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Intelligence and culture: how culture shapes what intelligence means, and the implications for a science of well-being

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This paper discusses the relationship between culture and intelligence. The main message of the paper is that intelligence cannot fully or even meaningfully be understood outside its cultural context. Behaviour that is considered intelligent in one culture may be considered unintelligent in another culture, and *vice versa*. Moreover, people in different cultures have different implicit (folk) theories of intelligence, so may not even mean the same thing by the word. The relationships between different aspects of intelligence can vary across cultures, with correlations that are positive in one setting proving to be negative in another. The paper opens with a general discussion of issues regarding the relationship between the two concepts. It then describes the theory of successful intelligence, which motivates our work on the interface between culture and intelligence. Finally, the article draws some conclusions.

Keywords: intelligence; culture; theory of successful intelligence; implicit theories of intelligence; practical intelligence

1. INTRODUCTION

The field of intelligence is relatively old. It has made some mistakes. In particular, its practitioners have often assumed that what applies to one culture applies to another. It is important that the much newer field of positive psychology does not repeat these mistakes: that in attempting to understand well-being, it understands intelligence in its multicultural context. Moreover, it is important that the field of positive psychology understands how intelligence, broadly defined, is mostly an attempt to use one's cognitive skills to achieve a state of well-being within one's cultural context.

Intelligence is always *displayed* in a cultural context. The acontextual study of intelligence imposes a (usually western) investigator's view of the world on the rest of the world. Can research provide an understanding of intelligence that is not so culturally constrained? Can it help us to understand the role of intelligence in well-being? We address these questions in this paper.

The paper is divided into four parts. In § 1, we introduce our main ideas. In § 2, we briefly present the theory of successful intelligence, which underlies our work (Sternberg 1985, 1990, 1997, 1999). In § 3, we discuss cultural studies relevant to these ideas. Some of these studies ask people to behave intelligently, whereas others query people as to their conceptions of what it means to behave intelligently. In § 4, we draw some conclusions.

Our own personal experiences motivated our interest in the interface between culture and intelligence through our own experiences. Three experiences were particularly instrumental.

The first experience occurred during our work in Jamaica in the mid 1990s. R.J.S. (the senior author) was sitting in a school listening to a lesson. The school was situated in one big room, such that each 'classroom' was merely a section of that room. There were no partitions between class groupings. Each teacher thus had to talk over the voices of the other teachers. R.J.S. was seated towards the edge of one of the class groups, and realized that he could hardly hear the teacher whose class he was supposed to be observing. Indeed, he could better hear the teacher of another class that was proximal to the class he attended, and realized that many of the other children who were not near to the teacher of their own group had the same problem. How could the children maximally profit from instruction that they could scarcely hear? How could their achievement equal that of the children who were better situated in the classroom? And how could they possibly equal the performance of western children who actually had their own walled classroom in which to listen to the teacher?

The second experience occurred in India in late 1995 (Sternberg & Grigorenko 1999). We were carrying out research in a school. It was 113 degrees (45 °C) in the shade. The stench of surrounding litter, excrement and assorted waste was overwhelming. E.L.G. was asking a child to solve a linear syllogism (e.g. one relating the heights of three children to each other). Upon hearing E.L.G. present a problem, R.J.S. thought to himself that she had made a mistake: it seemed that the problem she had just presented was indeterminate and had no solution. However, the young child to whom she presented the problem proceeded successfully to solve it. R.J.S. had made a

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mistake in trying to solve a very simple problem that a young child could solve. He realized that the kinds of teaching and testing conditions that apply in most of the developed world, however defective they may be, scarcely compare with those in the developing world. Anyone can be affected by such conditions, the uninitiated, like R.J.S., more than others. How often is any kind of test given in the developing world in conditions even approaching these?

The third experience occurred while we were doing research in Tanzania at the turn of the century. This experience truly gave new meaning to the concept of bad conditions for testing. The building in which we were testing collapsed at the time of testing! How could children possibly perform at a maximal level when they could not even count on the structural integrity of the building in which they were working? The testing had to be abandoned at that time because of the loss of the building.

These experiences suggested to us that intelligence, considered outside its cultural context, is in large measure a mythological construct. There are some aspects of intelligence that transcend cultures, namely, the mental processes underlying intelligence and the mental representations upon which they act. For example, individuals in all cultures need to recognize and define problems, formulate strategies to solve these problems, monitor and evaluate these strategies, and so forth. The nature of the problems may differ, but there are always problems, regardless of where or when one lives. One's skill in solving these life problems contributes to one's well-being; but the operations that one performs to solve problems gain expression in performance differently from one culture to another. As soon as one assesses performance, one is assessing mental processes and representations *in a cultural context*. How do these contexts manifest themselves?

Most psychological research is executed within a single culture, but we believe that single-cultural studies, in some respects, do an injustice to psychological research. In particular they: (i) introduce limited and often narrow definitions of psychological phenomena and problems; (ii) engender risks of unwarranted assumptions about the phenomena under investigation; (iii) raise questions about cultural generalizability of findings; (iv) engender risks of cultural imperialism: the belief that one's own culture and its assumptions are somehow superior to other cultures and their assumptions; and (v) represent missed opportunities to collaborate and develop psychology and psychological understanding around the world.

