Multilingualism, Cognition and Creativity

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Introduction

The way in which bilingualism is perceived has undergone a remarkable evolution. The phenomenon is no longer automatically considered as a problematic handicap as it tended to be when I began to work in this field, but rather as an intellectual bonus.

In the past it was often thought that bilinguals were less likely to achieve high potential in scientific or creative fields, primarily because of a biased mustering of evidence. Comparisons were made between successful unilinguals in a monolingual habitus against the problematic status of unsuccessful bilingual representatives, usually of deprived socio-educative backgrounds, while successful multilinguals were dismissed as the exceptional, privileged few who were not taken into account. Yet if we take a closer look at the number of creative people who were at least bilingual, if not multilingual, the implicit superiority of monolingual individuals can be challenged.

Some historical figures

The multilingual capacities of many historical figures are rarely underlined, or merely alluded to en passant in most reports on their achievements. A few illustrations, from a long line of illustrious figures, should suffice to draw attention to a neglected aspect of their fame.

The Emperor Charles V is quoted as using five languages for different purposes with different interlocutors and he is often attributed the quotation: « The more languages one knows the more human one is. »

The Tudor monarchs were adept at manipulating several languages. Henry VIII is said to have known Welsh, could debate in Latin - which he knew better than the contemporary archbishop of Cologne (Scarisbrick, 1971), negotiate in French, as well as his obvious use of English. Elisabeth I impressed her foreign visitors by her skills in Latin debate. Even the German-speaking George I, who was notoriously inadequate in English, discussed politics at his cabinet meetings in London in French and Latin with his ministers.

Frederick the Great, renowned as a military genius, astute politician, competent composer of music and adequate philosophical debater, was a proficient German-French bilingual (as studied in detail in Petersilka, 2005.) A similar picture emerges for Catherine the Great’s linguistic skills, covering German, Russian and French.
The exact sciences

When asked how many of his contemporary Nobel Prize winners were bilingual, Ilya Prigogine (Nobel Prize for Chemistry, 1977) who spoke Russian, French and English and taught through French and English, replied, «the majority» (personal communication) a statement that should provide food for thought for those who believe multilingual skills may hamper scientific creativity. A glance at the list of Nobel Prize winners since the foundation of the award, their country of origin and place of work, suffices to confirm the affirmation by Prigogine, particularly the scientific winners in recent decades, many of whom published in English but worked in non-English-speaking universities.

The humanities

The same food for thought is provided by the impressive number of creative writers who lived and worked in more than one language. The following list is but an illustration of a large number of leading intellectuals and artists who illustrate this point (for further information, cf. Baetens Beardsmore, 1978; Forster, 1970; Lind & Suerbaum, 1968; Graham, 1956).

Joachim du Bellay (1522-1560) French Renaissance poet who produced verse in French and in Latin and is the author of the Défense et illustration de la langue française (1549), a milestone in the propagation of the French language as a language of culture.

John Milton (1608-1674) wrote poetry in Latin, Italian and English.

Gottfried Leibniz (1646-1716) German philosopher and mathematician wrote in French and Latin.

Johann Wolfgang Goethe (1749-1832), poet and playwright, first minister of the Duchy of Weimar, whose scientific interest led him to discover the intermaxillary bone, wrote many of his love-letters in excellent French, interspersed with his poems in German. He read French, Italian, English, Latin and Greek authors in the original, and himself translated Benvenuto Cellini from Italian and Voltaire and Diderot from French (cf. Ancelet-Hustache, 1960, 95-98, and 165).

Joseph Conrad (1857-1924) born in the Ukraine, grew up reading Polish, French and English and produced his literary output in English.

Maurice Maeterlinck (1862-1949) Nobel Prize for Literature - 1911, spoke the Flemish dialect of Ghent where he was born and wrote in French.

