues associated with translation rather than thinking patterns (Davidson, 2001b, 2005b; Kotatko, Pagin, & Segal, 2001) and therefore, demonstrating a *language effect* rather than *cultural effect*.

This is a legitimate concern and needs addressing. Many of the studies in this area involve the process of *back-translation* (i.e., materials are developed in one language, usually English, and then translated into the native language of the participants, and then translated back into English to ascertain any shifts of meaning). Subjects are then tested in one or other language. This effectively ignores the very real problem that language differences may influence understanding of the key terms. It is assumed, perhaps wrongly, that any issue arising from back-translation of the language involved in testing is simply a random error. However, it may plausibly involve systemic errors that influence the results obtained. Ji, Zhang and Nesbitt (2004) note the example of the word "pride" in English being translatable into two possible Chinese words both with negative meanings (Ji et al., 2004).

To control for this, Ji et al., (2004) designed an experiment to test bilingual participants looking at the effect of culture as well as language. They designed an experiment to elicit both taxonomic and thematic thinking for bilingual subjects in both languages (in this case, Chinese and English). If culture were the key driver accounting for the differences, they expected to see evidence that a cultural

difference remained *despite* the language used in testing. They expected participants to ''think differently'' in one language than in another. If, on the other hand, *language* was the key driver, the expected to see a difference in responses among bilinguals; in particular, a difference in the responses of ''coordinate'' and ''compound'' bilinguals.[6] To be specific, a language effect was expected for coordinate but not compound bilinguals. This is because coordinate bilinguals have different representations for key terms. On the other hand, cultural beliefs should be the main influence on the responses for compound bilinguals.

Ji et al. (2004) recruited a total of 174 subjects from mainland China and Taiwan (coordinate bilinguals) as well as former UK colonies Singapore and Hong Kong (compound bilinguals). The subjects were students studying in the US and mainland China. The choice of subjects from these countries was critical. It was expected that a language effect should be more pronounced in the mainland Chinese and Taiwanese than the other subjects, and that cultural effects should less pronounced in more ''westernised'' subjects from Singapore and Hong Kong. Subjects were presented with a battery of triplets similar to *seagull—squirrel—tree* from 10-test sets and responses were coded as taxonomic or relational. (Ji et al., 2004) ''Filler'' triplets such as Monday, Wednesday, Friday were also included. In a subsequent parallel study, Ji et al. (2004) investigated responses from subjects from Hong Kong and mainland China in both English and Chinese to rule out issues associated with self-selection and testing location. Results were compared with results from European Americans.

They found a significant influence of culture on responses, confirming once again the tendency of European Americans to categorise terms using a taxonomic classification system, and Chinese participants to classify in terms of relationships or thematic classification system, regardless of study location and language used. A language effect was found between mainland and Taiwanese subjects when tested in Chinese compared to when tested in English (confirming expectations for coordinate bilinguals). This was not the case for Hong Kong or Singaporean subjects (compound bilinguals) in the US or Hong Kong when tested in both languages. It would seem that culture does influence the ability to categorise items independent of language. Ji, Zhang and Nisbett conclude: 'These findings are consistent with the view that Westerners' reasoning is relatively analytic (including a tendency to focus on categories) and that Chinese reasoning is relatively holistic (including a tendency to focus on relationships). More important, our data suggest that the cultural differences between European Americans and Chinese are not an artefact of language' (Ji et al., 2004).

Implications for education

What does the above evidence demonstrate? Though certainly not conclusive, the evidence suggests the following: ''Asians'' and ''Westerners'', taken as broadly-

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[6] Compound bilinguals learn native and second languages simultaneously and, owing to earlier learning, have *one representational token* for a verbal label and its translational equivalent. Coordinate bilinguals learn native and second languages consecutively and, owing to later learning, have *two distinct representations*, and 'relatively independent associational networks for translational equivalents' (Ji et al., 2004). Neurological evidence exists supporting these differences in terms of the spatial location of language activity areas (Kim, Relkin, Lee, & Hirsch, 1997).

defined ethnic groups,[7] categorise information quite differently. Specifically, they differ in the use of taxonomic and thematic categorisation as ways of making sense of the world, and objects within the world. However, some of the differences are subtle. There are differences in the use of superordinate categories to guide reasoning (Asians will tend to be guided by them, Westerners will not); the use of plausibility of conclusions in decisions about logical validity (Asians, and not westerners, will be tend to be influenced by plausible conclusion in how they judge arguments); and the use of memorisation techniques in preference to rules of reasoning (Asians will be more likely to memorise when given simulacrums as opposed to adopting tacit logical rules). I now wish to suggest that these differences have a not insignificant bearing on the enterprise of ''critical thinking'' in tertiary institutions.