Some investigators have realized the importance of cultural context (for reviews of relevant literature see Laboratory of Comparative Human Cognition 1982; Serpell 2000; see also Greenfield 1997). For example, Berry (1974) reviewed concepts of intelligence across a wide variety of cultural contexts. Carraher *et al.* (1985) (see also Ceci & Roazzi 1994; Nuñes 1994) studied a group of children in whom intelligence as adaptation to the environment was especially relevant. This was a group of Brazilian street children, who are under great contextual pressure to form a successful street business. If they do not, so-called 'death squads' may murder children who, unable to earn money, resort to robbing stores (or who are suspected of resorting to robbing stores). They found that the same children who were able to do the mathematics needed to run their street business were often little able or unable to do school mathematics. In fact, the more abstract and removed from real-world contexts the problems were in their form of presentation, the worse the children did on the problems. These results suggest that differences in context can have a powerful effect on performance.

Such differences are not limited to Brazilian street children. Lave (1988) showed that Berkeley housewives who could successfully do the mathematics needed for comparison shopping in the supermarket were unable to do the same mathematics when they were placed in a classroom and given isomorphic problems presented in an abstract form. In other words, their problem was not at the level of mental processes but at the level of applying the processes in specific environmental contexts.

The theory of successful intelligence provides a way of understanding these and other results.

2. THE THEORY OF SUCCESSFUL INTELLIGENCE

(a) *The nature of successful intelligence*

In the theory of successful intelligence, intelligence is defined as one's ability to achieve success in life in terms of one's personal standards, within one's socio-cultural context. The field of intelligence has, at times, tended to 'put the cart before the horse', defining the construct conceptually on the basis of how it is operationalized rather than *vice versa*. This practice has resulted in tests that stress the academic aspect of intelligence, as one might expect, given the origins of modern intelligence testing in the work of Binet & Simon (1916) in designing an instrument that would distinguish children who would succeed from those who would fail in school. However, the construct of intelligence needs to serve a broader purpose, accounting for the bases of self-defined success throughout one's life.

The use of societal criteria of success (e.g. school grades, personal income) can obscure the fact that these measures of performance often do not capture people's personal notions of success. Some people choose to concentrate on extracurricular activities such as athletics or music, and pay less attention to grades in school; others may choose occupations that are personally meaningful to them but that will never yield the income that they could gain by doing work that is less personally meaningful. In the theory of successful intelligence, the conceptualization of intelligence is individually determined but always occurs within a socio-cultural context. Although the processes of intelligence may be common across such contexts, what constitutes success is not. Being a successful member of the clergy of a particular religion may be highly rewarded in one society, but viewed as a worthless pursuit in another culture.

In the theory, one's ability to achieve success depends on the capitalization of one's strengths and correction or compensation for one's weaknesses. Theories of intelligence typically specify some relatively fixed set of abilities, whether this be one general factor and several specific factors (Spearman 1904), seven multiple factors (Thurstone 1938), eight multiple intelligences (Gardner 1983, 1999) or 150 separate intellectual abilities (Guilford 1982). Such a way of looking at intelligence may be useful in establishing a common set of skills to be tested. People achieve success, even within a given occupation, in many different ways. For example, successful teachers and researchers achieve success through many different blendings of skills

rather than through any single formula that works for all of them.

The theory states that a balancing of abilities is achieved so as to adapt to, shape and select environments. Definitions of intelligence traditionally have emphasized the role of adaptation to the environment (Intelligence and its Measurement 1921; Sternberg & Detterman 1986). But intelligence involves not only modifying oneself to suit the environment (adaptation), but also modifying the environment to suit oneself (shaping) and sometimes finding a new environment that is a better match to one's skills, values or desires (selection).

Not all people have equal opportunities to adapt to, shape and select environments. In general, people of higher socio-economic standing tend to have more opportunities and people of lower socio-economic standing have fewer. The economy or political situation of the society can also be factors. Other variables that may affect such opportunities are education (especially literacy), political party, race, religion, and so forth. For example, someone with a college education typically has many more career options than does someone who has dropped out of high school to support a family. Thus, how and how well an individual adapts to, shapes and selects environments must always be viewed in terms of the opportunities available to them.

Finally, success is attained through a balance of analytical, creative and practical abilities. Analytical abilities are those primarily measured by traditional ability tests. Success in life requires one not only to analyse one's own ideas as well as those of others, but also to generate ideas and to persuade other people of their value. This necessity occurs in the world of work, for example when a subordinate tries to convince superior of the value of his or her plan; in the world of personal relationships, when a child attempts to convince a parent to do what he or she wants or when a spouse tries to convince the other spouse to do things in his or her preferred way; and in the school, when a student writes an essay arguing for a point of view.

The theory would interpret the studies described earlier as showing the importance of context in understanding human intelligence. For street children, knowing how to do the mathematics needed to run a street business is a matter of survival; knowing how to solve similar or even identical problems in the classroom is not. The children have adapted to the exigencies of their own environments. The processes needed for solving problems may be largely the same in the classroom and the street contexts, but the different contexts elicit different behaviour, just as we may behave very differently in school from the way we do at work, or at work from the way we do at home.

3. CULTURAL STUDIES

In a series of studies in a variety of cultures, we have investigated some of our notions about intelligence and how they might apply in diverse contexts. As explained later in this section, they may apply quite differently, depending on where they need to be applied.

