ISSA Proceedings 2002 – In Defense Of The Realm: Administrative Responses To Anti-Globalization Argumentation

"The world is in a rush, and is getting close to its end."
Archbishop Wulfstan, York, 1014

Seattle, November 1999. Between 35,000 and 65,000 activists gathered in Seattle to protest the meeting of foreign ministers of the World Trade Organization, a little known – at the time – organization formed to resolve trade disputes. Peaceful marches turned violent as police sought to contain and remove the protesters. The resulting conflagration shocked the world and forever changed the media's treatment of globalism issues. "Seattle was a real watershed. It raised the awareness of the world. Before that, people didn't even know what the WTO was – maybe they thought it was the World Tourism Organization or something" (Ransom, 2001, 26).

In city after city, Washington, Melbourne, Prague, Davos, Quebec, Goteberg, Salzburg, Genoa, Doha, New York, when elite members of the international community gathered to promote globalism, large crowds of frequently violent protesters also gathered. Whether it is the World Trade Organization, the International Monetary Fund, the World Bank, the World Economic Forum, the Summit of the Americas, the European Union, or the G8 – each organization represents a transnational effort to promote economic growth through their own notion of what will encourage economic development. And each time they meet to set new policy, revamp existing regulations, or work out their differences, they now encounter the stratagems and visceral responses of anti-globalism activists. This shift in the discourse of globalization was rapid and violent. Trade across nation-states and very long distances is not new and neither is the concept that

the world is shrinking. But the rather benign view of globalization that was presented in the U.S. media prior to Seattle was rapidly reconfigured into a war between the "haves" and the "have-nots," or the powerful versus the powerless.

This essay is part of a larger study on the portrayal of the anti-globalization movement in the American media. We have argued that this social movement is best described as a loosely structured amalgamation of groups opposed to free trade, environmental dumping, and other practices deemed helpful only to large corporations and/or large governments. We believe that the movement engages its audience through a patchwork of "entertaining" activities that are uniquely suited to our current media culture (Baaske & Riley, 2000). Frequently contradictory in their goals and argument strategies, this movement has little sense of hierarchy and can be recognized as a movement only because its members identify themselves as such and because they both share and constitute networks of communication.

The arguments of the anti-globalization movement are extremely interesting – they are polysemic in nature and therefore vary widely and are often contradictory. The aftermath of Seattle is often referred to as the "stain of Seattle" by WTO Director General Mike Moore and other government leaders (Johnson, 2001). This stain is either portrayed as disappearing as violence ebbs, or as reappearing as concerns about sweatshops, rampant poverty, and forced trade agreements come to light (Lady Mac Beth move over!). The subsequent meetings of many of the world organizations have been a roller coaster ride of climactic protests and sedate street theater, as the road-show that is this movement appears in city after city as it doggedly pursues the institutionalized organizations of globalization. The responses by these leaders as they attempt to operate under the glare of worldwide publicity – while their meetings are guarded by strict security and fortress-like barricades – adds another level of interest and complexity to the media spectacle.

Understanding the arguments and the argumentative practices of a movement necessitates an examination of all the social actors. Argument is by its nature oppositional and dialectical. Extracting argumentative discourse from its dialogic context separates the argument from the social interactions that give it form. To put this another way, the shape and form of argumentation is necessarily responsive to the discourse and actions of the other interactants. Each move responds to and is reflective of the arguer's understanding of the other's argumentation. Thus examining advocacy as moves and counter-moves is one way

of enabling the argument student and scholar to more fully understand the tensions in social movements. This is especially the case, we believe, when the advocates involved in a controversy represent disparate and divergent voices. In this paper, we consider more fully the administrative responses to the anti-globalism movement.

Administrative rhetoric is the designation given to discourse proffered in defense of the current hierarchy of values; the policies of the current bureaucracies (Windt, 1982). Its advocates, "priests" in Burkean terms, respond to critics who imagine a more perfect social order. Administrative argument, in our minds, is therefore understood as responsive discursive and non-discursive actions engendered by the advocacy of those dissatisfied with the current power structure. Thus we focus on the words and actions taken by the representative and leaders of the international community in response to the protests leveled by the anti-globalism advocates.

Inherent within any argumentative practice is both the content of the advocacy, its substantive dimension, and the manner in which the advocacy is conveyed. Argument is not just what is said, but also how it is communicated. Keeping this in mind we organize our analysis of the administrative responses to the protest advocacy along two lines of inquiry: first, what are the characteristics of administrative argumentation? And second, what is the administrative response to the substantive arguments advanced by the opponents of globalization? This perspective also leaves open the possibility that arguments are physical, visual, or other alternative texts.

Argumentative Characterizations

The heads of state, finance ministers, assorted bureaucrats and media experts clearly do not conceive of the anti-globalization protesters as possessing equivalent standing. In fact, globalization spokespeople and the press consistently seek to denigrate the activists by painting them with broad and negatively charged labels.

Linking the protesters with violence is one such approach. After the violence surrounding the Summit of the Americas meeting in Quebec, Jules Crittenden (2001) of the Boston Herald declared, "Anarchists suspected of inciting clashes" (Crittenden, 2001, 3). The mayor of Prague, a scene of another violent confrontation between the police and protesters described those who battled with the police as "professional trouble-makers" (BBC News, 2001). The violence in

Genoa during a G-8 summit was so pronounced that a 23-year-old protester was shot and run over by police as he attempted to throw a fire extinguisher through the rear window of a police vehicle. The Prime Minister of Rome, Silvio Berlusconi, then threatened to withdraw Rome's commitment to host the United Nations' Food and Agriculture Organization (Boudreaux, 2001). In addition to criminalizing activists, others have suggested that protesters are as out of touch with reality as the "Luddites" of the nineteenth century (The Independent, 2000).
Co-optation is another administrative response engaged in by globalists. This includes setting up pre-conference meetings with protest organizers, as the Italian Foreign Minister, Renato Ruggiero, and Interior Minister, Claudio Scajola, did prior to the Genoa G-8 meeting (Trofilmov, 2001). More unusually, the multinational corporation Unilever donated money to the Ruckus Society – a protest group dedicated to training activists to hang from buildings and billboards (Useem, 2001). How well these actions work is unknown but the thought must be that if activists are included and supported and yet they still protest and engage in violence, they must truly be unreasonable and/or motivated by something other than expressing their views.

Argumentative characterizations can also be conveyed non-discursively. This has been achieved through the relegation of protesters to specified protest areas. In Quebec, Prague, and New York, police sought to isolate protesters by limiting them to designated free speech areas. Very tall fencing bound each such area.
Police also separate anti-globalism activists from conference participants by erecting chain-link fences. One effect of this is to minimize and marginalize the protesters. When conference participants cannot hear the protesters, their voices have been effectively silenced.
Fencing also has the pernicious effect of inviting criminality. Protesters shunted off away from relevance and locked behind a chain-link fence are practically invited to attempt to knock down the fence. This is what happened in Quebec (O'Clery, 2001). The Royal Canadian Mounted Police erected a 10-foot high, 2-½ mile fence around Old Quebec. The fence became the focal point for the protesting crowd. First they catapulted stuffed teddy bears and Barney dolls over the fence the rejected icon signifying perhaps that they were not a happy family. Then the crowd climbed and cut and rocked the fence until it came tumbling down. When the crowd rushed through the hole in the fence, the police drove the protesters back with tear gas. All of this activity at or near the fence makes one conclusion very clear, "The fence shaped the protests" (Montgomery, 2001, 3 of

5). In her study of the rhetoric of globalization Todd (2002) defines two primary types of response to the protesters by the organizations under attack: containment and criminalization, both of which are displayed in the Quebec story. Finally, there is a simple spin-doctor argument offered by the leadership of the WTO. "One cause of the protests, said Mike Moore, director-general of the World Trade Organization, is that globalization just hasn't gotten enough good public relations. 'We have to communicate its benefits better,' he said" (Boudette & Johnson, 2002, 6). To reuse an old phrase, they thought they had a failure to communicate.

Substantive Issues

The pro-globalization community takes great pains to address the substance of the objections raised by protest groups. Of course, they do so in the context of parent correcting the misstatements and misunderstandings of children. To illustrate this clash of ideas we consider four of the issues central to the dispute: development, democracy, the environment, and inclusivity.

The Development Debate

Anti-globalization advocates challenge the premise that reduction of trade barriers enhances the economic opportunity for developing nations. They point, for example, to the exploitation of workers in developing countries by multinational corporations that utilize sweatshops. Workers, they claim, toil in unsafe conditions not permitted in developed nations. Children are also employed because many developing countries lack prohibitions against child labor. While workers make little for their efforts, the corporations reap windfalls. Many unions also fear that reduction of trade restrictions will result in the exportation of jobs. Similarly, poorer countries want the right to ignore costly drug patents to treat growing problems like the AIDS epidemic (Cox, 2001).

Supporters of free trade contend that only development can raise the standard of living of the people of the developing world. They argue that removal of trade restrictions is the best way to promote such development. Bhagwati and Meyer (2002) are illustrative when they argue, "Proponents of trade have always considered that trade is the policy and development if the objective. The experience of the post-war years only proves them right" (Bhagwati & Meyer, 2002, 26). Nelson (2000) is even more emphatic when he contends, "In the past ten years free trade has done more to alleviate poverty than any well-intentioned law, regulation, or social policy in history" (Nelson, 2000, 40).

Three points need to be considered in assessing this substantive dispute. First, despite the claims of the elites (Gittins, 2002), there are many who claim the gap between haves and have-nots has widened (Holt, 2001). Second, globalization development has not fostered "sustainable development." Major development projects, such as building dams and pipelines are largely one-time only endeavors. Sustainable growth projects should continue to encourage development. For example, founding financial institutions with a stake in the community, such as the Grameen Bank in Bangladesh, are thought to do more for the long term. Finally, the economic dislocations associated with a free market are not illusory. The nature of the free market is to let the market decide who makes what products. While the theory is benign, the practice is that producers move from one community to another in search of cheaper labor, lower costs, and, above all, greater profit.

The Democracy Debate

A second significant concern of the anti-globalization advocates is what they perceive to be the usurping of legislative prerogatives of sovereign nations: the right to make their own laws. These activists insist that organizations like the WTO ignore the wishes of the electorate and legislate policy irrespective of wishes of the polity or its democratically elected leadership. Exemplary of this concern is the case of hormone enhanced U.S. beef. The EU has banned the importation of this beef under the belief that the use of artificial hormones poses serious risk of cancer. The U.S. considered this an unjustified trade restriction and took the case to the WTO's dispute settlement mechanism (DSM), a panel charged with arbitrating such trade disputes. When the WTO ruled against the EU many Europeans pointed to the outcome as an infringement on the right of nations to protect their own citizens (Weinstein & Charnovitz, 2001).

The administrative response to such allegations is two-fold. First, globalization supporters contend that all policies adopted by the WTO require consensus. That means that any nation member can veto a policy prior to its enactment. This, they claim, is the ultimate democratization of the trade process because all members participate through their elected (if that is the case) leadership (The Economist, 2001). Globalization advocates also challenge the assumption that DSM decisions usurp democratic decision-making. No nation is forced to change its policies. No U.S. beef has entered the EU market despite the DSM's ruling (Barfield, 2001). Thus the anti-globalization advocates appear to win twice – they find a great deal of media support for their local democracy arguments, and the U.S. is effectively

shut out of that market.

The administrative response, however, was less than forthright. It is correct that individual nations can walk away from the WTO, but to do so risks the imposition of trade sanctions and less developed nations rarely have the capability to go it alone. And, while it is true that the EU has not been forced to accept U.S. beef, it is also true that the EU has been forced to compensate the U.S. monetarily through the imposition of stiff tariffs. Finally, the DSM utilizes an adversarial process that relies on teams of lawyers, experts, documentation, access to resources, and a variety of other components that are not equally distributed across the 142 member nations. While the EU and U.S. may be able to bring comparable resources to the arbitration table, it is obvious that the same cannot be said of most disputants.

The Environment Debate

A third issue of interest to many of the anti-globalists involves the effect of globalization on the environment. Environmentalists form a significant component of the anti-globalization movement. Their concerns, in part, arise from the DSM's refusal to consider environmental issues as germane to trade disputes. These activists argue that it is legitimate for nations to require that producers protect the environment while creating goods. They argue that pollution abatement should be a cost of production that all pay. This levels the marketplace and protects the environment. Again there is an exemplary DSM case dramatically presented before the world – the sea turtle. U.S. policy recently blocked the importation of shrimp harvested without the use of Turtle Excluder Devices (DeSombre & Barkin, 2002). These devices were considered necessary by the U.S. to adequately protect the endangered sea turtle. Thailand, India, Pakistan, and Malaysia thought the restriction was unfair restraint of trade and brought the dispute to the WTO. In 1998, a WTO DSM trade panel ruled in favor of the Asian nations. Environmentalists made the sea turtle a cause celebre and condemned the DSM process for failing to consider the environmental costs as part of the trade equation.

WTO supporters quickly pointed out that the sea turtle case was not proof that the DSM failed to consider the environment. Rather, they claimed that the ruling was made on procedural grounds. The facts of the case largely support the globalizationists. DeSombre & Barkin (2002) explain that the U.S. Department of State initially ruled that the embargo applied only to fourteen states in the Caribbean and Western Atlantic and these states were given several years to

comply with the law's provisions. The Earth Island Institute and other NGOs sued the U.S. government in the U.S. Court of International Trade. This court ruled that the prohibition must be extended to all states that fish for shrimp. The Court also ruled that the regulations be applied to all states immediately and in full. The WTO deemed that the Court imposed extension of the original act was discriminatory. This ruling was upheld upon appeal.

More importantly, both the DSM and the appeals board concluded that the U.S. law required that shrimpers use specific devices to protect the sea turtles. But, as DeSombre and Barkin explain, "If other countries unilaterally passed laws requiring different sea turtle protection measures, target states could be faced with a situation where they had to comply with potentially incompatible laws in order to export a product. This could undermine the principle of a rule-based system that is fundamental to the international trade regime" (DeSombre & Barkin, 2002, 15). In other words, by specifying the means of sea turtle protection the U.S. was usurping legislative prerogative from the sovereign Asian nations. In addition, the Appellate panel found that DSMs could "accept unsolicited submissions from nonstate actors such as environmental groups, and that panels should determine whether an exception to international trade rules had a legitimate environmental purpose before determining whether it constituted a disguised barrier to trade and was applied in a fair and justifiable manner. Both of these decisions can be interpreted as making it easier to defend environmental exceptions to WTO rules" (DeSombre & Barkin, 2002, 16). Nevertheless, significant environmental concerns remain.

The Inclusiveness Debate

The final issue we will consider is the allegation brought by anti-globalization advocates that the elite institutions of globalization are products of western and northern hemisphere democracies (Iritani & Peterson, 1999). The explicit conclusion drawn is that southern and non-western nations are relegated to second tier status. Advocates for this position point to the lack of progress on issues important to developing countries made in the first round of trade talks (the Uruguay Round) and to the limited access developing countries had to the positions of influence in the trade talks (Yerkey, 2001). The "real news" of the Seattle meeting was that northern and southern hemispheric nations could not agree on the topics for the next round of talks. Critics of globalization point to the intransigence of the northern nations as the cause of this breakdown.

The administrative response to these charges had to wait until the outcome of the WTO meeting held in Qatar (even then it took an extra day for the ministers to reach agreement). The culmination of the Qatar meeting was a new round of talks aimed at addressing some of the many issues promoted by the developing world. These include reduction of non-tariff supports for food, intellectual property rights, and services. Globalists trumpet these accomplishments as proof that the northern elites have opened the door to developing nations.

This administrative argumentative position neglects to recognize that it was the pressure of an increasingly obstinate G77 (developing countries) that prompted the U.S., Japan, and the EU to weaken (Khor, 1999). And it was only when India and other developing nations threatened to walk out of the Qatar talks that the big three agreed that these issues would be included in the talks. The inclusion of these topics in the next round of trade talks is symbolically significant. Including the topics does not however guarantee the outcome of the discussions. The northern powers included so many items to be negotiated that it is conceivable that none of the southern concerns will be adequately addressed.