Stefan George (1868-1933) German symbolist lyrical poet who learnt Italian, Hebrew, Greek, Latin, Danish, Dutch, Polish, English, French and Norwegian. Although he published mainly in German he translated many authors into German and also wrote, purely for pleasure in an invented poetic language called «lingua romana». He destroyed the results of this production so as to prevent prying philologists from attempts to reconstruct it!

Rainer Maria Rilke (1875-1926) born in Prague when it was part of the Austro-Hungarian Empire published poems in German and French.

Vladimir Nabokov (1899-1977), brought up trilingually in St Petersburg, wrote in Russian, in French and in English and translated some of his own works from Russian into English and from English into Russian, but also re-wrote some of his Russian novels in their English version.

Elias Canetti (1905-1994) Nobel Prize for Literature – 1981. A Bulgarian whose mother-tongue was Ladino and spoke German and English through schooling abroad, published mainly in German.

Julien Green (1900-1998) French-American novelist and playwright who wrote in both French and English and was the first non-Frenchman to become a member of the Académie française.

Emil Cioran (1911-1995) Romanian author with good knowledge of German who wrote in Romanian and French. Originally with fascist tendencies he later regretted his attraction to totalitarian ideas after his installation as a permanent resident in France. An interesting reflection of Cioran’s is his comment, “On n’habite pas un pays, on habite une langue.” (Aveux et anathèmes, Paris, Gallimard, 1987) which in a loose translation can be re-interpreted as “One does not inhabit a country, one lives in a language” and revealing the significance of his bilingual and expatriate status.

Samuel Becket (1906-1989) Irish author and playwright who wrote in both English and French but his major works were all written in French.

Paul Celan (1920-1970) Poet of Jewish origin, born in Romania, lived in France, wrote primarily in German but filled his writings with foreign words and expressions taken from Hebrew, with one poem published in French, which became his home language after he settled in France in 1948.

Vassilis Alexakis (1943- ) Greek author, film-maker and playwright who writes in Greek and in French, and in his plays mixes spoken language and the language of the deaf. Two of his titles are revealing, «La langue maternelle» and «Les mots étrangers», reflecting his preoccupations with bilingualism.

The above illustrations are not intended to show that there were fewer great monolingual statesmen and women, scientists or creative writers, which would be absurd, but aim to redress the imbalance on perceptions of exceptional talent, often assumed to go in favour of the unilingual.
Multilingual Education, Cognition and Creativity

In circumstances where appropriate pedagogic strategies coincide with a favourable social environment it is perfectly feasible to build up harmonious bilingual development. Beyond the dispelling of potential fears about « collateral damage » brought about by badly organised bilingual education, several action-research programmes undertaken in different countries reveal with much precision the cognitive advantages that good bilingual education can bring in its wake. This is the specific aim of the proponents of CLIL/EMILE programmes and similar research enterprises, whether they go under this label or not.

Based on a synthetic overview produced by Georges Lüdi (1998) it is possible to make the following assertions with reference to properly developed school bilingualism. The assumption taken here is that CLIL/EMILE type programmes help develop cognitive skills which have the potential to produce more widespread creativity, whether in modest innovative changes to an existing frame of reference, new approaches to established ways of operating, or major creative endeavours.

Bilingual children have a greater faculty for creative thinking at their disposal. They perform significantly better in tasks which require not the finding of the single correct answer to a question, but where they are asked to imagine a number of possible correct answers, for example, giving the maximum number of interesting and unusual uses for a cup (Baker, 1988, Ricciardelli, 1992). These findings have been confirmed by Braun (2007, 241) in measures in French-Dutch bilingual programmes in Belgium, where a clear superiority was found in pupils in an immersion-type programme compared with their monolingual peers in creativity tests, and this systematically and on all measures that were used (e.g. on fluency, flexibility and originality scales).

Bilingual children have greater communicative sensitivity in that they are more able to take into account situational factors and to react appropriately by correcting errors of sequencing and behaviour (Ben-Zeev, 1977). It is thought that this is caused by the need, on the basis of different signals, to rapidly determine the choice of the appropriate language for a particular context (Baker, 1996, 136).