(a) *Children may develop contextually important skills at the expense of academic ones*

Investigations of intelligence conducted in settings outside the developed world can often yield a picture of intelligence that is quite at variance with the picture one would obtain from studies conducted only in the developed world. In a study in 1996 in Usenge, Kenya, near the town of Kisumu, we were interested in school-aged children's ability to adapt to their indigenous environment.

We devised a test of practical intelligence for adaptation to the environment (see Sternberg & Grigorenko 1997; Sternberg *et al.* 2001). The test of practical intelligence measured children's informal tacit knowledge for natural herbal medicines that the villagers believe can be used to fight various types of infections. More than 95% of the children suffer from parasitic illnesses. Children in the villages use their knowledge of these medicines at an average frequency of once a week in medicating themselves and others. Thus, tests of how to use these medicines constitute effective measures of one aspect of practical intelligence as defined by the villagers, as well as their life circumstances in their environmental contexts. Their well-being hinges upon their being able to self-medicate. Those who cannot suffer to a greater degree the consequences of the illnesses. Middle-class westerners might find it quite a challenge to thrive or even survive in these contexts, or, for that matter, in the contexts of urban ghettos often not distant from their comfortable homes.

We measured the Kenyan children's ability to identify the natural herbal medicines, where they come from, what they are used for and how they are dosed. Based on work that we had carried out elsewhere, we expected that scores on this test would not correlate with scores on conventional tests of intelligence (Sternberg *et al.* 2000). To test this hypothesis, we also administered to the 85 children the 'Raven coloured progressive matrices test' (Raven *et al.* 1992), which is a measure of fluid or abstract-reasoning-based abilities, as well as the 'Mill Hill vocabulary scale' (Raven *et al.* 1992), which is a measure of crystallized or formal knowledge-based abilities. In addition, we gave the children a comparable test of vocabulary in their own Dholuo language. The Dholuo language is spoken in the home, English is spoken in the schools.

We found no significant correlation between the test of indigenous tacit knowledge and scores on the fluid-ability tests. But, to our surprise, we found statistically significant correlations of the tacit-knowledge tests with the tests of crystallized abilities. The correlations, however, were negative. In other words, the higher the children scored on the test of tacit knowledge, the lower they scored, on average, on the tests of crystallized abilities. Tests of fluid abilities also showed correlations with practical intelligence in the negative direction.

These surprising results can be interpreted in various ways, but based on the ethnographic observations of the anthropologists on the team, P. Wenzel Geissler and Ruth Prince, we concluded that a plausible scenario takes into account the expectations of families for their children. Many children drop out of school before graduation, for financial or other reasons. Moreover, many families in the village do not particularly value formal western schooling. There is no reason why they should, since the children of many families will, for the most part, spend their lives farming or engaged in other occupations that make little or no use of western schooling. Few, if any, will go to universities. These families emphasize teaching their children the indigenous informal knowledge that will lead to successful adaptation to the environments in which they will really

live. Children who spend their time learning the indigenous practical knowledge of the community generally do not invest heavily in doing well in school, whereas children who do well in school generally do not invest as heavily in learning the indigenous knowledge: hence the negative correlations. In some cases, they do not learn the indigenous knowledge because no one wants to take them on as apprentices to teach them. They may therefore be perceived as the 'losers' in the village.

The Kenya study suggests that the identification of a general factor of human intelligence may tell us more about how abilities interact with patterns of schooling and especially western patterns of schooling, than it does about the structure of human abilities. In western schooling, children typically study a variety of subjects from an early age and thus develop skills in a variety of areas. This kind of schooling prepares children to take a standard test of intelligence. Such a test typically measures skills in a variety of areas. Intelligence tests often measure skills that children were expected to acquire a few years before taking the intelligence test; but as Rogoff (1990, 2003) and others have noted, this pattern of schooling is not universal and has not even been common for much of the history of humankind.

Throughout history and in many places still, schooling, especially for boys, takes the form of apprenticeships in which children learn a craft from an early age. The children learn what they will need to know to succeed in a trade, but not a lot more. They are not simultaneously engaged in tasks that require the development of the particular blend of skills measured by conventional intelligence tests. Hence it is less likely that one would observe a general factor in their scores, much as we discovered in Kenya.

The context-specificity of intellectual performance does not apply only to countries far removed from North American or Europe. One can find the same on these continents, as we did in our studies of Eskimo children in southwestern Alaska.

(b) *Children may have substantial practical skills that go unrecognized in academic tests*

We found related although certainly not identical results in a study of Yup'ik Eskimo children in southwestern Alaska (Grigorenko *et al.* 2004*a*). We were particularly interested in these children because their teachers thought them, for the most part, to be quite lacking in the basic intelligence needed for success in school. However, many of the children had tremendous practical knowledge that few, if any, of the teachers had, such as how to travel from one village to another in the winter on a dogsled in the absence of landmarks that would have been recognizable to the teachers (or to us).

We assessed the importance of academic and practical intelligence in rural and urban Alaskan communities. A total of 261 high-school children were rated for practical skills by adults or peers in the study: 69 in grade 9, 69 in grade 10, 45 in grade 11 and 37 in grade 12. Out of these children, 145 were females and 116 were males, and they were from seven different communities: six rural and one relatively urban. We measured academic intelligence with conventional measures of fluid and crystallized intelligence. We measured practical intelligence with a test of tacit (informally learned) knowledge as acquired in rural Alaskan Yup'ik communities.