Finally, even the former Chair of the World Bank, Joseph Stiglitz (2002) admits that the current bureaucracies have not served the needs of developing nations: "Globalism today is not working for many of the world's poor. It is not working for much of the environment. It is not working for the stability of the global economy. Part of the problem lies with the international economic institutions, with the IMF, the World Bank and the WTO, which help to set up the rules of the game. They have done so in ways that, all too often, have served the interests of the more advanced industrialized countries – and particular interests within those countries rather than the developing world" (Stiglitz, 2002, 41).

Post 9-11: Quiescence and Rebound

Of course, our analysis, as well as the actions of both sides in the globalism dispute, has been altered by the events of the war on terrorism. Meetings of the IMF and World Bank scheduled to be held in September 2001 were canceled. Mass protests that were to occur contemporaneously with those meetings were also canceled. In fact, the protest movement may have been intrinsically changed by the world's increased sensitivity to terrorism and violence. Several "mainstream" protest groups have indicated a desire to avoid confronting American interests, especially when such protests spark violence. "I think we will have to reassess the role of big street protests," indicated Thea Lee, associate director for international economics with the AFL-CIO labor union. Similarly, Tim

Atwater of the Jubilee USA Network, a coalition of religious groups pushing debt relief, noted, "We have to appreciate that people are mourning, have fears and are pretty confused about the world. We have to be a little more creative to get people involved in causes that will make the world a better place to live for their grandkids" (Hiebert, 2001, 26).

Despite these cautionary expressions, as long as the concerns remain, protests will follow. The first two months after the September 11th attacks there were few protesters in evidence. The EU meetings in September and October 2001 attracted very little attention, and the IMF and World Bank meetings in Ottawa, Canada drew only a few thousand activists. Because of the difficulty in getting there and the restrictions on participants, even the WTO meeting in Doha in November resulted in little media attention devoted to coverage of the protest groups. But anti-globalization protesters signaled that the respite was over when 80,000 protesters gathered in Brussels during the December EU meetings (Shiskin, Kazakina & Taylor, 2001) and a quarter million people rallied in March of 2002 in Barcelona. Both protests were relatively passive and resulted in few arrests.

In our previous research on the protests in Seattle we noted that the media portrayed the amalgamation of protest groups – people dressed as sea turtles and the rioters as well – as one large street theatre. Post 9-11, the protesters decided to embrace the metaphor and actually put on a dramatic show. As Fernandez (2001) noted, the protesters in Washington brought a 70-foot long, smoke spewing dragon that was 17 feet tall. "Protesters saw the dragon as a fanged, power to the people avenger against corporate greed and made it the centerpiece of their demonstration (Fernandez, 2001, B02).

Whether there will be a return to violence remains to be seen.

Conclusion

The administrative discourse of globalization leaders and advocates is their attempt to create the "truth" surrounding their activities and their communication. Although our assessment of these arguments may not always seem charitable, we understand quite well that as Foucault (1980) noted, "There is a battle 'for truth', or at least 'around truth' – it being understood once again that by truth I do not mean 'the ensemble of truths which are to be discovered and accepted', but rather 'the ensemble of rules according to which the true and the false are separated and specific effects of power attached to the true', it being understood also that it's not a matter of a battle 'on behalf' of the truth, but of a

battle about the status of truth and the economic and political role it plays (Foucault, 1980, 132)." In this sense argumentative truth is linked with systems of power and the operation of the arguments. In the globalization battles, there are many facts but few truths. Giddens (1999) notes that the evidence indicates that globalization appears to be improving the world's economy for most citizens but the widening rich-poor gap remains a terrible problem. And the World Bank report states that globalization leads to faster growth and poverty reduction in poor countries" (Watkins, Dollar & Kraay, 2002, 24). These conundrums that will require continued analysis of the public arguments surrounding globalization.

REFERENCES

Barfield, C. E. (2001). *Free trade, sovereignty, and democracy: The future of the World Trade Organization*. Washington: AEI Press.

Bhagwati, J. & Meyer, A. (2002). The poor's best hope – trading for development – removing trade barriers is a job for the poor as well. *The Economist*, June 22, p. 26.

Boudette, N.E. & Johnson, I. (2002). New York 2002: Forum critics are kept at bay – Peaceful demonstrations fall on deaf ears of participants inside the "Bubble" – "We're being marginalized." *The Wall Street Journal Europe,* February 4, p. 6.

BBC News (June, 2001) http://news.bbc.co.uk/hi/english/world/europe/newsid_944000/944341.stm

Boudreaux, R. (September 4, 2001). Spooked by G-B violence, Rome rejects role of host Europe. *Los Angeles Times*, p. A5.

Cox, J. (2001). WTO meeting shrinks amid attack fears, feuds. *USA Today*, November 7, B.01.

Crittenden, J. (May 21, 2001). Anarchists suspected of inciting clashes. *Boston Herald*, p. 003.

DeSombre, E.R. & Barkin, S. (2002). Turtles and trade: The WTO's acceptance of environmental trade restrictions. *Global Environmental Politics 2*, 12-18.

The Economist (2001). *Who elected the WTO?* September 29, p. 26-29.

Fernandez, M. (2001). Breathing fire over economics: Dragon puppet enlisted for globalization protest. *Washington Post*, November 10, B02.

Foucault, M. (1980). *Power/Knowledge.* New York: Pantheon.

Giddens, A. (1999), *Runaway world: How globalization is reshaping our lives*. London: Profile Books.

Gittins, R. (2002). Globalization's benefits starting to filter down. *Sydney Morning Herald,* February 2. p. 40.

Hiebert, M. (2001). Globalization-Violence is out of fashion: The protestors who have chased the World Trade Organization around the globe may seem quiet in Qatar; That doesn't mean they won't be there. *Far Eastern Economic Review*, November 15, p. 26.
Holt, P.M. (2001). Rich versus poor, old versus young: Heed the cries. *The Christian Science Monitor*, July 5, p. 9.
The Independent. (2000). *The Prague protests did nothing to advance the relief of world poverty*, September 29, p. 3.
Iritani, E. & Peterson, J. (1999). Raucous WTO meeting ends without accord; Summit: Trade ministers fail to achieve goal of detailed agreement in session marred by infighting, street violence. *Los Angeles Times*, December 4, A1.
Johnson, G. (November 29, 2001). Two years after WTO protests, activists say "stain" remains. *Associated Press Newswires*.
http://ptg.djnr.com/ccroot/asp/publib/st…AAAMjAwMjA2MDexNTMwMDAAAAAL&referer=true
Kohr, M. (1999). Analysis/The WTO and Seattle aftermath – Developing nations struggle for a voice. *Bangkok Post*, December 22.
Montgomery, D. (August 30, 2001). Global economy's new guardian; D.C.'s answer to the IMF, World Bank protests: miles of chain-link. *The Washington Post*, C01.
Norton, R. (2000). Anti-trade/Pro-poverty. *Fortune*, January 10, p. 40.
O'Clery, C. (2001). Tear gas attacks keep protestors in check. *Irish Times*, April 23, p. 14.
Ransom, D. (May, 2001). A world turned upside down. *New Internationalist*, p. 26.
Shiskin, P. Kazakina, K. & Taylor, E. (2001). Globalization's foes reappear in force at Brussels protest. *The Wall Street Journal*, December 14, p. A13.
Stiglitz, J. (2002). Single economic model does not suit whole world. *News International,* June 24, 2002, p. 41.
Todd, A.M. (2002). *The globalization of mobilization: Protest strategies of global justice movements 1999-2001.* Unpublished doctoral dissertation, University of Southern California.
Trofimov, Y. (July 2, 2001). Italian government girds to face G-8 protesters. *The Wall Street Journal Europe*, p. 2.
Useem, J. (November 26, 2001). Four months ago this image was the most frightening symbol. *Fortune Magazine,* p. 76.
Watkins, K., Dollar, D. & Kraay, A. (2002). Point/counterpoint: Making globalization work for the poor. *Finance and Development*, March 1, 24.

Weinstein, M.M. & Charnovitz, S. (2001). The greening of the WTO. *Foreign Affairs,* 80, 147-157.
Yerkey, G. (2001). Seattle to Doha. *Europe,* 410, 7-11.

ISSA Proceedings 2002 – Designing A Computer-Supported Collaborative Learning Situation For Broadening And Deepening Understanding Of The Space Of Debate

1. Introduction: Collaborative Argumentation-Based Learning (CABLE)

In the continuation of research on the role of socio-cognitive conflict in cooperative learning (Doise and Mugny, 1981), it has been conjectured that the cooperative resolution of such conflicts in argumentative interactions could be the most important factor (Mevarech & Light, 1991). More recent research has begun to elucidate the processes by which the types of argumentative interactions that arise spontaneously during cooperative problem solving can lead to co-construction of knowledge (Baker, 1996, 1999). For example, the interactional pressure imposed by mutually recognised verbal conflict can lead students to refine meanings, to dissociate notions and to elaborate more coherent discourses, either during argumentation phases, or else as a means of resolving, dissolving or closing them.**[*]**

However, such argumentative interactions — particularly those that operate on a conceptual plane — are relatively rare, especially in scientific and other

disciplines taught in school. There are undoubtedly good reasons for this (see e.g. Golder, 1996; Quignard & Baker, 1999; Quignard, 2000). For example, the topic must be intrinsically debatable, students must be motivated to argue with respect to it, there should be an appropriate intersubjective distance between students' points of view (c.f. Rommetveit, 1979), students should have sufficient knowledge of the topic, interpersonal relations and socio-institutional factors should not prevent free expression of divergent views, and so on. One particular paradox concerning conditions for argumentative interaction and for learning itself is especially important here: in learning situations that are designed so that students will co-construct new knowledge, by hypothesis, they will not have the kind of coherent and firmly entrenched points of view that could lead to dialectical confrontation (Nonnon, 1996). We should thus expect that students' discussions would rather correspond to a cooperative exploration of a dialogical space. In this paper, we refer to such a space that is explored by students' in cooperative learning situations during their argumentative interactions, as the *space of debate*. The goal of the research described in this paper is thus to understand how to design collaborative learning situations so that students will be led to broaden and deepen their understanding of the space of debate (see §2 and 4 below). We term this type of learning "CABLE": Collaborative Argumentation-Based LEarning. We consider a specific type of collaborative learning situation, in which students' activity is mediated by use of a Computer-Supported Collaborative Learning (CSCL) environment (see e.g. Koschmann, 1996) called DREW**[i]**, that was developed within the framework of the SCALE project*. DREW provides a variety of Web-based tools to communicate and carry out joint problem-solving tasks, including a typewritten synchronous CHAT tool, a collaborative text-writing tool and — especially important in this context — a tool for jointly drawing argument graphs via the web.

Given the strict conditions for CABLE that we have already described, the attempt to design a CSCL environment for this purpose may appear paradoxical, since constraints that are inherent in such situations are well known. For example, free expression of ideas and arguments should be more inhibited in typewritten computer-mediated communication (CMC) than in face-to-face spoken communication (c.f. Clark & Brennan, 1991), and lack of co-perception should cause coordination problems. However, face-to-face situations have the disadvantages that students' communication can be largely inefficient or redundant, and that it is difficult to control effectively the carrying out of

sequences of tasks. CSCL environments can also be seen as having several counterbalancing advantages. On one hand, CSCL environments enable complex sequences to be structured; on the other, there is now some evidence that typewritten CMC can encourage students to reflect on the recorded trace of their interaction, and to 'filter' their communication so as to only express more complex aspects of problem-solving (Tiberghien & de Vries, 1997).

Here we concentrate on the principles underlying design of teaching materials for CABLE, together with sequences of tasks in which they are to be used, in relation to characteristics of CSCL tools. We report results of an experiment carried out at secondary school level, during which students debated about Genetically-Modified Organisms (GMOs) using DREW, in one condition using CHAT and in another using CHAT together with an argument graph tool. In addition, we briefly describe a new method for evaluating broadening and deepening understanding of the space of debate, called the QED method, on the basis of analysis of students' texts produced before and after their debates. In conclusion, we discuss further research for design of CSCL situations that more effectively favour CABLE.

2. Design of teaching materials and task sequence

The design of teaching materials, or pedagogical texts, for collaborative argumentation-based learning at school must satisfy several different types of constraints.

Firstly, it must be possible to integrate the topic of debate within national curricula. On the basis of a review of official programmes in France (see http://www.education.gouv.fr/sec/), we chose the topic of genetically-modified organisms because it is a topic that is dealt with in the Life and Earth Sciences programme, this being the only scientific subject that is genuinely open to the study of contemporary problems that are debated in society at large (e.g. ecology, public health, etc.). In addition, this topic can also be dealt with in the Civic Education programme, as well as in French (maternal language) class, where argumentation is a specific content to be taught. Secondly, the actual content of the teaching materials on GMOs must be practically readable within school timetable constraints.

Finally, as a basis for CABLE, the teaching materials must present a wide and balanced set of arguments and points of view with respect to GMOs (breadth of

the space of debate), together with information about key concepts such as "gene" (depth of space of debate).

We created new teaching materials on the basis of a number of primary sources (notably websites) that corresponded to clearly identifiable 'voices' of *social actors* implicated in the question of GMOs. They included "Limagrain" (a major grain producer), the French Research Ministry, Greenpeace (a non-governmental organisation concerned with ecology), and several recent press cuttings (e.g. from *Le Monde*). Within the voice of each social actor, several epistemological points of view are represented, such as scientific, agronomic, economic and ethical points of view. The dimensions of social actors and of *epistemological* points of view are distinct since, for example, each social actor selects and represents the scientific 'facts' in a different way. We chose to group teaching materials according to social actors so as to facilitate the identification, subsequent 'ventriloquation' and appropriation of these voices (Bakhtine, 1929/1977) in students' debates. In order to check coverage of the materials in these terms, voices of social actors and for/against arguments were analysed using *Table 1* below.

Table 1 Table used for design of teaching materials for debates on GMOs.

Topic	Opinion	Limagrain	Greenpeace	Ministry	The Press
Food	For				
	Against				
Health	For				
	Against				
Environment	For				
	Against				
Agriculture	For				
	Against				
Economy	For				
	Against				
Ethics	For				
	Against				

Table 1 – Table used for design of teaching materials for debates on GMOs

The following are two comparable examples of "economic" arguments with respect to GMOs, presented by Greenpeace and by the French Research Ministry:
– *Ministry of Research / economic argument*: "Even if it is difficult, for the present, to evaluate potentialities of these new technologies, their appearance on the world market risks affecting markets in developing countries, with competition playing in favour of the North, that could benefit from specific products, thus increasing unbalance. Following this hypothesis, it appears

important that researchers or producers in the South should be able to use existing techniques if they wish".
– *Greenpeace / economic argument*: "Certain multinational companies try to make us believe that GMO are used to give better yields and to reduce hunger in the world. However, harvests are sufficient to feed the whole planet; the problem is rather that of the sharing out of food".

From the use of conditional and hypothetical expressions, it is clear that the Ministry wishes to express a 'balanced' or 'objective' voice, that informs but does not adopt a position, whereas Greenpeace clearly argues against a putative support for GMOs (reducing hunger in the world).

The materials were designed in collaboration with French and economic science teachers to check their educational usability and understandability by students aged 17-18 years.

Clearly, it is not feasible to simply give these materials to students and ask them to "debate" with the Internet tools. They need to be prepared for debating, in terms of acquiring appropriate knowledge of the domain, the tools to be used, and argumentation itself; they also need to consolidate the knowledge co-constructed in the debate. We therefore designed a specific task sequence within which the teaching materials were to be used, that is summarised in *Figure 1***(ii)**.

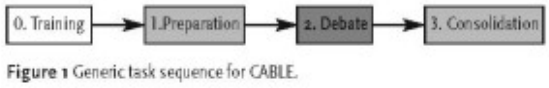

Figure 1 Generic task sequence for CABLE.