Metalinguistic capacities are more advanced in bilinguals than in equivalent monolingual groups. This refers to better analytical skills as well as better cognitive control over linguistic operations (Bialystok, 1988, 1991a). For example, bilinguals have greater sensitivity to semantic relationships between words (Cummins, 1978; Diaz & Padilla, 1985). This brings in its wake advantages for acquiring literacy skills and a better chance of success at school. Braun’s (2007) analysis of reading comprehension among children who had followed a Dutch immersion type programme in French-speaking Belgium when compared with those in traditional monolingual programmes confirms this.

Bilinguals can make better use of self-regulating mechanisms, as when they begin a statement and then track back to correct themselves (Ekstrand, 1981).

In tests of spatial perception they perform better than unilinguals. In what is known as the embedded figure test (Witkin et al., 1971) they are more skilled at re-tracing the figures, which seems to indicate greater cognitive clarity and a superior ability to analyse the problem. McLeay (2003) showed that bilinguals were better able to deal with more complex tasks on measures of spatial imagery which reflect high control of attention.
The advantages bilingual children have could possibly be explained by the more varied cultural experiences they are confronted with and the need to make choices and alternate between two languages. According to Vygotsky (1985) they distance themselves more readily from a given language which makes the child more conscious of the relative nature of the conceptual filter through which a particular language gives meaning or verbal expression to the outside world. This is because the child uses more than one language, which confers an increased capacity for abstraction and a greater ease at manipulating categories.

It would appear that bilingual skills lead to greater development of creativity both on verbal and non-verbal levels of activity, such as leading bilinguals to offering different solutions to mathematical problems when compared with unilinguals (Cummins & Galutsan, 1974).

Gajo & Serra (2002) have conducted investigations into the teaching of mathematics via the medium of both Italian and French in the Val d’Aoste region of Italy. Their major research questions were:

1. The classical question about whether one acquired a language better and more efficiently in a bilingual model of education
2. The new question about whether one learnt the non-linguistic content-matter better in a bilingual model of education.

This they did by analysing the specific language needed for mathematics in both languages and the differences between the everyday use of each language. This research represents an extension of the type of analysis made by Bialystok (1991b).

They concentrated on the assumption underlying all teaching, i.e. that the construction of knowledge for a particular discipline is built up on the basis of verbal interaction. Due to negotiation on both the content matter and the language of the specific non-linguistic subject-matter between teachers and learners the school subject can be handled more in depth by the brain. It is by means of the scaffolding of cognitive operations, the sorting out of new information, the construction of links between the different types of information, the
organisation of facts and the operations leading to the solution of problems that the learner progresses. This is done by concentrating on the linguistic structures which are required for abstract operations.

Gajo & Serra’s investigations revealed that the results in mathematics where slightly better in the bilingual classes but there were significant differences in the way the monolingual comparison groups operated. It would appear that bilinguals and monolinguals tend to use different strategies in working on the mathematical content of the courses:

Bilingual children […] ultimately and inevitably process language differently from monolingual children (Bialystok, 1991b, 139).

The monolinguals seemed to be stronger in their acquisition of knowledge of facts, whereas the bilinguals were better in acquiring the mathematical operations. In other words, the research revealed a difference between informational knowledge and operational knowledge for the two groups of subjects. Informational knowledge refers to the capacity to memorise, or « knowing that », whereas operational knowledge refers to the capacity to apply what one knows to new circumstances, or « knowing how ». Operational knowledge is significant for creativity, whereas informational knowledge serves more as a tool on which creativity must be built up. The studies on the learning of mathematics in a bilingual context were confirmed amongst different school populations, both in primary and secondary education, and even amongst beginners in second language programmes.