The urban children generally outperformed the rural children on a measure of crystallized intelligence, but the rural children generally outperformed the urban children on the measure of Yup'ik tacit knowledge. The test of tacit knowledge was superior to the tests of academic intelligence in predicting the practical, and particularly, hunting skills of the rural children (for whom the test was created), but not of the urban ones. Thus, in terms of the skills that mattered most to the children's everyday lives, the test of practical intelligence was distinctly preferable.

(c) *Practical intellectual skills may be better predictors of health than academic ones*

In their study, Grigorenko & Sternberg (2001) tested 511 Russian school children (ranging in age from 8 to 17 years) as well as 490 mothers and 328 fathers of these children. They used entirely distinct measures of analytical, creative and practical intelligence.

Fluid analytical intelligence was measured by two subtests of a test of non-verbal intelligence. The 'test of *g*: culture fair, level II' (Cattell & Cattell 1973) is a test of fluid intelligence designed to reduce, as much as possible, the influence of verbal comprehension, culture and educational level, although no test completely eliminates such influences. In the first subtest, 'series', individuals were presented with an incomplete, progressive series of figures. The participants' task was to select, from among the choices provided, the answer that best continued the series. In the 'matrices' subtest, the task was to complete the matrix presented at the left of each row.

The test of crystallized intelligence was adapted from existing traditional tests of analogies and synonyms or antonyms used in Russia. Grigorenko & Sternberg (2001) used adaptations of Russian rather than American tests because the vocabulary used in Russia differs from that used in the USA. The first part of the test included 20 verbal analogies (internal-consistency reliability, 0.83). An example is 'circle–ball = square–? (i) quadrangular, (ii) figure, (iii) rectangular, (iv) solid, (v) cube'. The second part included 30 pairs of words, and the participants' task was to specify whether the words in the pair were synonyms or antonyms (internal-consistency reliability, 0.74). Examples are 'latent–hidden' and 'systematic–chaotic'.

The measure of creative intelligence also comprised two parts. The first part asked the participants to describe the world through the eyes of insects. The second part asked participants to describe who might live and what might happen on a planet called 'Priumliava'. No additional information on the nature of the planet was specified. Each part of the test was scored in three different ways to yield three different scores. The first score was for originality (novelty); the second was for the amount of development in the plot (quality); and the third was for creative use of prior knowledge in these relatively novel kinds of task (sophistication). The mean inter-story reliabilities were 0.69, 0.75 and 0.75 for the three respective scores, all of which were statistically significant at the $p < 0.001$ level.

The measure of practical intelligence was self-report and also comprised two parts. The first part was designed as a 20 item, self-report instrument, assessing practical skills in the social domain (e.g. effective and successful communication with other people), in the family domain (e.g. how to fix household items, how to run the family budget) and in

the domain of effective resolution of sudden problems (e.g. organizing something that has become chaotic). For the subscales, internal-consistency estimates varied from 0.50 to 0.77. In this study, only the total practical intelligence self-report scale was used (Cronbach's alpha, 0.71). The second part had four vignettes, based on themes that appeared in popular Russian magazines in the context of discussion of adaptive skills in the current society. The four themes were, respectively, how to maintain the value of one's savings, what to do when one makes a purchase and discovers that the item one has purchased is broken, how to locate medical assistance in a time of need, and how to manage a salary bonus one has received for outstanding work. Each vignette was accompanied by five choices and participants had to select the best one. Obviously, there is no one 'right' answer in this type of situation. Hence Grigorenko and Sternberg used the most frequently chosen response as the keyed answer. To the extent that this response was suboptimal, this suboptimality would work against us in subsequent analyses relating scores on this test to other predictor and criterion measures.

Clearcut analytical, creative and practical factors emerged for the tests. Thus, with a sample of a different nationality (Russian), a different set of tests and a different method of analysis (exploratory rather than confirmatory analysis) supported the theory of successful intelligence.

In this same study, the analytical, creative and practical tests that we employed were used to predict mental and physical health among the Russian adults. Mental health was measured by widely used paper-and-pencil tests of depression and anxiety, and physical health was measured by self-report. The best predictor of mental and physical health was the practical intelligence measure (or, because the data are correlational, it may be that health predicts practical intelligence, although the connection here is less clear). Analytical intelligence came second and creative intelligence came third. All three contributed to prediction, however. Thus, we again concluded that a theory of intelligence encompassing all three elements provides better prediction of success in life than does a theory comprising just the analytical element.

The results in Russia emphasized the importance of studying health-related outcomes as one measure of successful adaptation to the environment. Health-related variables can affect one's ability to achieve one's goals in life, or even to perform well on tests, as we found in Jamaica.

(d) *Physical health may moderate performance on assessments*

In interpreting results, whether from developed or developing cultures, it is always important to take into account the physical health of the participants one is testing. In a study that we carried out in Jamaica (Sternberg *et al.* 1997), we found that Jamaican school children who suffered from parasitic illnesses (for the most part, whipworm or Ascaris) performed more poorly on higher-level cognitive tests (such as of working memory and reasoning) than did children who did not suffer from these illnesses, even after controlling for socio-economic status.

Thus, many children were poor achievers not because they lacked abilities, but because they lacked good health. If you are moderately to seriously ill, you probably find it more difficult to concentrate on what you read or what you hear than if you are healthy. Children in developing countries are ill much and even most of the time. They simply cannot devote the same attentional and learning resources to schoolwork as do healthy children.