Figure 1 – Generic task sequence for CABLE

The training phase (0), of 2 hours' duration, comprised a short introduction to argumentation notions and techniques that would be necessary during the debate phase (2), including use of Toulmin-like diagrams (Toulmin, 1958) to represent theses, pro and contra arguments. In addition, students were trained on the DREW interface tools. The rationale was that since students were supposed to learn from the debate phase, this would be hindered if they also had to learn concurrently how to use the tools.

During the preparation phase (1), students were given the teaching materials on

GMOs to read (during their own time), together with the same table that was used for design of those materials (Table 1 above), with which they could take notes. The pedagogical rationale was that such guided reading would enable better memorisation of which social actors made what argument about which topic, thus helping to initially structure argumentative knowledge. At the beginning of the phase that took place in class, after re-familiarising themselves with the dossier on GMOs, the students were asked individually to write a short text presenting their own opinions, and associated arguments, on the question: "Should the production of GMOs be allowed or not?". The pedagogical rationale of this sub-task was firstly to enable students to render explicit and reflect upon their personal opinions, and secondly, to enable them to further structure the argumentative knowledge filled-in by the students in note form in *Table 1.*

The ensuing debate phase was carried out either using a CHAT interface, or else using the CHAT in combination with an argument graph (see below). In both cases, students were asked to each express their opinions and provide arguments for them, then to explore and deepen the question together in order to subsequently enrich their individual texts. Within the last 10 minutes of the debate, the students were asked to sum up their points of agreement and disagreement. The pedagogical rationale of this phase was that by interacting together, students would deepen and broaden their understanding of the space of debate, by various means: acquisition of new arguments from their partners, refinement of their own understanding by expressing arguments and by understanding criticisms of them, negotiating refined meanings of key concepts (such as the notion of genetic modification).

In the final phase of the task sequence (3), students return to individual work, and are asked to improve their individual texts, *in the light of the discussion* that had just taken place. This task was intended to help students to integrate the knowledge they had acquired during the debate, and as a result of it.

3. An experiment: multirepresentational collaborative argumentation-based learning.

In November 2001 we carried out an experiment in a secondary school in Lyon, using the teaching materials and task sequence described above, together with the DREW CSCL environment. The experiment had two main objectives. Firstly, we aimed to determine the extent to which the teaching materials and task sequence would in fact enable students to deepen and broaden their

understanding of the space of debate. Secondly, we wanted to determine the extent to which such understanding would be influenced by the use of an argument-graph drawing tool, in comparison with CHAT interactions.

In the experiment, phase (0) lasted for one session of 2 hours; phases 1 to 3 together lasted a second session of 3 hours. The CHAT condition involved 21 students from a single class and the "CHAT+GRAPH" condition, 28 students from a different class. In each case, the students were randomly grouped into dyads (and one triad in the CHAT condition), since we wanted to eliminate the possible effect of dyad constitution (c.f. Quignard & Baker, 1999).

With respect to our second objective, we hypothesised that students using the argument graph would acquire deeper and broader understanding of the space of debate than students using CHAT alone. Although verbal interaction (CHAT condition) is an effective means of negotiating meaning, due to its intrinsic or strategic indeterminacy (Edmondson, 1981), we hypothesised that this effect would be outweighed by the fact that diagrammatic representations are more determinate, and thus more memorable (Ainsworth, Bibby & Wood, 1999; Schnotz, 2001; Rouet, 2001; van Someren, Reimann, Boshuizen & de Jong, 1998). The students would thus express more arguments, and would be able to more easily see the 'gaps' in their space of debate.

The principal interface of the DREW CSCL environment is shown in *Figure 2.* The CHAT window, with the trace of the interaction is on the left and the argument graph window on the right. In this first version of the software, our aim was to produce a graph that is as simple as possible: boxes for arguments/theses, and only two types of argumentative links ("+" and "–"), whose interpretation is left to the students and their teacher in a given session**[iii]**. A more important feature concerns the fact that the students are able to express their opinions — "in favour" and "against" — for any element of the argument graph (each person's opinion appears in a different colour). In order to highlight differences of opinion, and to focus discussion upon them, boxes with respect to which opposed opinions have been expressed appear in a 'crushed' form. In this respect, the DREW argument graph tool differs from several others, such as the argument graphs in Suthers' "Belvédère" system (Suthers & Hundhausen, 2001; Suthers & Weiner, 1995; Suthers 1998; Suthers, Toth & Weiner, 1997), since it is intended to be more a *medium* through which argumentation *dialogue* can occur, than as a third-party 'object' to be commonly constructed.

Figure 2 – The Drew interfacec

Several other researchers have studied the role of (computer-based) argument-graphs in learning (see e.g. Veerman, 2000). For example, Suthers and colleagues (ibid.) saw the Belvédère system as a stimulus for conversation and reasoning, rather than as a medium of interaction (contrary to DREW, described above). In initial versions of Belvedere, the argument diagrams contained many different types of nodes and links (e.g. *Principle, Theory, Hypothesis, Claim* for nodes, and *Supports, Explains, Predicts, Conflicts, Justifies, Undercuts, Causes*, for links). However, it was found that students spent most of their type arguing about the meaning of these elements, rather than reasoning in the scientific domain itself, so the diagrams were simplified in later versions. Our experiment with DREW can thus be seen as a means of validating design of the learning situation, and as an attempt to determine whether or not argument graphs that are simplified to a small number of link types can after all be effective media of debate and learning.

Using the task sequence and teaching materials described above, we asked pairs of students to debate either using CHAT, or else using the DREW argument graph tool, in conjunction with CHAT.

4. Results and discussion

The data collected from the experiment consisted of students' individual texts, produced before the debate, and then revised after it, together with automatic traces of the interactions themselves.

4.1 Analysis method: QED

We measured the contribution of the students' discussions (CHAT or CHAT with the graph tool) to improved understanding of the space of debate by evaluating the differences between individuals' texts produced before and after the discussion. In order to calculate such differences, we devised a new method for evaluating the quality of the space of debate, as expressed in texts, called the QED**[iv]** method.

The first step of analysis involves segmenting the text into (counter-)arguments, with respect to a principal thesis (e.g. “GMOs should be allowed”), and identifying the student’s general opinion with respect to that thesis (e.g. “against”, “in favour”, “neither for not against”). Each segment must then be classified as a pro or a counter argument with respect to the thesis, then classified in terms of one of a list of epistemological points of view (see above — e.g. “economic”, “ethical”, “agronomic”, …), and finally, its degree of elaboration must be assessed.

Thus classified, the text is evaluated according to the following factors**[v]** that correspond to a good, wide, elaborate and coherent space of debate:
– *richness*: the student’s text is “rich” when it provides a large set of arguments;
– *elaboration*: the student’s text is “deep” when it develops arguments, with sub-arguments, examples, explanations, etc.;
– *balance*: the student’s text is more “balanced” when it provides well-balanced pro/against arguments. If the question is really open, there must be arguments on each side (pro and against);
– *coverage*: the student’s text has a wide coverage when the arguments reflect the variety of the opinions or standpoints of the different actors of the debate, or cover the different topics of the question;
– *coherence*: the student’s text is coherent when the general point of view (or opinion) expressed is a rational function of the arguments given (e.g. a pro opinion associated exclusively with counter-arguments is viewed as having low coherence).

Figure 3 below shows an example of the texts of a student (Carla), produced before and after debate, for the CHAT-only condition (translated from French to English, keeping students’ punctuation and transliterating spelling or grammatical errors).

Before discussion	*After discussion*
GMOs is a subject that is currently in the news that must seem to concern everyone nevertheless, numerous opinions diverge. As far as I'm concerned, I can't yet manage to stop at something fixed , I think that there are as many arguments "for" as arguments "against". One must admit it, GMOs could be useful : - in the domain of food, an improvement in the nutritional quality of certain products, an augmentation flop production –thus- reduction of famines, guaranteed quality- notably, lowering of chemical residues in fruits. –from the medical point of view, medicines could be invented, principally against macrocéphalose but also vaccinations. – from the environmental point of view, a sort of "respect" would be established given the reduction of chemical types of products, particules… – with respect to agriculture, properly speaking, there would be better guarantees of production, even an increase in it, with even less chemical processing. –with respect to economics, the guarantee of supply due to better performance of production would be the fundamental positive aspect giving rise to numerous socio-economic stakes.	GMOs is a subject that is currently in the news that must seem to concern everyone nevertheless, numerous opinions diverge. As far as I'm concerned, I can't yet manage to stop at something fixed , I think that there are as many arguments "for" as arguments "against". One must admit it, GMOs could be useful : -in the domain of food, an improvement in the nutritional quality of certain products, an augmentation flop production –thus- reduction of famines, guaranteed quality(notably, lowering of chemical residues in fruits) are positive factors –from the medical point of view, medicines could be invented, principally against macrocéphalose but also vaccinations. – from the environmental point of view, a sort of "respect" would be established given the reduction of chemical types of products, particules… leading to a considerable lowering of pollution. - with respect to agriculture, properly speaking, there would be better guarantees of production, even an increase in it, with even less chemical processing. –with respect to economics, the guarantee of supply due to better performance of production would be the fundamental positive aspect giving rise to numerous socio-economic stakes. Nevertheless, the few arguments "against" are all the same important and to be very seriously taken into consideration. –in the medical domain, can give rise to risks of allergies. –for food, it would greatly penalise biological agriculture. –from the point of view of public health, the consumer could feel a bit left out. To conclude GMOs would allow Mankind to carry out great advances but all the same beforehand their non-risk must be 200% sure (above all with respect to the organism). Despite the fact that my opinion tends towards accepting these uses, cloning is a possibility that repulses me: in no case at all do we have the right to put ourselves on a higher rank in order to decide on creation of life (human and genetically modified) of anything whatsoever. Certainly some hypotheses have been brought forth but one must maintain sufficient detachment so as to not "dive in with one's head lowered" into this new experience and envisage ALL possible imaginable cases.

Figure 3. Example of a student's texts before and after debate (CHAT only condition).

The text Carla wrote before debate illustrates her divided opinion (neither wholly for nor against). She has a medium coverage of topics (on a scale of low-medium-high) dealing with economics, food, medicine and the environment. Her argumentative balance is heavily in favour of GMOs, with no arguments against. In the light of her expressed opinion — neither for nor against — this fact gives her a low score on coherence, since ideally she should also express arguments against GMOs. In sum, she has a very low QED score (6%).

The text Carla wrote after debate reveals that she had decided to support GMOs (pro opinion). She added arguments in three other topic areas (agriculture, public health and scientific risks), thus receiving the highest score for coverage of topics. She developed more balanced arguments since she expressed arguments against GMOs and also gave counter-arguments. She has a high coherence score due to the fact that her arguments now support her opinion. Her new QED score (55%) reflects a noticeable increase in the quality of space of debate.

It should be noted that the QED method is restricted to the extent that it only takes the nature of arguments and opinions into account, and not the (discursive, linguistic) structure of the text itself. This is related to practical reasons: in our case, 98 texts had to be analysed, and four other partners in the SCALE project used the method. Such aspects will be taken into account in further work.

4.2 Results

The results of analyses of students' texts using the QED method**[vi]** are shown in *Figure 4* below.

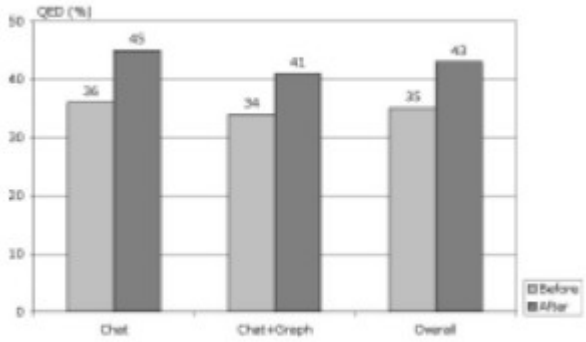

Figure 4 Graph of QED scores with different tools (Chat without and with Graph) before and after the interaction. The last column gives the overall results.

In this experiment, 21 students were in the chat-condition, and 28 students were in the chat-graph-condition.

Our first question was: *do students QED scores improve significantly, in both conditions?*
A paired-samples t-test was done on QED scores before and after discussion (pretext and posttext). Results show a significant difference, $t(48) = -4.61$, $p < .001$, with a higher QED score after discussion ($M = 42.92$) than before ($M = 34.92$). This means that students' texts showed a higher quality of space of debate after discussion, irrespective of the experimental condition.

Our second question was: *do students perform better in the chat-only condition than students in the chat-graph condition?*
The repeated measures show that there was in fact no effect of the interaction between condition and QED-scores, $F(1.47) = 0.25$, $p > .01$. This result indicates that the increase of QED-scores was the same for both students in the chat-condition and students in the chat-graph-condition.

4.3 Discussion
Our results, based on differences between QED scores for individual texts before and after debating, show that students' knowledge of the space of debate for GMOs improved significantly during the experimental task sequence, but that the use of an argument graph for communication, as compared with a CHAT interface, made no significant difference with respect to this improvement.

Although the design of our teaching materials and task sequence are thus validated, to the extent that they do in fact enable students' to acquire more

knowledge of the space of the debate, it is not possible to isolate exactly what aspect of them is responsible for this (the design of the teaching materials, the task sequence, etc). This fact is related to the necessity of using a pedagogical sequence that was intended to be genuinely useful and usable in schools: isolating smaller tasks for experimental purposes would have been educationally unacceptable.

There are several possible explanations for our negative result with respect to the relative utility of the argument graph tool in this process. One simple explanation relates to problems with interface design that could have prevented the argument graphs from realising their full pedagogical power. Preliminary studies revealed that students spent much effort in rearranging the diagrams in a relatively restricted screen space. Other problems could have related to inefficient interaction caused by the fact that only one student could edit an argumentation element at a given time.

A second possible explanation relates to the extent to which students were able to integrate knowledge acquired or co-constructed in the interaction into their individual texts. In the case of the CHAT interaction condition, both the interaction and the texts are in the same semiotic medium: typewritten text. This could thus have helped 'transfer' of knowledge from interaction to text. However, in the case of the argument graph interaction, the medium is different — i.e. from a graphical representation (with some interactive CHAT text) to written text — and this requires extra cognitive work, which could have prevented the students in the graph-CHAT condition from performing as well as they could have. An interesting future experiment would therefore be to compare like with like, i.e. "text (CHAT (text" compared with "argument graph (argument graph interaction (argument graph".

A third possible explanation relates to the QED measure itself: perhaps there would have been significant differences had the discursive and linguistic aspects of the textual structure been taken into account.

In order to fully interpret our results we are presently carrying out detailed analyses of the students' interactions themselves. The analysis distinguishes different functional categories of interaction, including interaction and task management, argumentative interaction (Baker, 1999; Quignard, 2000; de Vries, Lund & Baker, 2002) and negotiation of meaning in argumentation, the latter

corresponding to 'deepening' of the space of debate. This analysis should enable us to understand the extent to which the interface design hindered interaction in the graph condition, and the extent to which the changes in students' texts can genuinely be explained by knowledge co-construction. (It is of course possible that the learning effects were due to new reflexion on the texts alone, reconstructing from memory the original teaching materials).

The following *(Table 2)* is an extract from a CHAT interaction, in which the student who had produced the texts shown above (Figure 3) had participated. Dotted lines divide the extract into four principal sequences, whether argumentative or not.

Table 2. Extract from a students' CHAT interaction.