"Taxonomic" categorisation is, naturally, more appropriate than "thematic" categorisation to the enterprise of western-style critical thinking—understood in the tertiary context in terms of inferences from acceptable premises to conclusions (Section "Inference making: the essence of critical thinking"). As Ji et al., note above, it is more "analytic", and less "holistic" in nature. Grouping abstract ideas under categories allows for logical manipulation more easily, perhaps, that grouping objects under themes or processes. It has been provocatively suggested that, while thematic, "event-like" categorisation is a very natural way of making sense of the world, e.g., in the psychological development of children, it is taxonomic classification that changes most with maturational development from childhood (Ji et al., 2004; Markman & Hutchinson, 1984). In particular, we improve our ability to manipulate abstract categorisation schemas as we become more educated. The ability to reason abstractly using categorical reasoning is part of the mark of an educated person. It is assumed, perhaps gratuitously, that this ability is inculcated in the process of studying, and that this ability is species-universal. However, this may not be the case—or at least, not comprehensively so. The evidence outlined above suggests that this ability might be, to some degree, linguistically and culturally-modulated—even if it is not linguistically determined.

The use of superordinate categories and conclusion plausibility to guide decision-making about reliable inferences, suggests that while Asians are undoubtedly equally intelligent and capable as westerners, they may not be as well-versed in the basic principles of western informal logic. I argued earlier that this is to be expected. They were not raised in western culture (though undoubtedly, they have absorbed aspects of it, even if this knowledge might be patchy).

Perhaps some of these principles, but not all, are species-universal. Perhaps some are species-universal in large measure as *concepts*, but not at the margins of *use*. What might this look like? In Davidsonian terms, perhaps Asian peoples—coming as they do from a very different linguistic, cultural and social communities—might not share enough of the ''passing theory'' necessary for intra-lingual (logical) communication, even if they share (in large measure) the ''prior theory'' (Davidson, 2005a).[8] That is, pre-linguistically, Asians are as ''logical'' as non-Asians. In practice,

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[7] As noted earlier, empirical studies have looked at different national groups and the results are largely the same.

[8] The ''prior theory'' expresses how a speaker is prepared in advance to interpret an utterance of a speaker; the ''passing theory'' expresses how a speaker *does*, in fact, interpret the message of a speaker. In the above discussion, I am imagining what this might look like considering inference-making instead of utterances.

however (under tight experimental conditions), they appear not to be. Whatever the explanation for this, the evidence clearly indicates that the basic principles of western critical reasoning are not well understood—or at least, are not well-deployed—by Asians, and that there are (albeit, very subtle) intercultural influences on inference-making. The extent of these differences is an empirical matter.

In informal logic, of course, plausible conclusions have no bearing on argument validity (an argument can follow logically from premises to conclusion even if the premises are false or meaningless). The distinction between "soundness" (a property of *premises*) and "validity" (as a property of *arguments*) is a crucial distinction in logic classes. Yet the evidence shows that Asians are more likely to be guided by conclusion plausibility. Similarly, the relevance of superordinate categories should have no bearing on whether an inference to a conclusion is valid or not (see the earlier argument about "Masdocks"). Yet, again, the evidence consistently shows that Asians are influenced by such things in judging arguments. Finally, the number of classification errors on the visual task, involving matching test phase items with new items, suggests than Asian subjects are not automatically adopting inference-based rules to guide decision-making, but rather memorisation techniques. It would appear that if the data from the experiments described are accurate and reliable, it is no wonder that Asian students have trouble in demonstrating an acceptable level of "critical thinking" when studying at tertiary level. Some of the critical tools appear to be missing, or at the very least under-developed.