Similar positive results have been documented for Basque bilingual education models, very different from those investigated by Gajo and Serra. In standardised measures used throughout all the participating autonomous communities of Spain the Basque Country and Navarre scored above the average for Spain in mathematics and Spanish-language reading comprehension in primary education, in spite of or thanks to educating bilingually (Sierra, 2008, 41-42). The same source reveals that on the PISA 2003 tests for reading skills the rating for the bilingual Basque pupils was higher than those for France and the United States and higher than the OECD mean (Sierra, 2008, 43).

Incidentally, Gajo & Serra’s studies revealed a positive impact on the teaching of mathematics in the stronger L1, including that aimed at monolingual programmes, as the comparisons enabled teachers to become more aware of the need to work on the specific nature of the language required and not just the mathematical concepts, as they had tended to do before the comparisons with the bilingual classes.

Muñoz (2002 :35) suggests that handling a non-linguistic subject through the medium of a second language in a CLIL/EMILE type programme makes teachers more conscious of the linguistic needs of learners, which provokes more efficient comprehension control strategies in response to these needs. Teachers use such strategies to make new facts and phenomena more comprehensible and better anchored in their specific context. Moreover, the need for permanent comprehension controls leads to more intensive interaction between teachers and learners, which increases the opportunities to use the target language for the acquisition of non-linguistic content-matter. The added value of such CLIL/EMILE models of teaching is that it encourages fluency, whereas language courses tend, even if not exclusively, to focus on accuracy. Hence the two types of instruction, language courses and content-matter courses, present combined advantages in both linguistic and cognitive development. Whether these advantages lead to greater creative skills is a moot point, since there has been no specific
research into creativity resulting from multilingualism, a difficult challenge without some consensual definition of what makes up creativity.

Cavalli (2005), who has worked in a similar vein to Gajo and Serra, reports on extensions of the investigations on mathematics to other areas of the curriculum in the Val d’Aosta region of Italy, referring to work by Assuied et al. (1994) and the several studies into cognitive skills by Assuied & Ragot (1999a, 1999b, 2000b).

Research into the cognitive effects of bilingual education in primary schools in the Aosta region, where a bilingual model of education using Italian and French exists for all children, has been carried out on the entire school population of 10 year olds.

Measures were specifically used for assessing, not the language component of the bilingual programme, but rather the cognitive skills by using parallel texts for the stronger language, Italian, and the weaker school inculcated language, French. Interesting results were produced, depending on the language of the parallel measurements. Certain cognitive operations, for example, those requiring the identification of the most significant elements in each of the parallel texts, revealed no relevant differences between the two languages. Those measures which required the coordination of cognitive capacities, and where the task was to sort out the given elements so as to produce a hierarchy, or others where the task was to synthesise information, produced slightly better results in the stronger Italian language. This represented an advantage for the stronger language in handling a slightly more difficult task, but the differences were not great when compared with the weaker school language. However, in the most difficult set of tests, where it proved impossible to rapidly grasp the nature of the task required to produce a result, that is, those which made call on the most complex set of cognitive skills, the results were better in the French second language than the Italian stronger language. It would appear that in the more demanding tests when the Italian measures were used the children relied on global comprehension skills which led to them providing superficial reactions and less precise responses. On the other hand, in the parallel tests using the weaker school language, French, the youngsters concentrated more on the details of the text and provided more precise and accurate responses to the questions (Assuied & Ragot, 2002). These findings represent an interesting refinement to Bialystok’s hypothesis that:

Second-language problems are depicted as demanding higher levels of skill than comparable problems in a first language because the demands placed upon performance for speakers in a second language are more taxing than those imposed for speakers carrying out the same function in a first language. (Bialystok, 1991b, 123).

The above studies, like those of Gajo and Serra mentioned earlier, add confirmatory evidence, when addressing content-matter subjects, to Bialystok’s conclusion, based on an analysis of grammaticality judgements, that:

Children who were bilingual, irrespective of age or literacy, scored higher on the items demanding higher levels of control of processing. Children who were bilingual and biliterate also demonstrated some advantage on items demanding high levels of analysis (Bialystok, 1991b, 132).