Line N°	T(h:m:s)	Interlocutor	Interaction
[16]	09:37:47	Carla	no but+ seriously I'm six of one half a dozen of the other
[17]	09:37:50	Betty	what?
[18]	09:37:55	Betty	....
[19]	09:38:02	Betty	????????
[20]	09:38:25	Carla	i'm not for just as i'm not against
[21]	09:38:33	Carla	my opinion is divided
[22]	09:39:05	Betty	ah good argument!
[23]	09:39:27	Carla	what i really think is...
[24]	09:39:48	Betty	is..........
[25]	09:39:59	Carla	2 seconds i'm thinking
[26]	09:40:11	Betty	take your time
[27]	09:40:16	Carla	thanks
[28]	09:40:20	Betty	it's nothing
[29]	09:40:23	Carla	i'mm sick of this already
[30]	09:40:32	Carla	[illegible]!!
[31]	09:40:34	Betty	of what of thinking?
[32]	09:41:04	Carla	'll be better production so less famines
[33]	09:41:35	Betty	yeah but if it's bad for the organism it comes to the same thing
[34]	09:42:13	Carla	maybe it allows making vaccinations e.g against [illegible] sickness and i think that can be a good thing
[35]	09:42:58	Carla	the -- pollution and that's important if we don't want to drop dead
[36]	09:43:00	Betty	yes but they can [illegible] without making all food genetically modified
[37]	09:44:03	Carla	but tell me i think you're against you so explain me why?
[38]	09:44:26	Betty	because it's bad for the human organism
[39]	09:44:55	Carla	answer me
[40]	09:45:11	Betty	and since if we start with plants in 10 years or less it will be human beings turn
[41]	09:45:38	Carla	to be modified?
[42]	09:46:02	Betty	err yeah maybbe we'll even be cloned
[43]	09:46:19	Carla	yes it's true me you know i'm dead against cloning of anyone
[44]	09:46:33	Betty	err yeah me too
[45]	09:48:07	Carla	why are you against GMOs? isn't there the slightest positive argument according to you?
[46]	09:48:33	Betty	umm maybbe but nothing's been proved
[47]	09:48:46	Betty	for the vaccinations nothing's proved
[48]	09:50:08	Carla	it's clear they're only hypotheses for the present but imagine for a second if it worked don't you think it would be one great step forward for Mankind?
[49]	09:50:58	Betty	yes but they cn get ther in some other way than how they did up to now
[50]	09:51:58	Carla	if gmos can help in several domains im completely "for" but
[51]	09:52:11	Betty	bt x?
[52]	09:52:30	Carla	two seconds

The extract begins (lines [16] to [31]) with Carla expressing her opinion with respect to the question "Should production of GMOs be allowed or not?": she has a divided opinion, neither clearly for nor against, as stated in her original text (Figure 3 above).

The main argumentative interaction phase is from lines [31] to [51] (in [52] Carla asks for time to think, thus interrupting this sequence).

In the first argumentative subsequence (lines [32] to [36]), Carla initiates the dialogue, providing only arguments in favour of GMOs (they will reduce famine, allow vaccinations and reduce pollution). Her adoption of the proponent role (c.f. Barth & Krabbe, 1982) is surprising, given that she said she had a divided opinion. Betty plays the opponent role in this sequence: reducing famine (enabling people to stay alive) is useless if they then eat what is bad for them

(GMOs), and vaccinations could be made without genetically modifying food.

Since Carla has rendered her point of view explicit, she now asks Betty to do the same, even though this is implicit in the fact that she just adopted the opponent role**[vii]**. Betty states that GMOs are bad for organisms, then introduces the case of *human* organisms, and cloning. Betty's 'slippery slope' argument is that if we begin by modifying plant organisms, we will end up modifying (cloning) human organisms. This argument succeeds: Carla has to concede. This process is particularly interesting from the point of view of *deepening the space of debate*, since the students have also performed a conceptual operation in argumentative interaction (Baker, 1999), whereby GMOs have been *associated* with cloning (Baker, *in press*).

In the last sequence ([45] to [52]), Carla again asks Betty to explain why she is against GMOs, and reverts to her previously expressed 'neutral' role in asking whether Betty does not recognise any argument in favour of GMOs. As a means of 'dissolving' the verbal conflict, the students relativise arguments with respect to GMOs: they're only "hypotheses", "nothing has been proved".

In this extract we can see potentially constructive processes that work on the conceptual background of the space of debate. But what effect did this interaction have on the way in which the students subsequently modified their original texts? Confronted with a tenacious opponent of GMOs, Carla was introduced to a large number of arguments against GMOs. This enabled her to become conscious of the risks linked to this biotechnology. In addition, the fact that Betty insisted that Carla should express her final opinion led to Carla clarifying her position (see *Table 3* below).

Table 3. Extract from CHAT interaction: Betty obliges Carla to make her position explicit.

[93]	10:07:40	Betty	so are you for or against??????
[94]	10:08:12	Carla	look it's like piercing in the beginning everybody was against it but then people changed their minds
[95]	10:09:16	Betty	yes that's a fashion it's not the same this is nature that's on the line and the human organism
[96]	10:09:48	Carla	i am for j900% in the only case that it doesn't cause any problems but they have to be sure 600%

Having such an opponent may explain why Carla added a large section stating potential GMO risks to the end of her text, thus partially re-equilibrating her arguments and clarifying her position. Her argument structure becomes "deeper", in particular in relation to risks and "broader" in relation to public health and agriculture. As mentioned previously, her text is more "balanced" since she has added arguments against and is more "coherent" since her text better supports

her newly expressed point of view.

5. Conclusions and further work

This paper has described research whose aim was to understand how to design situations — teaching materials, task situations and Internet tools — for a specific form of collaborative learning related to argumentative activities: broadening and deepening the space of debate.

Our results show that it is in fact possible to create situations in which students will elaborate and express their opinions with respect to subjects taught in school, in argumentative interactions across Internet, provided that teaching materials, tasks and tools are appropriately designed.

Nevertheless, given our null result with respect to the contribution of communicating via an argumentation-graph to collaborative argumentation-based learning, our interfaces and task sequences need to be modified to better exploit their full pedagogical potential. We have suggested that remaining within the 'world' of argument graphs, in individual and group activities, could produce better results. Another possibility that is being explored in the SCALE project is to generate textual representations of argumentation graphs for students, who could then more easily compare their original texts with their interaction.

Finally, we recognise that argumentative interactions have limits as processes by which collaborative learning can occur: although the students may have engaged in a potentially constructive interaction, they might not have 'really' (normatively) improved their understanding of the space of debate. One possibility that we are exploring in ongoing research is thus to identify and define the role of teachers in such interactions (c.f. Lund & Baker, 1999).

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Finally, this research could not have been carried out without the collaboration of our colleagues at the École des Mines de St.-Étienne, Annie Corbel, Philippe Jaillon and Jean-Jacques Girardot, who are responsible for the implementation of the DREW Internet tools. Additional special thanks to Philippe Jaillon for essential computational assistance during our school experiment.

NOTES

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[i] DREW: Dialogical Reasoning Educational Web tool. Within the SCALE project, DREW was developed within the RIM research team at the École des Mines de St. Étienne (France). Additional information can be obtained in Deliverable 5 of the SCALE project, at http://www.euroscale.net/

[ii] This generic task sequence was designed by the GRIC team in Lyon, in collaboration with J. Andriessen and M. van Amelsvoort of the University of Utrecht (Netherlands). The generic sequence was instantiated by each partner of the SCALE project team in a way that was adapted to national educational systems.

[iii] See Quignard, this volume, for a description of theoretical foundations of this interface.

[iv] Here “QED” stands for “Qualité de l’Espace du Débat” in French, which means “quality of the space of debate”.

[v] Once scored, the factors are entered into a mathematical formula that gives a weighted sum score, the details of which are not presented in this short paper, but will be shortly forthcoming. The QED method was elaborated by M. Quignard (GRIC, Lyon), in collaboration with M. Baker (GRIC, Lyon), J. Andriessen and M. van Amelsvoort (Utrecht University). Details can be found in Deliverable 8 of the

SCALE project, at: http://www.euroscale.net/

[vi] The statistical processessing of the QED scores obtained from the students texts was carried out by M. van Amelsvoort (Utrecht University).

[vii] This is perhaps an empirical illustration of Barth & Krabbe's (1982) normative requirement for externalisation of attitudes in formal dialectics?

REFERENCES

Ainsworth, S.E., Bibby, P.A., & Wood, D.J. (1999). Analysing the costs and benefits of multi-representational learning environments. In M.W. van Someren, P. Reimann, H.P.A. Boshuizen, & T. de Jong (Eds.), *Learning with multiple representations* (pp. 120-134). Oxford: Elsevier Science.

Baker, M.J. (1996). *Argumentation et co-construction des connaissances*. Interaction et Cognitions, 1, 2/3, 157-191.

Baker, M.J. (1999). Argumentation and Constructive Interaction. In G. Rijlaarsdam & E. Espéret (Series Eds.) & Pierre Coirier and Jerry Andriessen (Vol. Eds.) *Studies in Writing: Vol. 5. Foundations of Argumentative Text Processing*, 179–202. Amsterdam: University of Amsterdam Press.

Baker, M.J. (in press). Argumentative interactions, discursive operations and learning to model in science. In P. Brna, M. Baker, K. Stenning & A. Tiberghien (Eds.), *The Role of Communication in Learning to Model*. Hillsdale N.J.: Lawrence Erlbaum Associates.

Bakhtine, M. (1929/1977). [Volochinov, V.N.] *Le Marxisme et la Philosophie du Langage*. Paris : Minuit. [Ist edition : Voloshinov, Leningrad 1929].

Barth, E.M. & Krabbe, E.C.W. (1982). *From Axiom to Dialogue: A philosophical study of logics and argumentation*. Berlin: Walter de Gruyter.

Clark, H. H & Brennan, S. (1991). Grounding in communication. In L.B. Resnick, J.M. Levine & S.D. Teasley (Eds.) *Perspectives on Socially Shared Cognition*, pp. 127-149. Washington DC: American Psychological Association.

De Vries, E., Lund, K. & Baker, M.J. (2002). *Computer-mediated epistemic dialogue: Explanation and argumentation as vehicles for understanding scientific notions*. The Journal of the Learning Sciences, 11(1), 63—103.

Doise, W. & Mugny, G. (1981). *Le développement social de l'intelligence*. Paris : InterÉditions.

Edmondson, W. (1981). *Spoken Discourse : A model for analysis*. London : Longman.

Golder, C. (1996). *Le développement des discours argumentatifs*. Lausanne: Delachaux & Niestlé.

Koschmann, T. (Ed.) (1996). *CSCL: theory and practice of an emerging paradigm*. Mahway, New Jersey: Lawrence Erlbaum Associates.
Lund, K. & Baker, M.J. (1999). Teachers' collaborative interpretations of students' computer-mediated collaborative problem-solving interactions. *Proceedings of the International Conference on Artificial Intelligence and Education*, Le Mans, July 1999. S.P. Lajoie & M. Vivet (Eds.) *Artificial Intelligence in Education*, pp. 147-154. Amsterdam : IOS Press.
Mevarech, Z.R. & Light, P. H. (1992). *Peer-based interaction at the computer: looking backward, looking forward*. Learning and Instruction, 2, 275-280.
Nonnon, E. (1996). *Activités argumentatives et élaboration de connaissances nouvelles: le dialogue comme espace d'exploration*. Langue Française, 112 (décembre 1996), 67-87.
Quignard, M. & Baker, M.J. (1999). Favouring modellable computer-mediated argumentative dialogue in collaborative problem-solving situations. *Proceedings of the International Conference on Artificial Intelligence and Education*, Le Mans, July 1999. S.P. Lajoie & M. Vivet (Eds.) *Artificial Intelligence in Education*, pp. 129-136. Amsterdam : IOS Press.
Quignard, M. (2000). *Modélisation cognitive de l'argumentation dialoguée. Etudes de dialogues d'eleves en resolution de probleme de sciences physiques. Thèse de doctorat de sciences cognitives*. Grenoble : Université Joseph Fourier. [Cognitive modelling of argumentation dialogue. Studies of students in physics problem-solving].
Rommetveit, R. (1979). On the architecture of intersubjectivity. In R. Rommetveit & R. M. Blaker (Eds.) *Studies of language, thought, and verbal communication*,. pp. 93-108. London: Academic Press.
Rouet, J-F. (2001). Designing multimedia systems for learning: Some lessons and further issues. In J-F. Rouet, J. J. Levonen, & A. Biardeau (Eds.), *Multimedia learning: Cognitive and instructional issues* (pp. 167-172). Amsterdam: Elsevier Science.
Schnotz, W. (2001). Sign systems, technologies, and the acquisition of knowledge. In J-F. Rouet, J. J. Levonen, & A. Biardeau (Eds.), Multimedia learning: *Cognitive and instructional issues* (pp. 9-29). Amsterdam: Elsevier Science.
Suthers, D. & Hundhausen, C. (2001). Learning by Constructing Collaborative Representations: An Empirical Comparison of Three Alternatives. In P. Dillenbourg, A. Eurelings & K. Hakkarainen (Eds.), *European Perspectives on Computer-Supported Collaborative Learning: Proceedings of the First European Conference on Computer-Supported Collaborative Learning* (pp.577-584).

Maastricht, The Netherlands: Universiteit Maastricht.
Suthers, D. & Weiner, A. (1995). Groupware for developing critical discussion skills. In J. L. Schnase & E. L. Cunnius (Eds.), *Proceedings of Computer Supported Cooperative Learning*, Bloomington, Indiana.
Suthers, D. (1998). *Representations for scaffolding collaborative inquiry on ill-structured problems*. Paper presented at the annual conference of the American Educational Research Association, San Diego, California.
Suthers, D., Toth, E. and Weiner, A. (1997). *An Integrated Approach to Implementing Collaborative Inquiry in the Classroom*. Proceedings of the conference on Computer Supported Collaborative Learning: CSCL'97 (pp.272-279).
Tiberghien, A., & De Vries, E. (1997). *Relating characteristics of learning situations to learner activities*. Journal of Computer Assisted Learning, 13, 163-174.
Toulmin, S.E. (1958). *The Uses of Argument*. Cambridge: Cambridge University Press.
Van Someren, M. W., Reimann, P., Boshuizen, H. P. A., & de Jong, T. (1998). *Learning with Multiple Representations.* Amsterdam : Elsevier Science.
Veerman, A. L. (2000). *Computer-supported collaborative learning through argumentation*. Enschede: PrintPartners Ipskamp. Proefschrift Unversiteit Utrecht.

ISSA Proceedings 2002 – She Blinded Me With Science: Material Argument In The Indianapolis Children's Museum

Children's museums, which have been in existence for just over 100 years, are the growth sector of the museum industry. While other museums and tourist attractions have struggled to sustain attendance, children's museums have welcomed record numbers of visitors. In 2000, the 400 children's museums in the United States attracted 33 million visitors (Sangiorgio 2002: 70). The popularity of these museums is so high that the Association of Youth Museums reports that 100 new Children's museums are currently in the planning phase (Atkin 2000: 15). While these museums naturally attract children and their parents, there is also a close association between children's museums and educational institutions. Thus, the children's museum serves not only as a place of play, but also a place of serious intellectual activity. Critics of children's museums have complained that they are "frivolous; lacking content, rigor or standards; and dangerously blurring the lines between playgrounds, Disneyland, and museums" (Schwarzer 1998: 66). Yet, few scholars have closely examined the types of materials that are being offered to children in these museums. Despite these criticisms, there is no doubt that exhibits presented in children's museums are carefully planned and executed, and that much pedagogical theory is involved in the implementation of the displays offered to visitors. This very careful attention to display begs for critical scholars to analyze the types of arguments that are being presented to visitors in these museums, especially given the power that these institutions have in formulating claims about the importance of culture and science to very impressionable audiences.