Do conventional tests, such as of working memory or of reasoning, measure all of the skills possessed by children in developing countries? Work that we have done in Tanzania suggests that they do not.

(e) *Dynamic testing may reveal cognitive skills not revealed by static testing*

A study that we conducted in Tanzania (see Sternberg & Grigorenko 1997, 2002; Sternberg *et al.* 2002) demonstrates the risks of giving tests, scoring them and interpreting the results as measures of some latent intellectual ability or abilities. We administered to 358 school children between the ages of 11 and 13 years near Bagamoyo, Tanzania, tests including a form-board classification test, a linear syllogisms test and a twenty questions test, which measure the kinds of skills required in conventional tests of intelligence. Of course, we obtained scores that we could analyse and evaluate, ranking the children in terms of their supposed general or other abilities. However, we administered the tests dynamically rather than statically (Vygotsky 1978; Brown & French 1979; Brown & Ferrara 1985; Lidz 1991; Haywood & Tzuriel 1992; Guthke 1993; Grigorenko & Sternberg 1998; Sternberg & Grigorenko 2002).

Dynamic testing is like conventional static testing in that individuals are tested and inferences about their abilities are made. But dynamic tests differ in that children are given some kind of feedback to help them to improve their scores. Vygotsky (1978) suggested that children's ability to profit from guided instruction that they received during a testing session could serve as a measure of the children's zone of proximal development, or the difference between their developed abilities and their latent capacities. In other words, testing and instruction are treated as being of one piece rather than as being distinct processes. This integration makes sense in terms of traditional definitions of intelligence as the ability to learn (Intelligence and its Measurement 1921; Sternberg & Detterman 1986). What a dynamic test does is directly to measure processes of learning in the context of testing, rather than measuring these processes indirectly as the product of past learning. Such measurement is especially important when not all children have had equal opportunities to learn in the past.

In the assessments, children were first given static ability tests. Experimental-group children were then given a brief period of instruction in which they were able to learn skills that would potentially enable them to improve their scores. Control-group children were not given such instruction. Then they were all tested again. Because the instruction for each test lasted for only *ca*. 5–10 min, one would not expect dramatic gains. However, on average, the gains in the experimental group were statistically significant. The experimental group also showed significantly greater gains than did the control group. More importantly, scores of the experimental-group children on the pre-test showed only weak although significant correlations with scores on the post-test. These correlations, at about the 0.3 level, suggested that when tests are administered statically to children in developing countries, the results may be rather unstable and easily subject to influences of training. The

reason for this could be that the children are not accustomed to taking western-style tests, and so profit quickly even from small amounts of instruction as to what is expected from them. By contrast, the correlations for the control group were at the 0.8 level, as would be expected when one merely administers a pre-test and a post-test without an experimental intervention.

Of course, the more important question is not whether the scores changed or even correlated with each other, but rather how they correlated with other cognitive measures. In other words, which test was a better predictor of transfer to other cognitive performance, the pre-test score or the post-test score? We found the post-test score to be the better predictor in the experimental group.

In the Jamaica study described earlier, we had failed to find effects of anti-parasitic medication, Albendazole, on cognitive functioning. Might this have been because the testing was static rather than dynamic? Static testing tends to emphasize skills developed in the past. Children who suffer from parasitic illnesses often do not have the same opportunities to profit from instruction that healthy children have. Dynamic testing emphasizes skills developed at the time of test. Indeed, the skills or knowledge are specifically taught at the time of the test. Would dynamic testing show effects of medication (in this case, praziquantel for schistosomiasis) not shown by static testing?

The answer was yes. Over time, treated children showed a distinct advantage over children who received a placebo, and were closer after time had passed to the control (uninfected) group than were the placebo-treated children. In other words, dynamic testing showed both hidden skills and hidden gains not shown on static tests.

(f) *New 'intermediate tests' of cognitive skills reveal new aspects of cognitive performance*

In cultural research, we may want to assess school-related skills that are intermediate between abilities and achievement. Traditional tests of cognitive abilities are quite far removed from school performance. Achievement tests are a form of school performance.

In our work in Zambia, we devised such an intermediate test (Grigorenko *et al.* 2004*b*). Children in school and outside it continually need to be able to follow instructions. Often they are not successful in their endeavours because they do not follow instructions as to how to realize these endeavours. Following complex instructions is thus important for the children's success.

The Z-CAI measures working memory, reasoning and comprehension skills in the oral, written and pictorial domains. The Z-CAI was designed to measure children's ability to follow oral, written and pictorial instructions that become increasingly complex; be simple to implement, so that teachers could be easily trained to administer the instrument; be sensitive specifically to any improvement in cognitive functioning that was a result of improved health status; and be psychometrically sound (valid and reliable) in Zambia.

We found that children tested on the Z-CAI who were treated for parasitic illnesses outperformed children who were not treated relative to baseline performance.

(g) *Intelligence may be different things in different cultures*

Intelligence may be conceived in different ways in different cultures (see reviews in Berry 1997; Sternberg & Kaufman 1998). Yang & Sternberg (1997*a*) reviewed Chinese philosophical conceptions of intelligence. The Confucian perspective emphasizes the characteristic of benevolence and of doing what is right. As in the western notion, the intelligent person expends a great deal of effort in learning, enjoys learning and persists in life-long learning with a great deal of enthusiasm. The Taoist tradition, in contrast, emphasizes the importance of humility, freedom from conventional standards of judgement and full knowledge of oneself as well as of external conditions.