Research of the type referred to represents a powerful argument for the advantages of CLIL/EMILE type bilingual programmes, since it helps to increase the potential for, if not the realisation of, more creative thinking at some stage of development.
The investigations reported by Cavalli et al have produced measures on three levels; 
on the level of language competence;  
on the level of subject competence;  
on the level of cognitive competence.

The initial measures were tested on 1008 pupils in 57 classes situated in 12 middle schools. In 
the following section I will synthesize the research conducted in the Val d’Aoste on 
measuring cognitive competence. These were compared with 1 class of 13 Italian pupils in the 
neighbouring region of Piedmont who did not receive bilingual education and 126 
monolingual French pupils in 5 middle school classes in a neighbouring region in France.

The language measurements provided comforting results for the linguistic goals of the 
bilingual programme, which includes some restricted contact with English as a third school 
language.

Results show that for French linguistic competence:  
- written comprehension is good or very good for two thirds of pupils who are capable of 
understanding complex task instructions which imply taking into account several 
parameters;  
- in written production half the pupils are capable of carrying out a complex task and 
communicating efficiently, even though their performance is not comparable to that of 
native speakers; the other half of pupils appear to have blockages more of a cognitive than 
of a linguistic nature;  
- in oral production intelligibility is highly satisfactory;  
- for auditory comprehension, in spite of the difficult test requirements, pupil performance 
is very good.

As far as Italian is concerned, in written comprehension one pupil out of five fails at the tests 
which pose a cognitive challenge, whereas in written production writing skills in Italian 
coincide with those for French but the global results are less satisfactory with respect to the 
textual typologies, which is probably attributable to teaching practice.

Finally, with reference to written comprehension in English the pupils are capable of juggling 
with information given under different forms and in different languages.

For the other research questions the following findings reveal the innovative strengths of the 
research conducted on this school population.

The goal was to discover whether working in a bilingual education system where French was 
the weaker target language represented a burden on the acquisition of knowledge, or whether 
on the contrary it represented a facilitator.
Cognitive competence was defined as follows:

“L’ensemble des outils avec lesquels nous organisons nos expériences, nous nous les représentons, nous les fixons dans notre mémoire, nous en tirons des leçons, c’est-à-dire nous les généralisons, nous devenons ainsi capables de mieux comprendre les expériences suivantes, c’est-à-dire nous apprenons. Ces compétences sont en fait constitutives de toute activité mentale, et en ce sens elles sont la condition de tout apprentissage.” (Assuied et Ragot 1999 : 2)

The measures used were aimed to discover whether the logical functioning of pupils at the end of the bilingual middle school were equally available in Italian, the first language, and French the second language. Altogether nine sets of measurements were used in groups of three to evaluate the following skills.

Skills relating to the sorting and organisation of information, i.e. analytical skills which involve selecting the relevant information, categorising it and selecting the appropriate summary.

Skills involving the construction of concepts based on a categorisation, that is recognising an appropriate definition and constructing a definition.

Skills relating to argumentation and the logical value of an inference.

It could be argued the above cognitive skills gradually being developed increase the potential for creative thinking, whether in the humanities or the sciences. The question then arises whether such skills are equally well developed in bilingual education models or better than in monolingual education.

The parallel tests were conducted in the two languages on separate occasions across almost the total school population of the age group targeted. Global results showed that the majority of pupils are capable of calling on the required skills in both languages. 88.5% of pupils obtained 60% scores in the Italian versions and 82.1% did so in the French versions.

It is claimed that the fact of operating in a bilingual schools system enables pupils to learn to pay better attention to relevant information, leading them to transfer the attention paying skills used to decode the second language texts to their stronger first language.