This paper will investigate how the Indianapolis Children's Museum, recently ranked by *Child Magazine* as the top children's museum in the country, creates arguments about science in its displays. While children's museums include much more than science alone, science is usually given a preferred position within the museum. In fact, the Indianapolis Children's Museum devotes nearly half of its exhibition space to scientific exhibits. Scientific discovery and the knowledge of science are two themes that resonate both in contemporary children's museums and in the development of the children's museum, so it seems apropos to investigate what types of arguments these sites make about science and scientific discovery to their audiences. *1. Children's Museums*

The first museum intended especially for children was established in Brooklyn,

N.Y. in 1899 by the Brooklyn Institute of Arts and Sciences. The Brooklyn Children's Museum was envisioned as a place that would explore "every branch of natural history, attempt to delight and instruct the children who visit it, and stimulate their powers of observation and reflection" (Alexander 1997: 133). This vision statement, which emphasizes both the content of the museum and its pedagogical goals, is notable for its prescience. Contemporary children's museums define themselves as an educational institution with a particular emphasis on science and culture. Indeed, children's museums define themselves as audience rather than artifact centered; their mission is not academic, but pedagogic (Lewin 1994: 77).

The Brooklyn Children's Museum was a resounding success and soon visitors from a number of cities that wanted to start their own children's museums were making pilgrimages to the site. In 1924, Mrs. Mary Stewart Carey visited the Brooklyn museum and brought back to the Indianapolis Progressive Education Association her vision of establishing a similar institution in Indianapolis. Mrs. Carey, a wealthy, well-connected civic and social leader, was able to use her considerable influence to create a board of directors and to begin collecting materials and monetary donations to open the museum.

The Indianapolis Children's Museum officially opened in January 1926 in a building located in Garfield Park, south of downtown Indianapolis (Kriplen, 1982). The museum's collections were a haphazard mix of donated items that had been begged from the families of children enrolled in the Indianapolis public schools**[i]**. Interest in the museum was extraordinary, and the museum soon linked with the public schools to create educational programs intended to supplement the schools' curricula. As public interest in the museum grew, so did its collections. The museum would move twice in order to find a space that would allow for suitable display areas before finding a permanent home on Meridian Street, north of downtown Indianapolis.

The current museum is the largest children's museum in the United States. It fills 356,000 feet of gallery space (Children's Museum 2001c), and at any one time it can only show about 1/10th of its collection (Sangiorgio 2002: 71). Its collections have both extraordinary depth and breadth, the museum can and does rotate its exhibits regularly. One example of the museum's ambitions is the plans now underway to construct a Dinosphere to take advantage of the museum's impressive array of dinosaur relics (Sangiorgio 2002: 71). Thus the museum is a

text that is constantly being revised; its structure is constantly changing. While there are certainly some parts of the museum that are fixed, even the fixed elements may be subtly changed depending on the time of day the exhibit is visited.

Most of the museum is devoted to science and culture; what little floor space is not dedicated to these two categories of knowledge is area devoted to play. In addition to the exhibit areas, the museum houses a room it designates as "Playscape", where infants and pre-schoolers are encouraged to play with adults. This area also includes "Babyscape", an area for children under the age of 2 to "explore with their senses" (Children's Museum 2002). The museum currently houses a planetarium on its lowest floor. Visitors to the planetarium are taken on a guided tour of the solar system several times a day. One space in the museum is set aside for rotating exhibits; during the time of the writing of this paper the two exhibits that were housed in this space were "Bones: A Look Inside You" and the "Science of the Circus."

The permanent scientific displays are spread throughout the museum. The top floor is largely occupied by "Scienceworks" which opened as a state of the art science gallery in 1996 (Brown 1996: 34). This room is primarily focused on biological and environmental science; it includes a rock wall that children are invited to climb through (so that they may witness what lives inside the rocks), a habitat for birds, a water habitat populated by turtles, fish, and insects, and two large areas where children can play with water. Of the water play areas, one is devoted to teaching children about how the water table influences population and the other teaches children how water can be navigated, with a focus on tides, locks, eddies and water flow rates. There are two exhibits in this area that do not focus on the natural sciences. The first is a Rube Goldbergesqe machine that uses gravity and acceleration to shoot pool balls through an array of passageways. The second is an exhibit that invites children to build structures, appropriately named the Construction Zone.

Visitors find the dinosaur exhibits housed on three separate floors. The museum displays a full size mastodon skeleton that was uncovered on a farm in Greenwood, Indiana (about 30 miles away from the museum), in a space adjacent to Scienceworks. Visitors are encouraged to touch a "real" dinosaur bone attached to a display board located next to the skeleton, Visitors are also invited to watch as museum staff uncover the bones of other dinosaurs in the Dinolab.

Here, scientists go about their work uncovering bones that have been packed for shipment to the museum. Twice a day the lab is opened to visitors who get to talk to the scientists and to feel the bones that are being worked upon

The lowest floor of the museum houses the "What If" gallery. This room, intended for children ages 4-8, includes another dinosaur exhibit, a coral reef, and a mummy. Children are invited to play games that help them to learn about the different aspects of discovering knowledge. In this area, and throughout the museum, the museum relies on staff and volunteers to engage with visitors about the displays. There is little written material to supplement the exhibits; instead visitors are encouraged to play, touch, and talk about what they see.
The Indianapolis Children's museum makes four claims about the function of its exhibits:
1. Education justifies every object, activity, and event. There is a purpose behind each display, a story to tell with each exhibit, an idea to unfold in each gallery.
2. Bright vivid colors and dramatic lighting effects are used to capture attention. Labels are written in easily understood, contemporary language.
3. Exhibits are placed carefully to afford even the youngest a good look, and materials are presented in identifiable sequence. Whenever possible, exhibits are 'hands-on' or participatory in nature.
4. No matter how sophisticated the exhibit, human contact remains the most important source of learning (Children's Museum 2001a).
These four principles clearly espouse the museum's value hierarchy; in most cases the needs of the audience outweigh the preservation of the collections. Additionally, these principles articulate how the museum views its audience: engaged, active, and participatory. Such a vision of audience explains why the museum creates the arguments that it does about science in its exhibits.

2. Visual Argument
In 1996, *Argumentation and Advocacy* published two special issues concerned with the possibility of visual argument. Although one essay appeared that negated the possibility that visuals could serve as argument (Fleming 1996), it was clear from the editors' selections that the community of argument scholars accepted that visual argumentation was not only a legitimate form of argument, but that it was time for argumentation scholars to turn their attention to the critical evaluation of visuals. J. Anthony Blair concludes his contribution to the first of the special issues with the bold statement that, "visual arguments are not a

particularly exciting conceptual novelty; they do not constitute a radically different realm of argumentation" (1996: 38).

In subsequent years, communication scholars have turned their attention to visual rhetoric as well. No archetype theory or method for the analysis of visual argument has yet emerged from these writings, but it is clear that the visual turn in argument and rhetoric has emerged as one of the dominant themes of contemporary theorizing. However, one troubling issue emerges from these texts. The focus of most scholarship seems to be on two-dimensional visual experiences; critics seem more comfortable equating the visual with the pictorial than with the material. This is especially true of the work of W.J.T. Mitchell, one of the pioneers in the field of visual analysis**[ii]**. His latest work on visual rhetoric, *Picture Theory*, compresses the broad scope of visual representations to the notion of the picture (1994: 7)**[iii]**. Certainly, the analysis of photographs and visuals that accompany mass media images are fruitful areas for study, but to focus on these images to exclusion of all other visual argument is to exclude some of the most influential visual argument possibilities.

Museums are more than just visual, two-dimensional spaces; they are decidedly material. This is especially true for a children's museum that not only displays visual objects, but also encourages visitors to touch, i.e. to feel the object's materiality. Michael Herschensoh, Director of the Children's Museum in Seattle, notes, "The focus of our museum and most other children's museums is interactive, hands-on, play-based learning" (Farmer 1995: 168). Thus, traditional visual rhetoric templates, while useful in some respects for the analysis of material rhetoric, have not been developed to deal with the complexities of sites such as museums. What can be taken from the study of visual argument are issues dealing with the context and audience of the argument.

Visual argument analysis has two dominant foci: one concerned with the substance of the argument, the other with the interaction that the argument has with the audience. Shelly (1996) and Blair (1996) are both concerned with understanding the substance of the argument. Shelly's work creates a schema for identifying the different functions of visual argument; she distinguishes two types of visual appeals: the demonstrative and the rhetorical. While Shelly cautions that her categories are not mutually exclusive and should not be viewed as a closed system of categorizing, her primary concern is with understanding the purpose of the visual in an argument system. Blair's task is much more fundamental; he asks

what should count as visual argument. To this end, he provides criteria that determine what constitutes visual argument.

Blair and Goarke (1996) and Finnegan (2001) investigate the intersection of the visual form and audience assent. Blair and Goarke argue that in order to understand how a visual argument works on an audience, a critic must examine three types of context, "immediate visual context, immediate verbal context, and visual culture" (1996: 6). The first two contexts are interpreted in relation to the visual being studied; the third requires a critic to understand how the public reads the visual in relation to its interaction with other visuals. Blair and Goarke (1996) note: "The meaning of a visual claim or argument obviously depends on a complex set of relationships between a particular image/text and a given set of interpreters" (5).

Finnegan (2001) argues that audiences are likely to respond to pictorial representations because they construct naturalistic enthymemes when they view pictorial representations. In other words, an audience will give credibility to a photograph or other visual because they participate in the enthymeme being made by the photographer about the nature of the pictorial representation by granting that the visual they are seeing is real (143). Finnegan's work may be applied to material argument as well in that audiences are more likely to view a claim as true when material objects presented by an institution make it. Thus, the view of science presented by the Children's Museum must be true because it is supported by material objects that are "real" and displayed by a curatorial staff that has "knowledge."

Although argument scholars have yet to conceptualize how material objects work to create argument, Carole Blair (1999), in her theorizing on how to understand material rhetoric, posits five questions that a critic should ask about a material site:

1. What is the significance of the text's material existence?
2. What are the apparatuses and degrees of durability displayed by the text?
3. What are the modes or possibilities of reproduction or preservation?
4. What does the text do to (or with, or against) other texts?
5. How does the text act on person(s)?

These five questions are extremely useful for a critic who is interested in understanding texts that involve multiple senses. Blair's questions go beyond the simple issue of how visuals represent and ask how audience members interact

with a material site. What makes museums powerful arguers is the audience's action; when a visitor chooses to play in an exhibit, they are taking a role that the museum wishes for them to assume. Thus Blair's final question addresses the power that museums have in gaining the assent of the audience.

In order to assess the power of the Indianapolis Children's Museum's argument, I will analyze both the content of the exhibits and the ways in which visitors are engaged by the materials exhibited. It is my claim that the Indianapolis Children's museum constructs arguments about science and scientific discovery that invite children to participate with knowledge from a multiplicity of perspectives. Although I do not claim that the text presented by the museum is polysemous, it certainly does not create a singular vision of science.

3. Arguments about Science in the Museum

The Indianapolis Children's Museum advances two claims about scientific discovery:

1. science is wonder and
2. science is play.

Rather than making essentializing claims about what science is and how it should be practiced, the museum chooses to emphasize that science is welcoming to any number of perspectives. While the museum certainly neglects much scientific inquiry in its choice of exhibits, it does develop exhibits that respond to the preferences of audience members. As an example, the Dinosphere came about because visitors suggested that the dinosaur exhibit be enlarged.

The natural sciences dominate the museum. In the largest permanent science exhibit, Scienceworks, most of the floor space is devoted to ecological exhibits. Visitors are encouraged to play with a watershed, climb through a passageway that will reveal "what lives in the dirt," view the life that exists in an Indiana pond, and interact with live animals that museum staff display at regular intervals. Visitors also encounter three different dinosaur areas within the museum. On the top floor, adjacent to Scienceworks, is a mastodon skeleton. Down one floor is the "Dino Discovery Lab" where visitors can interact with paleontologists who are in the process of uncasing the bones of the 7 different dinosaurs who will inhabit the new Dinosphere. The bottom floor includes the "What If" exhibit, which invite children to discover dinosaurs. As visitors walk into the display, they are encouraged to pick up a check sheet that asks "How do you know if you've found a dinosaur?" Children are encouraged to critically examine

bones, skeletons, and geography as they uncover fossils in a sandpit.

Physical sciences are the second most common types of materials displayed. As visitors enter Scienceworks, they are confronted with a giant gravity maze in which pool balls are shot, dropped, and careened from various trajectories. The museum also houses a two-story tall water clock that is placed in the atrium of the museum immediately before visitors enter the inside exhibit areas. Each day at 1 p.m. when the clock empties itself to reset, visitors are invited to hear a physicist explain how the clock works. Unlike the natural science exhibits, these displays only give visitors limited hands-on experience. Visitors may only gaze upon the water clock; there are no opportunities for interaction with this exhibit. Although the ball maze is not a perpetual motion machine, visitors only interact with this exhibit in so far as they turn a crank that pushes the balls into the maze or feed balls into two other slots in the machine. A third physical science exhibit is an IRL racing car that visitors are encouraged to climb into along with two racing video games. This exhibit was heralded as an "exciting program that introduces physics principles through auto racing" (Carlson & Mintz 1993: 101).

The significance of these exhibits is their ability to excite visitors about the possibility of science. Carole Blair asks, "What is different as a result of the text's existence?" (1999). In answer to this question, the Children's Museum creates a unique space for visitors to experience science. Unlike the typical science classroom, there are no right or wrong answers. Visitors may enter the exhibit at multiple points and are encouraged to think about exhibit materials in multiple dimensions. Signs positioned around the exhibits encourage parents and children to discuss the material that they have seen. The museum creates discourse about science that would not exist otherwise; it takes science out of the classroom context and turns it into play and wonder. Exhibits create wonder by their material apparatus; visitors are amazed that they are playing with "real" artifacts.

In a museum, especially one devoted to the audience, the material of the exhibits announces a particular viewpoint. The Children's Museum makes three important choices in its exhibits that create an argument about scientific knowledge. Initially, the museum has made a conscious choice to display genuine artifacts rather than replicas. Visitors are told that they are touching "real" bones, sitting in an "actual" Indy 500 racecar, and interacting with live animals. Each of these experiences heightens the audience's appreciation of the wonder of science. The paleontologist who was working on the day of my last visit confided that the most

frequent question he is asked by visitors is “Is it really real?”

The second choice the museum makes in the construction of its exhibits is to offer minimal supporting written material to explain its displays. For example, there are two written pieces that accompany the mastodon skeleton: one is a posterboard that has a bone attached and asks visitors if they have ever “felt one of these before”. No other information about the bone is given; it is unclear what type of dinosaur, if indeed it is a dinosaur leg, this bone came from. The second written piece placed by the skeleton contains three short paragraphs of text. The first paragraph asks children to imagine that they are living among the dinosaurs in Central Indiana; the second explains that the dinosaur had to be carefully excavated and pieced back together; the third tells some of the ways in which paleontologists learn from these bones. This lack of authoritative text allows the visitor to create a narrative about the artifacts displayed that fits with his or her current ability to think about science. The argument that emerges from these supporting materials is not a specific claim about the purpose of science, but a general claim about the wonder of scientific discovery. Worth noting is that one specific claim is almost always forwarded by the supporting material that accompanies the artifacts: the museum wants its visitors to know that the artifact they are seeing or playing with is “real.”

The third way that the museum frames its arguments is to emphasize human interaction between children, parents and museum personnel. The museum employs 188 full time and 200 part time staff members, and relies on over 300 volunteers (Children’s Museum 2001c). On any given day, visitors will be greeted in the galleries by experts in early childhood education, physicts, chemists, paleontologists, and biologists. Both the staff and the volunteers are responsible for engaging visitors in conversations about the exhibits; each interaction that a visitor has with a museum staffer will be tailored for the needs and interests of that visitor. Clearly this is a risky strategy; many visitors are uncomfortable being approached by the museum staff. Many of the employees I interviewed recounted stories of visitors walking away from them as they attempted to engage in conversations. Children, however, are far more likely to talk to the staff; especially because the staff is quick to point out the games and puzzles that accompany many of the exhibits. Additionally, the museum has posted at adult eye level, signs that ask parents to talk to their children about what they see at the museum.