The difference between eastern and western conceptions of intelligence may persist even in the present day. Yang & Sternberg (1997*b*) studied contemporary Taiwanese Chinese conceptions of intelligence, and found five factors underlying these conceptions: (i) a general cognitive factor, much like the *g*-factor in conventional western tests; (ii) interpersonal intelligence (i.e. social competence); (iii) intrapersonal intelligence; (iv) intellectual self-assertion: knowing when to show that you are smart; and (v) intellectual self-effacement: knowing when *not* to show that you are smart. In a related study but with different results, Chen (1994) found three factors underlying Chinese conceptualizations of intelligence: non-verbal reasoning ability, verbal reasoning ability and rote memory. The difference may be a result of different subpopulations of Chinese, differences in methodology or differences in when the studies were done.

The factors uncovered in Taiwan differ substantially from those identified in US citizens' conceptions of intelligence by Sternberg *et al.* (1981): (i) practical problem solving; (ii) verbal ability; and (iii) social competence; although in both cases, people's implicit theories of intelligence seem to go quite far beyond what conventional psychometric intelligence tests measure. Of course, comparing the Chen (1994) study with the Sternberg *et al.* (1981) study simultaneously varies both language and culture.

Studies in Africa in fact provide yet another window on the substantial differences. Ruzgis & Grigorenko (1994) argued that, in Africa, conceptions of intelligence revolve largely around skills that help to facilitate and maintain harmonious and stable intergroup relations; intragroup relations are probably equally important and at times more important. For example, Serpell (1974, 1996) found that Chewa adults in Zambia emphasize social responsibilities, cooperativeness and obedience as important to intelligence; intelligent children are expected to be respectful of adults. Kenyan parents also emphasize responsible participation in family and social life as important aspects of intelligence (Super & Harkness 1982, 1986, 1993). In Zimbabwe, the word for intelligence, *ngware*, actually means to be prudent and cautious, particularly in social relationships. Among the Baoule, service to the family and community and politeness towards, and respect for, elders are seen as key to intelligence (Dasen 1984).

It is difficult to separate linguistic differences from conceptual differences in cross-cultural notions of intelligence. In our own research, we use converging operations to achieve some separation. That is, we use different and diverse empirical operations to ascertain notions of

intelligence. So we may ask in one study that people identify aspects of competence; in another study, that they identify competent people; in a third study, that they characterize the meaning of 'intelligence', and so forth.

The emphasis on the social aspects of intelligence is not limited to African cultures. Notions of intelligence in many Asian cultures also emphasize the social aspect of intelligence more than does the conventional western or intelligence quotient-based notion (Lutz 1985; Poole 1985; White 1985; Azuma & Kashiwagi 1987).

It should be noted that neither African nor Asian notions emphasize exclusively social notions of intelligence. These conceptions of intelligence focus much more on social skills than do conventional US conceptions of intelligence, while simultaneously recognizing the importance of cognitive aspects of intelligence. In a study of Kenyan conceptions of intelligence (Grigorenko *et al.* 2001), it was found that there are four distinct terms constituting conceptions of intelligence among rural Kenyans—*rieko* (knowledge and skills), *luoro* (respect), *winjo* (comprehension of how to handle real-life problems) and *paro* (initiative)—with only the first directly referring to knowledge-based skills (including but not limited to the academic).

It is important to realize, again, that there is no one overall US conception of intelligence. Indeed, Okagaki & Sternberg (1993) found that different ethnic groups in San Jose, CA, had rather different conceptions of what it means to be intelligent. For example, Latino parents of schoolchildren tended to emphasize the importance of social-competence skills in their conceptions of intelligence, whereas Asian parents tended rather heavily to emphasize the importance of cognitive skills. 'White' parents also emphasized cognitive skills more. Teachers, representing the dominant culture, emphasized cognitive skills more than social-competence skills. The rank order of children of various groups' performance (including subgroups within the Latino and Asian groups) could be perfectly predicted by the extent to which their parents shared the teachers' conception of intelligence. In other words, teachers tended to reward those children who were socialized into a view of intelligence that happened to correspond to the teachers' own. However, social aspects of intelligence, broadly defined, may be as important as or even more important than cognitive aspects of intelligence in later life. Some, however, prefer to study intelligence not in its social aspect, but in its cognitive one.

4. CONCLUSION

When cultural context is taken into account, (i) individuals are better recognized for and are better able to make use of their talents, (ii) schools teach and assess children better, and (iii) society uses rather than wastes the talents of its members. We can pretend to measure intelligence across cultures simply by translating western tests and giving them to individuals in a variety of cultures. But such measurement is only pretence. Individuals in other cultures often do not do well on our tests, nor would we do well on theirs. The processes of intelligence are universal, but their manifestations are not.

Intelligence can be used to maximize well-being, but it also can be used to destroy it, as Hitler, Stalin, Amin and many other leaders have shown. By understanding cross-cultural meanings of intelligence and of well-being, we can seek to match intelligence to the attainment of well-being, rather than to its destruction.

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REFERENCES

Azuma, H. & Kashiwagi, K. 1987 Descriptions for an intelligent person: a Japanese study. *Jpn. Psychol. Res.* **29**, 17–26.