From the research conducted in the Val d’Aoste it appears that pupils are capable of using the following cognitive skills satisfactorily:

Move from descriptive or narrative messages to general, synthetic and categorising statements;

1 « The group of tools with which we organise our experiences, how we represent them, how we fix them in memory, how we learn from them, that is how we generalise from them, how we become capable of better understanding new experiences, i.e. how we learn. These skills are in fact basic to all mental activity and in this sense they are necessary for all learning (Assuied & Ragot, 1999a, 2). »
Recognise the extension of a conceptual domain and include facts into a more general category;

Recognise hierarchical levels of organisation of a concept, for example distinguish characteristics which include an object in its group together with the traits that specify it;

Use logico-formal aspects of the vocabulary and syntax (e.g. scientific suffixes, quantifiers used in natural language) to locate a level of generality;

Construct a valid definition of a concept according to the age appropriate logic of organisation.

The above skills were manifested in both the first and the second language, but it was noted that in heavy, rigorously presented texts pupils tended to under-estimate the amount of attention required to carry out the tasks in the stronger first language and to rely on global comprehension skills, something which occurred far less in the L2 cases. For example, in tasks depending on a strong appreciation of text logic results were significantly better for the school L2 than for the stronger L1. The number of pupils who obtained very good or good responses on the two tests applied was as follows:

Good responses Italian (1) 8.8% (scored 20/20) (2) 18.1% (scored 19/20)
Good responses French (1) 18.9% (scored 20/20) (2) 28.7% (scored 19/20)

This leads to the assumption that in the L1 the work is carried out less efficiently because of reliance on approximate semantic impressions, something which is less easy in the L2. It is equally possible that the specific discourse structure of scientific L1 Italian is over-estimated by teachers, or taken as given, whereas this is not the case in the schools’ L2. An interesting result was that in more argumentative texts, e.g. in discussions of opinions where the arguments are plausible but less rigorously connected and requiring the whole text to be retained in the working memory, pupils did better in their L1, where 66.3% achieved very good or good responses, versus 31.1% on the L2 French version (Assuied & Ragot 2000a, 26ff.)

In a recent investigation into auditory and written comprehension by Serra (2007) in Swiss final year primary schools working bilingually either through German and Italian or through German and Rheto-Romansch better test scores were obtained on the more difficult questions than on the simple questions. This also proved the case with the monolingual control groups. These results confirm the significance of approximate semantic impressions where inferences are interpreted based on knowledge of the world, rather than on sequential text logic. The simpler questions appear too simple and lead to over-interpretation. On reading comprehension the scores were again slightly higher for the bilingual group compared to the monolingual controls on the medium difficulty and most difficult questions. Such paradoxical results do reveal the high levels of comprehension that can be achieved through a bilingual programme, and confirm the Canadian results on immersion programmes.
The important feature of the above results is that they provide a new twist to the claim that:

Learners can develop proficiency in certain aspects of language use while their ability to perform in other contexts remains limited. Thus, language learners, particularly second-language learners, may ‘specialize’ for the oral conversational uses of the language or for the technical aspects. These two contexts demand different combinations of the underlying components required to process language, and learners can deliberately elaborate their resources necessary for one of these contexts (Bialystok, 1991b, 134).

The unexpected twist is that we generally assume that language use ‘specialization’ would tend to work in favour of the stronger L1, whereas this may be true for argumentative texts, but not so for those requiring a strong appreciation of text logic. This may, of course, be due to teaching methodology applied to L1 and L2 and not inherent to developing bilingual skills. However, in the Val d’Aoste region a specific bilingual teaching methodology tends to be generally applied, where code-alternation forms a controlled but integral part of teaching practice, so that there is no self-evident explanation of those results that are better in L2 tasks.
Conclusion