Human, rather than textual support, ensures that the museum is constantly in transition, even the permanent exhibits may change depending on how the museum staff or the visitors choose to talk about the exhibits. In any material display, the materials that are used to make an argument change over time; they may break, loose their luster, be re-arranged, or simply be viewed differently depending on the angle that the visitor takes on the exhibit. In the "What If" room, a visitor who decides to dig for fossils in the sand pit will have a much different view of the argument than one who quickly walks through the rooms. The museum's obsession with displaying the real also radically changes the text. Taken together, these two choices reinforce the primary claims being made about science; it is play and wonder. No specific claim about what constitutes science is made by the museum, nor does the museum reinforce the scientific method. Visitors are left with the overwhelming impression that science is what they make of it.

To this point, the museum's argument has been evaluated based on its substance; both in terms of what the museum presents (real artifacts that are available for play) and what is absent from the exhibits (directive written material). While the substance of the argument clearly articulates claims about the nature of science, perhaps the most influential aspect of the museum's argument is the way the exhibits act on the persons who visit. Visitors are encouraged to play, to experience the exhibits from multiple perspectives, to crawl under, into and on top of the artifacts. Almost every display invites action; visitors are invited to use their entire being with the exhibits, to crawl, climb, dig, or start the balls through the gravity maze. The museum invites children to "pretend to be earthworms as they crawl through the 'dirt' and explore habitats of 12 different underground animals" (Children's Museum 1999). Children can experience the Indiana pond from a variety of perspectives; they may crawl underneath the exhibit, look through a microscope at the pond life, or simply approach the pond and gaze at the flora and fauna at eye level.

Positioning visitors within the exhibits functions as a potent naturalistic enthymeme. The museum invites visitors to play with science, to experience it with multiple senses. As a result, visitors are left with a vision of science as involving. Rather than participating as a spectator, visitors join in with the exhibit and engage with it in whatever way they are able.This engagement reinforces the power of the museum's vision of science; science is not something one observes,

it is something one does. Science is fun!

4. The Wonder of Science and the Materiality of Arguments

Children's museums are powerful arguers; they engage with audiences that are particularly open to their visions of the world. Strong alliances between educational institutions and museums reinforce the museum's authority.Thus, an examination of what types of arguments are being made is important to understanding how audiences are engaged by these powerful rhetors. My analysis of the Indianapolis Children's museum reveals that this museum creates an inviting argument about the nature of science by constructing strong interactive exhibits. Caulton notes, "A hands-on or interactive museum exhibit has clear educational objectives and encourage individuals or groups of people working together to understand real objects or real phenomena through physical exploration which involves choice and initiative." (1998: 2). Interactive exhibits reinforce the arguments made by the museum by positioning visitors within the exhibit. Visitors leave the museum with a sense of wonder and awe. The Indianapolis Children's Museum offers a powerful emotional argument about the nature of science.

On the whole, the Indianapolis Children's Museum is an exemplary rhetor; its staff and leadership are cognizant of its power and its responsibility to the publics that it serves (Children's Museum 2001b). This museum has always been a leader in the children's museum movement, and it is refreshing to be able to state that this site creates visions of science that are not closed, forbidding, or unwelcoming. Although much more research needs to be done on the audience response to children's museums, this work serves as a good first step in understanding how these museums create their arguments.

While it is valuable to understand the types of arguments made by material sites, much more attention needs to be paid to developing methods for understanding the impact that material sites can have in creating and maintaining the arguments they offer to the public. The credibility of material sites is rarely questioned by their audiences and the argument being offered by the site may not be clearly articulated or explained. This work is a case study of one important site, much more could be learned with about how to interpret sites with more case studies or systematic comparisons of sites that would ultimately lead to a greater understanding of the apparatus used by these sites.

My work only begins to address the issue of how audiences are affected by the material presented in the exhibits. Perelman and Olbrechts-Tyteca's (1969) concept of the universal audience would be extremely useful to scholars who are interested in expanding both the theory and method of material argument. Much could be learned by examining what types of audiences the curators and educational staff of children's museums envision. Clearly, the Indianapolis Children's Museum has identified for itself a powerful universal audience, one that is able to learn from experience and is willing to interact with other human beings in the educational process. Additionally, the museum expects to educate audiences who enter its site with different experiences and expectations; Perelman and Olbrechts-Tyteca's schema may be useful in understanding why the museum is able to effectively appeal to such diverse visitors.

NOTES

[i] Most of the impetuous and funding for the museum involved the public school system. Students were rallied to become members of the museum by donating 25 cents for a pin shaped like a seahorse that was the emblem for the museum.

[ii] Mitchell's work, Iconography is identified by Birdsell and Goarke's review essay on visual argument as "the best single volume exploration of the broad sweep of intellectual history on these (visual) issues" (1996, 10).

[iii] Three articles have been published in Argumentation and Advocacy that are identified as dealing with visual argument. All three articles are concerned with the evaluation of pictures. (Shelly, 1996; Barbatsis, 1996; Finnegan, 2001)

REFERENCES

Alexander, E. P. (1997). *The museum in America*. Walnut Creek, CA: AltaMira Press.

Atkin, R. (2000, October 4). *More than a museum*. Christian Science Monitor, 92, 15.

Barbatsis, G.S. (1996). "Look and I will show you something you will want to see'': Pictorial engagements in negative political campaign commercials. *Argumentation and Advocacy*, 33, 69-78.

Birdsell, D.S. and L Goarke. (1996). Toward a theory of visual argument. *Argumentation and Advocacy*, 33, 1-10.

Blair, C. (1999). Contemporary U.S. memorial sites as exemplars of rhetoric's materiality. In. J. Selzer and S. Crowley (Eds.), *Rhetorical Bodies*. (pp. 16-57) Madison: University of Wisconsin Press.

Blair, J.A. (1996). The possibility and actuality of visual arguments. *Argumentation and Advocacy*, 33, 23-39.
Brown, A. (1996, July/August). Its a child's world after all. *Saturday Evening Post* 268, 34-5.
Carlson, N.B. & C.A. Mintz (1993). The Indy 500 and physics: How a partnership brought them together. *T H E Journal*, 21, 101-105.
Caulton, T. (1998). *Hands-on exhibitions: Managing interactive museums and science centers*. London: Routledge.
Children's Museum of Indianapolis. (2002). *Visitor's Guide.* (Brochure). Indianapolis: Children's Museum of Indianapolis.
Children's Museum of Indianapolis. (2001a). *Children's Museum concept.*. (online). Available: www.childrenmuseum.org/behindthe/concept.htM
Children's Museum of Indianapolis (2001b). *Our mission, vision and core principles statement*. (online). Available: www.childrensmuseum.org/behindthe/missionvisioncore.htm.
Children's Museums of Indianapolis (2001c). *Museum overview.* (online). Available: www.childrensmuseum.org/behindthe/overview.htm.
Children's Museum of Indianapolis (2000). *Scienceworks at the Dow Science Center*. (online). Available: www.childrensmuseum.org/opendoors/sciencew.htm.
Farmer, D.W. (1995). Children take learning into their own hands. *Childhood Education* 71, 168-169.
Finnegan, C.A. (2001). The naturalistic enthymeme and visual argument: Photographic representation in the "skull controversy". *Argumentation and Advocacy* 37, 133-149.
Fleming, D. (1996). Can pictures be arguments? *Argumentation and Advocacy*, 33, 11-22.
Lewin, A.W. (1994). Empowering the mind of the child in the children's museum. In J.R. Glaser and A.A. Zenetou (Eds.), *Gender Perspectives: Essays on Women in Museums*. (pp 77-81). Washington: Smithsonian Institution Press.
Macdonald, S. (1996) Theorizing museums: An introduction. In S. Macdonald and G. Fyfe (Eds.), Theorizing Museums. (pp 1-18). Oxford: Blackwell Publishers.
Kriplen, N. (1982). *Keep an eye on that mummy: A history of the children's museum of Indianapolis*. Indianapolis: The Children's Museum of Indianapolis.
Mitchell, W.J.T. (1986). *Iconology: Images, text ideology*. Chicago: University of Chicago Press.
Mitchell, W.J.T. (1994). *Picture Theory*. Chicago: University of Chicago Press.
Perelman, C. and L. Olbrechts-Tyteca (1969). *The new rhetoric*. (J. Wilkinson and

P. Weaver, Trans.). Notre Dame: University of Notre Dame Press.
Sangiorgio, M.P. (2002, February). The 10 Best Children's Museums. *Child*, 70-76.
Schwarzer, M.L. (1998). Collective Vision: Starting and sustaining a children's museum. *Curator*, 41, 66-71.
Shelley, C. (1996). Rhetorical and demonstrative modes of visual argument: looking at images of human evolution. *Argumentation and Advocacy*, 33, 53-68.

ISSA Proceedings 2002 – Linked And Independent Premises: A New Analysis

Most introductory logic and critical thinking textbooks include a discussion of linked and independent premises. The core intuition underlying this distinction is clear. In some arguments, the premises work together as a logical unit in such a way that the amount of support offered by one or more of the premises is dependent on the other(s).

Example:
Case 1
1. All members of the Oakwood Society are over 50 years old.
2. Bert is a member of the Oakwood Society.
3. Therefore, Bert is over 50 years old.

Here, neither of the premises provides any support for the conclusion without the other. Taken together, however, the premises validly imply the conclusion. Thus, the premises interact to produce a degree of support that is not simply the sum of the supports of the individual premises. Premises of this sort are said to be *linked***[i]**.

In other arguments, the premises work completely separately and independently

of one another, in such a way that the degree of support they provide for the conclusion remains the same even if some or all of the other premises are omitted or assumed to be false. Example:

Case 2

1. Harry's car has a flat tire.
2. Harry's right leg is in a cast.
3. Harry's driver's license was recently suspended.
4. Therefore, Harry won't drive his car to the game.

In this argument, each of the premises would continue to provide the same amount of support for the conclusion even if the other premises were omitted or assumed to be false. To be sure, the premises do "work together" in a sense: the overall strength of the argument would be reduced if one of the premises were suspended or knocked down. However, the premises "work together" only in a purely evidence-accumulating way. Unlike linked premises, they don't interact to form a single logical unit that provides a degree of support that is generally much greater than the combined support of the premises considered separately. Premises of this sort are said to be *independent***[ii]**.

Although the basic intuition underlying the linked/independent distinction is clear, there is considerable disagreement in both the textbooks and in the scholarly literature about how exactly these notions should be defined. In this paper I shall argue that all the leading textbook and scholarly accounts of the distinction are flawed, and I shall propose an alternative way of formulating the distinction.

1. Textbook Accounts

There are three leading accounts of the linked/independent distinction offered in logic and critical thinking textbooks. These are:

– the falsity/no support test
– the omission/no support test
– the omission/diminished support test

Let's examine each of these in turn.

A. The Falsity/No Support Test

Probably the most popular test is the falsity/no support test, offered among others by Copi and Cohen (1998: 45), Moore and Parker (2001: G-3-4), Reichenbach (2001: 165), Bickenbach and Davies (1997: 71), and Kelley (1988: 87).

Kelley offers perhaps the clearest statement of the test. He writes:
"In order to tell whether a set of premises is additive [linked] or not, we look at each premise separately, and ask whether it would support the conclusion by itself, without the other premises. The other side of the coin is to ask what would happen if one of the premises were false. Would that destroy the whole argument? Then the premises are additive; they depend on each other to support the conclusion. Or would part of the argument remain standing? Then the premises are nonadditive [independent]; each supports the conclusion independently" (Kelley 1988: 87).

Stated more precisely:
The falsity/no support test: A set of premises is *linked* just in case if any one of the premises were false, none of the other premises would provide any support for the conclusion. A set of premises is *independent* just in case if any one of the premises were false, then at least one of the remaining premises would continue to provide at least some support for the conclusion.

One problem with this test is that it is doubtful whether it makes sense to suppose that certain premises are false. Consider:
Case 3
1. All bachelors are males.
2. Max is a bachelor.
3. So, Max is a male.

Since (1) is necessary truth, it isn't clear what sense it makes to "assume" that it is false, or what follows logically from such an "assumption." (Standardly, counterfactuals with necessarily false antecedents are regarded as vacuously true.) Perhaps for this reason, most textbook writers prefer to speak of *omitting* premises in argument diagramming rather than assuming that they are false.

The falsity/no support test also runs into more obvious kinds of problems. Consider this argument in which one of the premises is only partially dependent on the other:
Case 4
1. All Chinese have brown eyes.
2. Xu is Chinese.
3. So, probably Xu has brown eyes.

Suppose the first premise is false. Then, because the second premise continues to provide relevant support for the conclusion, the premises count as independent on the falsity/no support test. But, intuitively, the argument is linked.

Finally, consider arguments in which the premises are irrelevant to the conclusion:

Case 5

1. Grass is green.
2. The North won the American Civil War.
3. So, Bush is the U.S. president.

According to the falsity/no support test, this argument is linked, since neither premise would provide any support for the conclusion if the other were false. Yet, intuitively, the premises are not objectively dependent on one another.

B. The Omission/No Support Test

Another leading textbook account of the linked-independent distinction is the omission/no support test, endorsed by Govier (2001: 51-52), Freeman (1988: 178), Johnson (1999: 13), Moore (1993: 40), and Rudinow and Barry (1999: 97), among others. The test can be stated as follows:

Omission/no support test: A set of premises is linked just in case if any one of the premises were omitted, none of the other premises would provide any support for the conclusion. A set of premises is independent just in case if any one of the premises were omitted, then at least one of the remaining premises would continue to provide at least some support for the conclusion.

This test avoids the problems that the falsity/no support test encounters by asking argument diagrammers to assume (arguendo) that certain premises are false. But it faces other objections, including the following. Consider:

Case 6

1. The first letter of X's first name is "T"
2. The second letter of X's first name is "e".
3. The third letter of X's first name is "d".
4. Therefore, X's first name is probably Ted.

Intuitively, this argument is linked, because the premises provide strong support when taken collectively but very little support when considered individually. According to the omission/no support test, however, the premises are

independent, because if any one of the premises were omitted, each of the remaining premises would continue to provide at least some support for the conclusion.

The omission/no support test also runs into problems with arguments that include countervailing premises, i.e., premises that, considered individually, provide evidence contrary to an argument's conclusion, but which nevertheless play an integral role in the argument as a whole. Consider:

Case 7

1. On Monday, I interviewed 40 Wexford College students and 32 of them were Republicans.
2. On Tuesday, I interviewed 10 Wexford College students and 4 of them were Republicans.
3. Therefore, most Wexford College students are probably Republicans.

According to the omission/no support test, this argument is linked because if the first premise were omitted, the second premise wouldn't provide any support for the conclusion at all. On the other hand, the premises are also independent, because if the second premise were omitted, the first premise would continue to support the conclusion**[iii]**.

C. The Omission/Diminished Support Test

Another leading test is the omission/diminished support test, endorsed, among others, by Hurley (2000: 64-65) and Layman (1999: 73). The test can be stated as follows:

The omission/diminished support test: A set of premises is linked just in case if any of the premises were omitted, the support provided by the other(s) would be diminished or destroyed. A set of premises is independent just in case if any of the premises were omitted, the support provided by the other(s) would not be diminished or destroyed.

This test works well with standard sorts of arguments, but it fails with various kinds of nonstandard arguments, including arguments with irrelevant or redundant premises.

Consider this typical argument with irrelevant premises:

Case 9

1. All dogs are mammals.
2. Some mammals are insects.

3. So, some insects are dogs.

Intuitively, this argument, like all categorical syllogisms, is linked. Yet, since neither premise would lose any power to support the conclusion if the other were omitted, the premises are independent according to the omission/diminished support test.

Further, consider this argument with redundant (i.e., logically superfluous) premises:

Case 10

1. If Joe is an uncle or a father, then Joe is a male.
2. The person referred to in the first premise is an uncle.
3. The person referred to in the first premise is a male.
4. So, Joe is a male.

On the omitted/diminished support test, this argument is linked, since if (1) were omitted, premises (2) and (3) would no longer provide any support for the conclusion. But the argument is also independent, since if (2) or (3) were omitted (but not both), the argument would still provide logically conclusive support for the conclusion.