The empirical evidence from cross-cultural psychology therefore provides support for a weakened version of one of the claims made earlier about Asian students, in particular, the claim about such students lacking "critical thinking" (Section "Can Asians think critically?"). It cannot, however, be legitimately concluded from what I have outlined that Asian students "lack" critical thinking completely. This would be a serious overstatement. It can be concluded there is some evidence that some Asians lack some of the tools of western reasoning (or are less likely to use them) and—importantly—it might reasonably be inferred that these tools might need to be explicitly taught (see Section "Objections" below). It also appears that there might be some empirical support for the thesis that culture does subtly modulate thinking patterns via language (i.e., the "modularity thesis" has some support), and that this is not an artefact of language.

Objections

A number of objections naturally arise. I address these briefly in what follows.

The move from the descriptive to the normative

It might be argued that I make an unsupported move from a descriptive claim (Asians appear to lack tools in western-style critical thinking) to a normative claim (these skills need to be explicitly taught). An argument against this objection can now be considered. Given that the climate of tertiary education has dramatically changed (Section "Conceptions and misconceptions about international students"), and given that the psychological evidence appears to show that Asian students lack tools in western critical thinking (Section "Implications for education"), educators are now not merely *obliged* to recommend a course of action to remedy the problem,

they are *morally compelled* to do so.[9] If tertiary institutions intend to welcome more and more Asian students into their educational sphere, often—though not exclusively—for financial reasons, they are morally bound to ensure that adequate support services, preparatory skills and suitable academic training is available for such students to help them succeed. The ''passing theory'' of western inference-making needs to be provided for adequate communication. This might now include explicit formal training in ''western-style'' informal logic (currently not done in Australia or elsewhere to my knowledge). The evidence seems to suggest that this training is now not merely desirable, but necessary.

A tertiary education involves more than the production of skilled accountants, managers, engineers and scientists. It is also an opportunity to inculcate ''generic'' skills. One of those important skills is critical thinking and the ''culture'' of western reasoning. Increasingly, universities in Australia and elsewhere (as well as employers) are emphasising ''generic'' skills as one of the key attributes of a university graduate (Attributes of the Melbourne Graduate, 2006). However, as noted in Section ''What is critical thinking?'', all students find critical thinking hard. Evidence presented in this paper suggests some reasons why this might be so, particularly in the case of Asian students studying in western tertiary institutions. It appears that a good working knowledge of English may not be sufficient for this purpose. Universities may need to explicitly teach these critical inference-making skills to international students either prior to, or ''infused'' within the focus subject matter during the semester (Davies, 2006a; Ikuenobe, 2001, 2003; Melville Jones, 1999; Solon, 2001). Regardless of the approach taken, if international students from Asia are to adequately engage in the conversations at university level, they need to be taught, and to learn, the critical and intellectual tools necessary for this engagement to occur. This is an obligation on the institution as well as the student. The move from the descriptive to the normative claim, in my view, is justified.

As I have argued elsewhere, this need not necessarily mean an insistence on informal logic classes as currently conducted in many Philosophy departments around the world (Davies, 2006a). In Australia and the US, innovative ways have recently been trialled to teach the skills of informal reasoning using computers. This approach is called Computer-Aided Argument Mapping (CAAM) (Harrell, 2005; Monk, 2001; van Gelder, 2000, 2001, 2002a, 2002b, 2005). This particular critical thinking approach involves the use of computer-supported diagramming techniques to ''map'' reasoning visually. It operates on the assumption that using a map is clearer than a verbal or oral description to a destination. Used in teaching complex patterns of inferences, the approach is particularly useful. The CAAM approach helps to turn dense passages of prose into intelligible, easily comprehended linked diagrams with premises which can be ''weighted'' in terms of plausibility. Recent work in Australia involving first-year undergraduate students at the University of Melbourne over a two-year period (2002 and 2003) involved conducting pre- and post-measures of informal reasoning using a standard measurement tool, the California Critical Thinking Skills Test (CCTST) (van Gelder, Bissett, & Cumming, 2004). The approach has led to standard deviation gains of .83 over the course of a 12-week semester. Clearly, such an approach would be of great benefit to international students who struggle in comprehending English prose.