The above is no more than an overview of domains that have not been sufficiently exploited in the research pertaining to bilingualism. The illustrations of a few famous historical figures, scientists and creative writers have served me in meetings intended to help dispel anxieties from parents embarking on bilingual education for their children (cf. Baetens Beardsmore, 2003). This is not to say that there is a causal link between multilingualism and outstanding achievement, given that there are many unilingual scientists and creators in all walks of life. But the illustrations are an attempt to show that there is no necessary handicap to creative thinking because of a multilingual background, on the contrary. To date there is no solid scientific evidence to prove that more widespread multilingual proficiency will lead to cognitive advantages such as to foster greater creativity. But an opposite position, which would try to prove a causal link between monolingualism and creativity, does not exist either. The major problem that bedevils investigations into either position is our inability to pin down creativity, or, to what extent potential creativity can be stimulated by a particular form of education. We are well aware of what features can stunt creativity, but it is yet to be proved that a schooling system can do little more than help foster genius in whatever field of human endeavour. We simply do not know how people become a Mozart, Tolstoy, Einstein or Freud.

The objective aimed at by all CLIL/EMILE type programmes is to capitalise on the integrated focus on language and subject matter issues in a coherent framework. The results of the research into the cognitive aspects of well-designed bilingual education, which is not elitist, not experimental, but applied and constantly adapted via focus-research to an entire school population of a given age, represent a relatively recent break-through by drawing attention to other aspects than the purely linguistic advantages claimed for similar programmes. And it is likely that this vein of research will become ever more important if we take into account the UNESCO (2003, 15) assertion that learning through the medium of the first language is not the most usual way of learning across the world.

The investigations reported here reveal to what extent, thanks to an appreciation of the added value brought about by well-designed bilingual education, thinking can become polyphonic, a quality attributed to the bilingual author of *After Babel*, George Steiner (Steiner & Ladjali, 2003, 48).
The impetus given within Europe to the promotion of bilingual education, and the specifically European development of CLIL/EMILE type programmes, can take some inspiration from the concluding remarks of the book by Prigogine and Stengers which point to the creative potential within the diverse, pluricultural elements that make up the continent:

C'est en Europe que s'inventa l'aventure inquiète d'un savoir susceptible de mettre en question toute norme, toute évidence, toute valeur traditionnelle. C'est en Europe aussi que s'inventa l'idée de démocratie, de société ouverte sur un avenir que ne modèle aucun ordre transcendant. Aujourd'hui, chacun le sait, il est devenu essentiel que science et démocratie inventent une nouvelle forme de dialogue. Pour qu'un véritable dialogue entre deux pratiques aux contraintes si différentes soit possible, il faut que se crée un monde dense et multiple d'intérêts partagés. Car c'est l'intérêt qui tout à la fois donne sens aux contraintes, permet de les reconnaître autrement que comme normes arbitraires, et de comprendre, voire de partager la passion des problèmes que conditionnent ces contraintes. L'Europe, où se libérèrent ces intérêts que l'on a trop longtemps définis comme opposés par nature, ceux du "savoir" et ceux de "la vie", comme disait Gaston Bachelard, devrait être singulièrement sensible à ce défi de l'avenir. Peut-être sa richesse culturelle, sa diversité, sa tradition historique nourriront-elles l'invention des pratiques nouvelles qu'appelle la construction du monde de demain (Prigogine & Stengers, 1988, 194).²

² It is in Europe that the disquieting adventure of knowledge likely to challenge all norms, all evidence, all traditional values was invented. It is also in Europe that the idea of democracy was invented, of a society open to a future not modelled by any supernatural order. Today, we all know, it has become essential for science and democracy to invent a new type of dialogue. To produce a dialogue between two types of practice subject to such differing constraints we must create a world with dense and multiple shared interests. It is because interests make sense of constraints, enable one to understand them as not arbitrary norms and to understand, even to share the passion for the problems conditioned by such constraints. In Europe, where these interests were set free, as Gaston Bachelard put it, those referring to “knowledge” and those referring to “life”, and for far too long by definition in conflict, such interests should be particularly sensitive to the challenge of the future. It may well be that Europe’s cultural wealth, diversity, historical tradition will lead to the invention of new practices that are required to construct the world of tomorrow.
References


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