Berry, J. W. 1974 Radical cultural relativism and the concept of intelligence. In *Culture and cognition: readings in cross-cultural psychology* (ed. J. W. Berry & P. R. Dasen), pp. 225–229. London: Methuen.

Berry, J. W. 1997 Immigration, acculturation and adaptation. *Appl. Psychol. Int. Rev.* **46**, 5–68.

Binet, A. & Simon, T. 1916 *The development of intelligence in children*. Baltimore, MD: Williams & Wilkins. [Originally published in 1905.]

Brown, A. L. & Ferrara, R. A. 1985 Diagnosing zones of proximal development. In *Culture, communication, and cognition: Vygotskian perspectives* (ed. J. V. Wertsch), pp. 273–305. New York: Cambridge University Press.

Brown, A. L. & French, A. L. 1979 The zone of potential development: implications for intelligence testing in the year 2000. In *Human intelligence: perspectives on its theory and measurement* (ed. R. J. Sternberg & D. K. Detterman), pp. 217–235. Norwood, NJ: Ablex.

Carraher, T. N., Carraher, D. & Schliemann, A. D. 1985 Mathematics in the streets and in schools. *Br. J. Devl Psychol.* **3**, 21–29.

Cattell, R. B. & Cattell, A. K. 1973 *Measuring intelligence with the culture fair tests*. Champaign, IL: Institute for Personality and Ability Testing.

Ceci, S. J. & Roazzi, A. 1994 The effects of context on cognition: postcards from Brazil. In *Mind in context: interactionist perspectives on human intelligence* (ed. R. J. Sternberg & R. K. Wagner), pp. 74–101. New York: Cambridge University Press.

Chen, M. J. 1994 Chinese and Australian concepts of intelligence. *Psychol. Dev. Soc.* **6**, 101–117.

Dasen, P. 1984 The cross-cultural study of intelligence: Piaget and the Baoule. *Int. J. Psychol.* **19**, 407–434.

Gardner, H. 1983 *Frames of mind: the theory of multiple intelligences*. New York: Basic Books.

Gardner, H. 1999 *Intelligence reframed: multiple intelligences for the 21st century*. New York: Basic Books.

Greenfield, P. M. 1997 You can't take it with you: why abilities assessments don't cross cultures. *Am. Psychol.* **52**, 1115–1124.

Grigorenko, E. L. & Sternberg, R. J. 1998 Dynamic testing. *Psychol. Bull.* **124**, 75–111.

Grigorenko, E. L. & Sternberg, R. J. 2001 Analytical, creative, and practical intelligence as predictors of self-reported adaptive functioning: a case study in Russia. *Intelligence* **29**, 57–73.

Grigorenko, E. L., Geissler, P. W., Prince, R., Okatcha, F., Nokes, C., Kenny, D. A., Bundy, D. A. & Sternberg, R. J. 2001 The organisation of Luo conceptions of intelligence: a study of implicit theories in a Kenyan village. *Int. J. Behav. Dev.* **25**, 367–378.

Grigorenko, E. L., Meier, E., Lipka, J., Mohatt, G., Yanez, E. & Sternberg, R. J. 2004*a* The relationship between academic and practical intelligence: a case study of the tacit knowledge of Native American Yup'ik people in Alaska. *Learning Individual Differences*. (In the press.)

Grigorenko, E. L., Jarvin, L., Kaani, B., Kapungulya, P. P., Kwiatkowski, J. & Sternberg, R. J. 2004*b* Effects of interventions against parasitic illnesses on a test of cognitive skills administered in Zambia. (In preparation.)

Guilford, J. P. 1982 Cognitive psychology's ambiguities: some suggested remedies. *Psychol. Rev.* **89**, 48–59.

Guthke, J. 1993 Current trends in theories and assessment of intelligence. In *Learning potential assessment* (ed. J. H. M. Hamers, K. Sijtsma & A. J. J. M. Ruijssenaars), pp. 13–20. Amsterdam: Swets & Zeitlinger.

Haywood, H. C., Tzuriel, D. 1992 *Interactive assessment.* New York: Springer.

Intelligence and its measurement 1921: a symposium. *J. Educat. Psychol.* **12**, 123–147, 195–216, 271–275.

Laboratory of Comparative Human Cognition 1982 Culture and intelligence. In *Handbook of human intelligence* (ed. R. J. Sternberg), pp. 642–719. New York: Cambridge University Press.

Lave, J. 1988 *Cognition in practice*. New York: Cambridge University Press.

Lidz, C. S. 1991 *Practitioner's guide to dynamic assessment*. New York: Guilford.

Lutz, C. 1985 Ethnopsychology compared to what? Explaining behaviour and consciousness among the Ifaluk. In *Person, self, and experience: exploring Pacific ethnopsychologies* (ed. G. M. White & J. Kirkpatrick), pp. 35–79. Berkeley, CA: University of California Press.

Nuñes, T. 1994 Street intelligence. In *Encyclopedia of human intelligence,* vol. 2 (ed. R. J. Sternberg), pp. 1045–1049. New York: Macmillan.

Okagaki, L. & Sternberg, R. J. 1993 Parental beliefs and children's school performance. *Child Dev.* **64**, 36–56.

Poole, F. J. P. 1985 Coming into social being: cultural images of infants in Bimin–Kuskusmin folk psychology. In *Person, self, and experience: exploring Pacific ethnopsychologies* (ed. G. M. White & J. Kirkpatrick), pp. 183–244. Berkeley, CA: University of California Press.