2. Scholarly Accounts

The deficiencies of the various textbook accounts of the linked/independent distinction have been widely noted in the scholarly literature, and various attempts have been made to state the distinction more adequately and precisely. Here, I shall examine two such attempts.

A. Yanal's Account

In various writings, Robert J. Yanal has defended an account of the distinction that turns on the notion of a set of premises "summing in the ordinary way" (Yanal 1988: 43, 53-55; 1991: 140). Consider, by way of explanation, the following example offered by Conway (1991: 150):

Case 11

1. Sharpshooter A will shoot at Herman, and she hits her target 80% of the time.
2. Sharpshooter B will shoot at Herman, and she hits her target 90% of the time.
3. Therefore, Herman will be shot.

How do we determine how strongly the premises, taken together, support the conclusion? Clearly, we cannot just add the two probabilities together, for that

would mean that the premises provide more than 100% support for the conclusion, which is impossible. So how should the premises be totaled?

According to Yanal, we should proceed as follows: Take the degree of support provided by the first premise (0.8). Then multiply the degree of support provided by the second premise (0.9) by the "unknown" left over from the first premise (0.2); thus, 0.9 x 0.2 = 0.18. Finally, add the two numbers together (0.8 + 0.18 =0.98). This means that there is a 98% chance that Herman will be shot. Assuming that the premises are completely independent, this seems to be the correct result [**iv]**.

When the premises of an argument "total" in the way they do in Case 11, Yanal says, they may be said to "sum in the ordinary way." Given this clarification, we are now in a position to state Yanal's proposed test.

Yanal's Summing Test: Two or more premises are independent when each premise provides at least some support for the conclusion and the premises sum in the ordinary way. Two or more premises are linked when they do not sum in the ordinary way but, instead, work together to make the overall strength of the argument much greater than they would if they were considered separately.

While this test seems to capture something intuitively right about linked/independent distinction, it confronts many objections. It assumes, dubiously, that it is possible to assign specific probability values to individual premises. It also fails to apply to many kinds of bad arguments. Consider:

Case 12

1. No Archbishops are professional wrestlers.
2. No professional wrestlers are grand chess masters.
3. So, no Archbishops are grand chess masters.

Intuitively, this argument, like all categorical syllogisms, is linked. However the premises provide no relevant support for the conclusion. Thus, according to Yanal's test, the premises are neither linked nor independent.

Yanal's test also fails when the support provided by the premises is only slightly greater if the premises are interpreted as linked rather than independent. Consider:

Case 13

1. X is a 4-year-old, 3-foot-tall paraplegic.
2. No NBA player is shorter than 5″10.
3. Therefore, X is not an NBA player.

Intuitively, this argument is linked because the premises, taken together, validly imply the conclusion. However, the first premise would continue to provide extremely high support for the conclusion (at least 99.99%) even if the second premise were omitted. Thus, according to Yanal's test, the argument is not linked, because the premises, treated as a logical unit, do not make the overall strength of the argument much greater than they would if they were considered separately. Nor is the argument independent on Yanal's test, because the second premise, considered separately, provides no relevant support for the conclusion.

Finally, Yanal's test yields counterintuitive results with many arguments that include countervailing premises. Example:
Case 14
1. CJ wears a beard.
2. CJ can bench-press 400 lbs.
3. CJ smokes cigars.
4. CJ enjoys knitting.
5. On balance, CJ is probably a man.

Intuitively, the premises of this argument are independent. However, because only some of the premises support the conclusion and the argument does not sum in the ordinary way, the argument counts as neither independent nor linked on Yanal's test.

B. Walton's Degree of Support Test
While conceding that no test works in every case, Douglas Walton proposes what he calls the "degree of support test" as the best available account. He states the test as follows:
The Degree of Support Test: "First, block one premise out of your mind, and then ask what degree of support the other premise (if true) gives (by itself) to the conclusion. Then, reverse the process, and block the other premise out of your mind, asking what degree of support the first premise (if true) gives (by itself) to the conclusion. Then, you add these two weights of support together, and ask what degree of support both premises together give to the conclusion. If there is a significant jump from the first joint degree of support to the second, the argument is linked. Otherwise, it is convergent" (Walton 1996: 181-182).

This test is similar to Yanal's account except that it avoids Yanal's problematic claim that the crucial difference between linked and independent arguments is

that linked arguments do, and independent arguments do not, sum in the ordinary way.

However, Walton's test is vulnerable to many of the same objections that undermined Yanal's account. Since there is no "significant jump" in the joint degree of support when arguments with irrelevant premises are interpreted as linked rather than independent, all such arguments are counted as independent. Yet, intuitively, as we saw, arguments with irrelevant premises like those in Case 12 are linked. Moreover, Walton's test, like Yanal's, yields counterintuitive results with arguments like those in Case 13, where the premises provide only slightly increased support when interpreted as linked rather than independent, and with arguments like those in Case 14, which feature countervailing premises.

In short, none of the leading textbook or scholarly accounts of the linked/independent distinction appear to be successful. Some logicians, most notably David Conway (Conway 1991:156) have concluded that all attempts to draw a clear, workable distinction between linked and independent premises have failed, and urge that we drop the distinction altogether. (Presumably, Conway would prefer to treat all arguments as explicitly or implicitly linked, seeing all apparently independent arguments as enthymemes with one or more implied linking premises.) However, I shall argue that a reasonably clear, intuitively sound distinction can be drawn between the linked and independent premises.

3. A New Account

Intuitively, a premise, P, is linked to another premise, P*, when a dependency relationship exists between P and P*, that is, when P is dependent upon P* for its degree of support, or P* is dependent upon P for its degree of support, or (as is typically the case) the premises are interdependent, each depending on the other for its degree of support. Put otherwise, two premises are linked when one or both affects the level of argumentative support of the other; otherwise, they are independent. But how can we make this intuitive notion more precise?

Consider an analogy. Imagine two lights, A and B, that are linked in the sense that one or both of the lights is dependent on the other for its ability to shine. Clearly, there are a variety of ways in which this dependency relationship could be manifested. One possibility is that if A were eliminated, B wouldn't shine at all, and if B were eliminated, A wouldn't shine at all. Another is that one or both lights might be dimmed (but still able to shine) if the other were eliminated. Still a third possibility is that one or both lights would be brightened if the other were

eliminated. In fact, with two lights and four possible dependency relationships (no shine, dimmer, brighter, and no change), there are fifteen possible ways in which a dependency relationship could exist between the lights. Only if neither light is dependent on the other for its ability to shine are the lights independent.

My suggestion is that the lights analogy closely models the possible ways in which two premises can be linked or independent in arguments. Two lights, A and B, are linked just in case A affects (i.e., destroys, weakens, or strengthens) the ability of B to shine, or B affects the ability of A to shine, or A and B affect one another. Two lights that aren't linked are independent of one another. Similarly, two premises, P and P* are linked just in case P affects (i.e., destroys, weakens, or strengthens) the ability of P* to support the conclusion, P* affects the ability of P to support the conclusion, or P and P* affect one another. Two premises that aren't linked are independent of one another.

We are now in position to state our proposed test of the linked/independent distinction, which I shall call the Dependency Relation Test (DRT). I shall first state a preliminary version of the test and then a revised version.

DRT-1:

Two premises, P and P* are linked if and only if the omission of P would affect (i.e., increase, diminish, or destroy) the amount of support P* provides for the conclusion; or the omission of P* would affect the amount of support P provides for the conclusion; or both. Two premises, P and P*, are independent if and only if they aren't linked.

This account, I suggest, successfully handles most of the objections that proved problematic for the other accounts, including arguments with necessarily true, partially dependent, or countervailing premises. However, there are two kinds of arguments that raise problems for DRT, namely, arguments with irrelevant premises and arguments with redundant premises. Consider first:

Case 15

1. All cats are mammals.
2. No beetles are cats.
3. So, all beetles are mammals.

In this argument, since neither premise seems to affect the degree of support offered by the other (the premises provide no support for the conclusion regardless of how they are interpreted), my test implies that the premises are independent. Intuitively, however, they are linked.

Consider next:

Case 16

1. If either Fred is an uncle or Fred is a father, then Fred is a male.
2. Fred is an uncle.
3. Fred is a father.
4. So, Fred is a male.

Here, one of the premises is redundant. The argument would still be logically valid if either (2) were omitted and (3) retained, or if (3) were omitted and (2) retained. DRT-1 thus implies that (2) and (3) are not linked, since the argumentative force of the remaining premises would not be affected if either were omitted. Yet suppose the arguer in Case 16 mistakenly believes and intends that the premises are linked, perhaps because he believes that adding "back-up" premises to an already valid argument can make the argument stronger. In that case, it is plausible to regard the argument as linked, much as we regard an argument as deductive if the arguer obviously intended the argument to be deductive, even if the conclusion plainly does not follow validly from the premises.

What examples like those in Cases 15 and 16 show is that any satisfactory account of the linked/independent must take into account the (actual or reasonably imputable) intentions of the arguer. Arguments like those in Cases 15 and 16 are rightly treated as linked, I suggest, not because there is any actual dependency relationship between the premises, but because the arguer presumably believed that there was such a relationship. In this respect, the linked/independent distinction is similar to the deductive/inductive distinction. Both ultimately turn on the messy and often only guessable issue of arguers' intentions.

Given the crucial role of arguer's intentions, my account must be revised as follows:

DRT-2:

The Dependency Relation Test: Two premises, P and P* are linked if and only if the arguer believes (1) that the omission of P would affect (i.e., increase, diminish, or destroy) the amount of support P* provides for the conclusion; or (2) that the omission of P* would affect the amount of support P provides for the conclusion; or both (1) and (2). Two premises, P and P*, are independent if and only if they aren't linked.

DRT-2 correctly implies that that the premises in Cases 15 and 16 are linked.

A. An Objection: Too Much Guesswork?

In closing, I would like to consider a likely objection to my proposed account, namely, that it is unsatisfactory because it involves too much guesswork.

Consider this example offered by David Conway (Conway 1991: 150):

Case 17

1. Harvey handles cobras barehanded and 80% of people who handle cobras barehanded die young.
2. Harvey drinks antifreeze for breakfast and 90% of people who drink antifreeze for breakfast die young.
3. Therefore, Harvey will die young.

Is this argument linked or independent? On the face of it, it looks virtually identical to the sharpshooter argument in Case 11, which we treated as independent. But appearances may be deceiving, as Conway points out. Suppose that, unknown to anyone, drinking antifreeze daily makes one partially immune to the effects of cobra venom. In that case, the premises logically interact with one another, and thus are linked. Conway's point is that standard accounts of the linked/independent distinction cannot be relied upon to give correct evaluations of premises that appear to be independent but aren't (Conway 1991: 150-151).

Conway directs his objection primarily against Yanal's summing test, but it can be applied to all of the tests we have examined. The falsity/no support test and the omission/no support test will give the wrong answer, mistakenly counting the argument as independent, whereas the omission/diminished support test, Yanal's summing test, and Walton's degree of support test can't be reliably applied, since, by hypothesis, is isn't known whether the premises are independent, although, by hypothesis, they are not.

Does Conway's objection also apply to my account? Not directly. For on my account, what determines whether an argument is linked or independent isn't whether the premises work as a logical unit but whether the arguer believes that they do. But of course this only shifts the locus of guesswork. In many cases, we have no real evidence what a particular arguer may have believed or intended, but must fall back on the hypothetical "typical" or "reasonable" arguer who figures so ubiquitously in informal logic. Thus, instead of guessing whether a set of premises like those in Case 17 interact in reality, we must guess whether a

typical or reasonable arguer would believe that they do. And often, Conway might object, we will guess wrong.

Does the fact that my account doesn't always yield clear, determinate answers show that the account is flawed? Hardly, for any plausible account of the linked/independent distinction will sometimes involve a significant amount of guesswork. Consider:

Case 18

1. Bob is stubborn.
2. Bob is a Taurus.
3. Therefore, Bob won't make a good mediator.

Are the premises in this argument linked or independent? That depends on how the argument is interpreted. Are (1) and (2) offered as separate, freestanding reasons for (3)? In that case, the premises are independent. Is (1) offered as a reason for believing (2), or (2) offered as a reason for (1)? In that case the premises are either independent or neither linked nor independent, depending on whether single premises are counted as independent or as neither linked nor independent. Or is the argument in fact an enthymeme, with, say, Most stubborn persons are not good mediators operating as an implied premise? In that case, two of the premises are linked and the other is not. The point is that there are inherent unclarities in argument structure that present difficulties for all standard approaches to argument diagramming.

Of course, some approaches to argument diagramming in general, and the linked/independent distinction in particular, may produce more uncertainty than others. In particular, the falsity/no support and omission/no support tests generally produce more clear-cut results than the other tests we examined, in part because it is easier to determine when a premise provides no relevant support for a conclusion than it is to determine whether it provides stronger or weaker support than it does in conjunction with another premise. But the first virtue of a satisfactory account of the linked/independent distinction is that it be adequate, not that it be straightforward to apply. And as we have seen, the falsity/no support and omission/no support tests are far from adequate.

Granted, the Dependency Relation Test defended in this article is probably too complex to be taught in an introductory logic or critical thinking textbook. For pedagogical purposes, therefore, it might be better to present introductory students with a simpler account, such as the omission/diminished support test,

which in my view is the least misleading of the standard textbook accounts. However, it should be clearly stated that a simplified account is being presented and that an adequate account is more complex**[v]**.

NOTES

[i] Other terms for "linked" include "conjoint," "dependent," "interdependent," and "additive".

[ii] Other terms for "independent" include "convergent" and "nonadditive."

[iii] I suspect that many of the confusions that bedevil the linked/independent distinction arise from confusions about what it means to "omit" a premise from an argument. Consider:

1. I promised Ann I would play tennis with her today.
2. Promises should always be kept, no matter what.
3. So, I should play tennis with Ann today, even though I have a splitting headache.

Suppose we omit the second premise in order to determine whether the premises are linked or independent. Intuitively, the first premise continues to provide some support for the conclusion. But no statement is probable with respect to another except in conjunction with a stock of relevant background information. So presumably the relevant antecedent is not:

(A-1) If any of the premises are omitted and absolutely nothing else is stated or assumed that would make the remaining premise(s) relevant to the conclusion

For if this is what it means to "omit" a premise, then all two-premise intuitively independent arguments would turn out to be linked.

But if this isn't the right way of formulating the relevant antecedent, what is? Perhaps this:

(A-2) If any of the premises are omitted and nothing similar is stated or assumed in its place that would make the remaining premise(s) relevant to the conclusion

I suspect something like (A-2) is what advocates of the various omission tests of the distinction have in mind. If so, there are obvious difficulties to overcome in spelling out what counts as a "similar" premise. Amazingly, this crucial issue appears not to have been discussed in the relevant literature.

[iv] Think of it this way: If sharpshooter A takes 100 shots at Herman, she will hit Herman 80 out of 100 times. This leaves 20 times when A's bullets will miss Herman. But, since sharpshooter B is 90% accurate, in 18 out of those 20 cases, B's bullets will hit Herman. Thus, in only two cases out of every 100 will both bullets miss Herman.

[v] My thanks to Robert J. Yanal and Bill Drumin for helpful comments on earlier versions of this paper.

REFERENCES

Bickenbach, J.E. & Davies, J.M. (1997). *Good Reasons for Better Arguments*. Peterborough, Ontario: Broadview Press, 1997.

Conway, D.A. (1991). On the distinction between convergent and linked arguments. *Informal Logic 13*, 145-158.

Copi, I.M. & Cohen, C. (1998). *Introduction to logic, 10th ed*. Upper Saddle River, NJ: Prentice-Hall.

Freeman, J.B. (1988) *Thinking Logically: Basic Concepts for Reasoning.* Upper Saddle River, NJ: Prentice-Hall.

Govier, T. (2001). *A Practical Study of Argument, 5th ed.* Belmont, CA: Wadsworth.