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[9] In the case of Australian higher educator providers, this is an a explicit requirement as mentioned in the Australian Vice Chancellor's Committee (AVCC) Code of Conduct (AVCC, 2005)

The evidence from mathematics

The point was made earlier (Section ''Can Asians think critically?'') that Asians do as well as, if not better, than western students in mathematics, and that this is evidence of logical reasoning skills. This might be said to be a counter-example to the argument in this paper for the modulation thesis.

It transpires that the evidence from mathematical reasoning is not clear-cut. I mentioned earlier that Asian students exhibit considerable abilities in mathematical reasoning, some even argue that they are better than western students at this (Brand, 1987). However, this won't necessarily do as a counter-argument to the case made in this paper. At least, it needs more argument. Wong's article demonstrates that Asian students do well in mathematics tasks because they use ''memorisation algorithms'' and rules from the way they experience learning and the classroom environment, and not from a deeper conceptual understanding of the context (Wong, 2002). According to Wong, it is 'still open to doubt as to whether they actually possess a deeper conceptual understanding than their Western counterparts' (p. 211). Note also that Brand's study reports only the phenomenal success of Asian-Americans in mathematics, possibly what one might expect given exposure to thought patterns from both cultures, i.e., an ability to think ''holistically'' as well as ''analytically'' (Brand, 1987). Nisbett and Peng's data also report that Asian-Americans (as distinct from Asians or Americans) give responses that are different from either group taken alone. The evidence from mathematics is not, I conclude, a counter-example.

Conclusion

It would be easy to dismiss the psychological research outlined with a wave of the hand, and muffled cries of covert racism. The extensiveness of evidence should warn us against this reaction. In the past few years the literature pointing to cross-cultural differences in thought patterns in a variety of areas has been voluminous indeed (Basseches, 1980; Becker, 1986; Chiu, 1972; Choi & Nisbett, 1998; Choi, Nisbett, & Smith, 1997a; Choi & Nisbett, 2000; Choi, Nisbett, & Smith, 1997b; Galtung, 1981; Holland & Quinn, 1987; Hutchins, 1980; Ji et al., 2004; Ji, Peng, & Nisbett, 1999; Kitayama & Masuda, 1997; Lopez, Atran, Coley, & Medin, 1997; Nisbett, Peng, Choi, & Norenzayan, 2001; Norenzayan, 2001; Norenzayan, Smith, Kim, & Nisbett, 2002; Peng, 1997; Peng, Ames, & Knowles, 2000; Peng & Nisbett, 1996, 1999). To my knowledge, this research has not yet percolated through to scholarship in Education.

A more considered response would compel us to consider the implications of the evidence for educational issues, in particular, problems associated with Asian students' adaptation—or lack of adaptation, as the case may be—to tertiary study. The relevance of the psychological research has to the kind of tasks students complete at university needs to be assessed. Do subtle alternative, non-Western, inference patterns make a difference to how students understand written tasks? Do they make a difference to the format of exams? Do they have a bearing on how students relate in the classroom in groups activities? The suitability of certain tasks for Asian students might need to be re-evaluated as an equity issue, along with a reconsideration of the importance of teaching of academic programs which specifically focus on critical reasoning. The issue of the adequacy of the preparation of some Asian students for higher degree study in western institutions might also need to be closely examined.

As noted, an obvious normative implication of the research might be that western critical inference patterns might need to be *explicitly taught* in the future if we are to accept and welcome ever higher numbers of international students into our higher education institutions. The evidence suggests that we should not assume that Asian students bring with them the same ability to categorise the world, and reason using these categories.

Does the evidence in this area raise the old chestnut of linguistic determinism? I don't think so. There are no obvious metaphysical or ontological implications. I mentioned earlier that it is easy to conflate a ''strong'' and ''weak'' version of linguistic determinism. I argued that while the weak version is certainly plausible, the strong version is not. In its strongest form, linguistic determinism claims that the world is largely *identical* to language commitments about the world; in its weakest form, it simply states that language—via the medium of culture—*influences* how we think about the world. If the evidence for differences in thought patterns is true, it would seem that there cultural influence have quite serious implications for the field of international education.

There is little doubt that Asians live in exactly the same world as the rest of us. However, this is not the issue. While the strong form of linguistic determinism is no longer credible, it may be possible that culture might subtlety modulate language and reasoning at the margins. The evidence from psychology seems to suggest that it does. The extent of this influence needs careful investigation.

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