Raven, J. C., Court, J. H. & Raven, J. 1992 *Manual for Raven's progressive matrices and Mill Hill vocabulary scales*. Oxford Psychologists Press.

Rogoff, B. 1990 *Apprenticeship in thinking. Cognitive development in social context*. New York: Oxford University Press.

Rogoff, B. 2003 *The cultural nature of human development*. London: Oxford University Press.

Ruzgis, P. M. & Grigorenko, E. L. 1994 Cultural meaning systems, intelligence and personality. In *Personality and intelligence* (ed. R. J. Sternberg & P. Ruzgis), pp. 248–270. New York: Cambridge University Press.

Serpell, R. 1974 Aspects of intelligence in a developing country. *Afr. Social Res.* **17**, 576–596.

Serpell, R. 1996 Cultural models of childhood in indigenous socialization and formal schooling in Zambia. In *Images of childhood* (ed. C. P. Hwang & M. E. Lamb), pp. 129–142. Mahwah, NJ: Lawrence Erlbaum.

Serpell, R. 2000 Intelligence and culture. In *Handbook of intelligence* (ed. R. J. Sternberg), pp. 549–580. New York: Cambridge University Press.

Spearman, C. 1904 The proof and measurement of association between two things. *Am. J. Psychol.* **15**, 72–101.

Sternberg, R. J. 1985 *Beyond IQ: a triarchic theory of human intelligence*. New York: Cambridge University Press.

Sternberg, R. J. 1990 *Metaphors of mind: conceptions of the nature of intelligence*. New York: Cambridge University Press.

Sternberg, R. J. 1997 *Successful intelligence*. New York: Plume.

Sternberg, R. J. 1999 The theory of successful intelligence. *Rev. Gen. Psychol.* **3**, 292–316.

Sternberg, R. J. & Detterman, D. K. *What is intelligence?* Norwood, NJ: Plume.

Sternberg, R. J. & Grigorenko, E. L. 1997 The cognitive costs of physical and mental ill health: applying the psychology of the developed world to the problems of the developing world. *Eye on Psi Chi* **2**, 20–27.

Sternberg, R. J. & Grigorenko, E. L. 1999 A smelly 113° in the shade, or, why we do field research. *APS Observer*, **12**, 1, 10–11, 20–21.

Sternberg, R. J. & Grigorenko, E. L. 2002 Just because we 'know' it's true doesn't mean it's really true: a case study in Kenya. *Psychol. Sci. Agenda* **15**, 8–10.

Sternberg, R. J. & Kaufman, J. C. 1998 Human abilities. *A. Rev. Psychol.* **49**, 479–502.

Sternberg, R. J., Conway, B. E., Ketron, J. L. & Bernstein, M. 1981 People's conceptions of intelligence. *J. Personality Social Psychol.* **41**, 37–55.

Sternberg, R. J., Powell, C., McGrane, P. A. & McGregor, S. 1997 Effects of a parasitic infection on cognitive functioning. *J. Exp. Psychol. Appl.* **3**, 67–76.

Sternberg, R. J., Forsythe, G. B., Hedlund, J., Horvath, J., Snook, S., Williams, W. M., Wagner, R. K. & Grigorenko, E. L. 2000 *Practical intelligence in everyday life*. New York: Cambridge University Press.

Sternberg, R. J., Nokes, K., Geissler, P. W., Prince, R., Okatcha, F., Bundy, D. A. & Grigorenko, E. L. 2001 The relationship between academic and practical intelligence: a case study in Kenya. *Intelligence* **29**, 401–418.

Sternberg, R. J., Grigorenko, E. L., Ngrosho, D., Tantufuye, E., Mbise, A., Nokes, C., Jukes, M. & Bundy, D. A. 2002 Assessing intellectual potential in rural Tanzanian school children. *Intelligence* **30**, 141–162.

Super, C. M. & Harkness, S. 1982 The development of affect in infancy and early childhood. In *Cultural perspectives on child development* (ed. D. Wagnet & H. Stevenson), pp. 1–19. San Francisco, CA: Freeman.

Super, C. M. & Harkness, S. 1986 The developmental niche: a conceptualization at the interface of child and culture. *Int. J. Behav. Dev.* **9**, 545–569.

Super, C. M. & Harkness, S. 1993 The developmental niche: a conceptualization at the interface of child and culture. In *Life-span development: a diversity reader* (ed. R. A. Pierce & M. A. Black), pp. 61–77. Dubuque, IA: Kendall/Hunt Publishing Co.

Thurstone, L. L. 1938 *Primary mental abilities*. University of Chicago Press.

Vygotsky, L. S. 1978 *Mind in society: the development of higher psychological processes*. Cambridge, MA: Harvard University Press.

White, G. M. 1985 Premises and purposes in a Solomon Islands ethnopsychology. In *Person, self, and experience: exploring Pacific ethnopsychologies* (ed. G. M. White & J. Kirkpatrick), pp. 328–366. Berkeley, CA: University of California Press.

Yang, S. & Sternberg, R. J. 1997*a* Conceptions of intelligence in ancient Chinese philosophy. *J. Theor. Phil. Psychol.* **17**, 101–119.

Yang, S. & Sternberg, R. J. 1997*b* Taiwanese Chinese people's conceptions of intelligence. *Intelligence* **25**, 21–36.

GLOSSARY

Z-CAI: Zambia cognitive assessment instrument