Hurley, P. (2000). *A Concise Introduction to Logic, 7th ed*. Belmont, CA: Wadsworth.

Johnson, R.M. (1999). *A Logic Book, 3d ed*. Belmont, CA: Wadsworth.

Kelley, D. (1988). *The Art of Reasoning*. New York: W.W. Norton & Co.

Layman, C.S. (1999). *The Power of Logic.* Mountain View, CA: Mayfield.

Moore, B.N. & Parker, R. (2001). *Critical Thinking, 6th ed.* Mountain View, CA: Mayfield.

Moore, K.D. (1993). *Reasoning and Writing.* New York: Macmillan.

Reichenbach, B.R. (2001). *Introduction to Critical Thinking.* New York: McGraw-Hill.

Rudinow, J. & Barry, V.E. (1999). *Invitation to Critical Thinking, 4th ed*. Ft. Worth, TX: Harcourt Brace.

Walton, D. (1996). *Argument Structure: A Pragmatic Theory*. Toronto: University of Toronto Press.

Yanal, R.J. (1988). *Basic Logic.* St. Paul, MN: West Publishing Co.

Yanal, R.J. (1991). Dependent and independent reasons. *Informal Logic 13*, 137-144.

ISSA Proceedings 2002 – The National Education Reform Debate And The Rhetoric Of The Contrarians

Abstract

In the years between 1991 and the present, Gerald Bracey and other so-called "contrarians" have called into question the dominant view of schooling in the United States. According to the contrarians, many widely held myths about public education are false, including the view that schooling and the economy are closely related and the notion that the schools are failing. The contrarians provide an exemplary case of public moral argument, one that draws attention to many salient issues in argument criticism: the role of experts in public discourse, the status of facts in public debates, the relative values of consensus and dissensus, and shifting communication practices within the public sphere.

The National Education Reform Debate and the Rhetoric of the Contrarians

So many people have said so often that the schools are bad that it is no longer a debatable proposition subject to empirical proof. It has become an assumption. But it is an assumption that turns out to be false. The evidence overwhelmingly shows that *American schools have never achieved more than they currently achieve*. And some indicators show them performing better than ever. (Bracey, 1991, p. 106)

That most people would read these last two sentences with intense skepticism grants Gerald Bracey's rhetoric a degree of critical interest. While substantial extant does suggest that Bracey may be right (Sandia National Laboratories, 1993), the claim that American schools are doing just fine merits attention because it contravenes what everyone believes to be certainly true. Since 1991, Bracey has made some version of the *schools-are-doing-fine* argument repeatedly, both in his annual *Phi Delta Kappan* reports, and in his other articles and books. Along with the other so-called "contrarians," Bracey has attempted a remarkable rhetorical feat by calling into question the dominant view of schooling in the

United States.

Bracey and the contrarians provide an exemplary case of public moral argument, one that draws attention to many salient issues in argument criticism: the role of experts in public discourse, the status of facts in public policy, and shifting communication practices within the public sphere. Drawing upon the "spheres of argument" literature as well as Boothian ethical criticism, this paper explores these themes and develops the premise that meaningful expert contributions to public moral argument can be hindered by an inappropriate confounding of expert and human moral virtue. The "spheres of argument" approach is exemplified in the argumentation field by Thomas Goodnight's (1982) article, "The Personal, Technical, and Public Spheres of Argument: A Speculative Inquiry into the Art of Public Deliberation." Drawing on Habermas, Goodnight's article sets the tone for a variety of later scholarly criticism (Farrell & Goodnight, 1981; Doxtader, 1995; Fabj & Sobnosky, 1995; Fraser, 1989; Olson & Goodnight, 1994; Fisher, 1994; Schiappa, 1989; Sommerville, 1989; Toker, 2002). Wayne Booth's critical approach is ethical and descriptive in nature. Known as a reader response critic, Booth has been influential in rhetoric since the 1960's. His (1988) book, *The Company We Keep: An Ethics of Fiction*, provides an approach to ethical criticism that complements the spheres of argument approach by directing critical invention toward descriptive and experiential topics that serve to flesh out judgments grounded in more traditional analyses of public argument.

This paper first explores the emergence of the contrarians in recent history, identifying the main issues at stake in the controversy surrounding them. Next, it traces the most prominent subject of contrarian discourse – standardized testing and the evaluation of school performance – in order to describe how the contrarians hinder the potential quality of public moral argument by too narrowly focusing their rhetorical efforts within the technical sphere and failing to engage the broader moral issues surrounding the controversy. Based on this starting premise, the paper provides a more extended discussion of the annual Bracey Reports in order to explore the possibility of a more meaningful rhetorical practice. It finds trace signs of such a potential, but also identifies a systematic myopia in Bracey's rhetoric that hinders his ability to transcend the constrained virtues of his expertise.

1. The Emergence of the Contrarians

If any one event can be said to have facilitated the emergence of the contrarians,

it was the production of the Sandia National Laboratories report, “Perspectives on Education in America,” in 1991. The Sandia Report provoked a great deal of response and controversy by contradicting the commonplace wisdom that the schools were failing miserably. Such contradictory evidence was not welcome news to the Bush administration, which sponsored the research (Jensen, 1994; Tanner, 1993). Indeed, Bush’s America 2000 was a national-standards based reform campaign, which heavily relied on the assumption that the schools were generally failing.

The Sandia researchers reported that the schools were doing better than commonly believed, and that many prevalent reform ideas were incompatible with one another. They observed that national standards are incompatible with local empowerment programs, making national standards appear ridiculous in view of the highly decentralized school districting system. Furthermore, they shed doubt on the prevailing belief that there is a meaningful connection between a nation’s schools and the condition of its economy. For those with vested interests in harming public education, the Sandia Report was a significant setback. According to Carl Jensen (1994), “the Sandia Report is so threatening to the anti-public-school-lobby that those supporting school choice initiatives still refuse to acknowledge its existence” (p. 57). The Sandia Report might have remained unpublished forever if not for photocopiers. Predictably, it began to serve as an icon around which school defenders could rally.

One account of the contrarians’ story starts with Bracey hearing a lecture by David Berliner in 1991 at an American Psychological Association symposium. Bracey advised Berliner to acquire the Sandia Report and, according to David Ruenzel (1995), it “was an auspicious meeting, for these two men would eventually try to do for a nascent revisionist movement what conservative duo Ravitch and Finn had done for the schools-need-radical-repair movement: make so much noise that people would have to pay attention” (p. 30). Two years later, Berliner teamed up with Bruce Biddle to produce *A Manufactured Crisis: Myth, Fraud and the Attack on America’s Public Schools*. Five years later, the American Association of *School Administrators* publicly christened the contrarians by publishing a special issue of The School Administrator entitled, “The Contrarians: The Leading Defenders of America’s Public Schools” (May 1996). During every year since 1990, the contrarians have published articles and books attempting to combat the abuse of schools by opportunistic politicians and the media.

It is important to establish the issue-context within which the contrarians emerged. The most familiar question in education reform discussions of the past two decades has been whether education should be privatized. This question has resulted from a widespread feeling, since the 1983 publication of *A Nation at Risk*, that American schools are not performing adequately, especially in terms of preparing students for contributing to America's international competitiveness. Various choice programs have been advocated, including the giving of tuition vouchers to parents so that they may send their children to any school they choose. According the advocates of choice, if the schools are not up to the job, the incentives of competition naturally will generate higher quality outcomes (Chubb & Moe, 1990).

Giving parents the choice of where to send their children to school relates to another important educational question: What is the proper locus of control for education? Letting parents decide is one method. In another development, the federal and state governments have become more involved in education debates by setting standards, providing incentives, and engaging in general advocacy. A Nation at Risk was one attempt of the federal government to influence the shape of educational discourse and a host of other commissioned reports have appeared since its 1983 publication. George Bush's America 2000 campaign, Clinton's Goals 2000 program, and George W. Bush's plan to require annual testing of students and minimum proficiency standards are three of the more recent federal efforts. Such programs have significant influence in terms of funding, publicity, and status.

Related to this issue of governance are a variety of other locus-of-control issues. For example, electronic networking has lessened the importance of place to schooling. Distance learning can provide education to more people in geographically larger areas. Home schooling has a whole new meaning given the emergence of electronic networks. Educational debates, therefore, are no longer about a relatively straightforward constellation of terms: schools, students, classrooms, teachers, neighborhoods, curricula, and local property taxes. Rather, the decrease in the importance of place has led to an increasing emphasis on access, which frequently comes down to a question of resources. This question of resources is perhaps the most important educational issue, in spite of how it is handled in the public discourse. Curiously, since the 1966 Coleman Report, it has been a matter of controversy whether education has anything to do with money (Mosle, 1996, p. 31). It has been open to scholarly and public debate whether

money is positively related to educational outcomes, whether we spend enough or too much on the schools, and whether money is being wasted on various components of the educational system. The status of educators has been open to similar differences of opinion.

How substantial a role these issues play in public controversies over schooling depends significantly on political exigencies, and it is difficult to sort out the technical from the political questions surrounding education reform issues. Thus, like many other public concerns education reform is markedly complex. Yet, predictably, the expertise John Dewey (1988) argues is necessary to handle complexity is highly fragmented and politicized in this context. It is important to examine this relationship between the technical and public spheres within education reform rhetoric because the learning processes institutionalized by educational systems are established early in people's lives. As Benjamin Barber (1993) argues, "the 'public' in public schools means not just paid for by the public but procreative of the very idea of a public" (p. 44).

2. The Contrarians' Assault On Standardized Testing

Using multiple strategies concerning a variety of different uses of testing, the contrarians endeavor to establish what appears to be a "knock down" argument that standardized test scores are meaningless and are misused by both government figures and the media. This position's enactment in contrarian writing suffers from too narrow a focus on statistically grounded arguments. My point here is not to declare total rhetorical failure, however, but rather to develop support for the argument that the contrarians confound expert and human virtues. While a technical grounding is one defining characteristic of the contrarian ethos, other elements of a viable rhetoric can be excluded from public view if such practices persistently push such elements aside.

School performance evaluation is a moral issue in several respects. The act of evaluation, like the act of criticism, implies a moral responsibility to evaluate with reference to just and fair standards. Pronouncing judgment upon schools entails a privileged position, and there is a high degree of trustworthiness assumed. Experts are not expected to pronounce unreliable or un-provable truths about schools. Moreover, the school performance issue becomes a matter of ethics to the extent that accusations are made regarding the misuse or abuse of statistical data. Such charges are very serious considering the potential impact on professional careers. Most importantly, evaluation is highly consequential for

teachers, students, and other parties invested in public education. Iris Rotberg (1996) summarizes the situation well:

In recent years, our expectations about what we can learn from testing students have become increasingly unrealistic… Scores on standardized tests are blamed for perceived failures in our economy and in international competition. They drive the debate on school reform. (p. 30)

Performance assessment thus entails moral as well as technical issues. The extent to which these and related concerns are forgotten in the deluge of data and the intricacies of statistical reasoning is the extent to which statistical argument can lead experts to appear disconnected and unpersuasive. The contrarians betray a palpable vulnerability to this problem, often failing to attend carefully enough to developing the underlying issues since their main business is the variegated workings of statistical reasoning. This difference in viewpoint affects contrarian public argument firstly as a pronounced unfamiliarity (Fisher, 1994). In other words, the company offered to laypersons by the contrarians tends to be the company of strangers**[i]**.

Bracey, for example, is especially prone to focus on statistical reasoning topics. For example, he repeatedly reminds his audience that statistical significance is not the same as actual significance (1993; 1994b; 1995b). Since tests of statistical significance were designed for small sample sizes, and many studies of educational achievement use very large sample sizes, even the smallest of differences will be statistically significant. He is also concerned with the misuse of central tendency measures. In the fourth Bracey Report, he asks, "Where can one place a standard that is credible as a 'high' standard without failing a large proportion of students?" (1994b, "New Data" section, para. 8). Harold Howe provides the provocative analogy that requiring all fourth graders to read at the "standardized" fourth grade level is like "requiring all the football teams in the country to win more than half their games" (1993, p. 19).

Another complaint of the contrarians is the confounding of disaggregated data with aggregated data (Jaeger & Hattie, 1996; Jaeger, 1994). As both Bracey and Richard Jaeger have observed, for example, the supposed decline in average SAT scores from the 1970s to the 1990s is an instance of Simpson's Paradox (Bracey, 1994a, p. 11; Jaeger, 1994, p. 28). While the overall average SAT score declined slightly, the means for each ethnic subgroup increased. The overall average can decline in spite of increases in every subgroup, because of changes in relative proportions of representation among different subgroups. As more people take

the SAT, it is remarkable that overall scores remain steady at all. The test was originally given to a group of wealthy, white, college-bound, mostly male students, and has served an increasingly large and diverse group of students since (Bracey, 1991; Berliner & Biddle, 1995, pp. 22-23).

According to the contrarians, standardized test scores get complicated in other ways as well. Careless population comparisons often allow convenient but erroneous conclusions to be drawn from data. For example, the money-doesn't-matter argument has been grounded in the claim that states with the lowest per pupil expenditures have the highest SAT scores. Such arguments mistakenly use per-pupil expenditures as the independent variable while using SAT scores as the dependent variable, but overlook significant differences in SAT-taking population sizes from various states. In attacking one such argument, Bracey (1994b) points out that, "What neither Will nor Bennett bothered to point out, of course, is that in the high-scoring states virtually no one takes the SAT" ("New Data" section, para. 25).

The examples discussed so far illustrate the technical proclivity of the contrarian vocabulary. What remains to be developed is an account of how this technical emphasis might be construed as inappropriate to the contrarians' role in public argument. My claim is that the contrarians play into a vulnerable position by perpetuating an impoverished discourse about schooling. If constricted measurements and an unsophisticated conceptual apparatus gut the meaning of "school", there will be little motive for defending it (Rose, 1995). Jaeger (1994) offers the following sweeping indictment of statistical misuse, which serves to illustrate how easily the meaning of school can become impoverished:

To credit or blame the schools alone for the achievement of the young is to promote the absurdity that schools are solely responsible for the education of youth… Schools do not determine the community and family characteristics that define their constituencies, the expectations that arise in those communities, the resources provided by the communities they serve, nor the capabilities, motivations, handicaps, language facilities, or support systems brought by the students they are to educate. Only if these factors were uniformly distributed throughout the industrialized world, would it be reasonable to attribute differences in educational outcomes to the success or failure of U.S. public schools. (p. 31)

While the underlying issues remain statistical, Jaeger plainly appeals to fairness and practical reason. Unfortunately, such exceptions are unusual, and one should

not read Jaeger too generously here. His claim remains a straightforward appeal to fairness, and his framing of the argument constrains the moral import of education in profound ways. If one holds the position that education creates and sustains a culture (Dewey, 1932), then the assertion that schools are helpless in determining the factors that influence them from the outside rings false. Only in a sharply circumscribed statistical world where characteristics, expectations, and factors are defined numerically would it make sense to draw boundaries the way Jaeger does in the above quotation. This sort of practice can create a rhetorical vulnerability to the extent that the "school bashers" decide the numbers are irrelevant after all (Bracey, 1996, "The Media" section, para. 3).

Even where the contrarians appear to move outside the numbers, a closer look often reveals a markedly uni-dimensional worldview. Booth's other scales can provide more detail concerning this judgment. In terms of the quantity/concision and breadth-of-range/concentration scales, the contrarians indeed offer "a lot of whatever they are good at" (Booth, 1988, p. 180). They excel in research methods and statistical problem solving, offering a high *quantity* of a very narrow *range* of invitations to their audience. While they generally do not look down upon their audience – the reciprocity scale – their remains an implied hierarchy and they often suffer from being undramatic, offering cool reserve, slack charm and tight coherence where some degree of intimacy, intensity, and disunity might enhance their appeal. Moreover, the shortcoming here goes beyond a problem of translation (Fisher, 1994). No matter how familiar the contrarians' discourse might be rendered, the meaning it assigns to education is narrow and incomplete, and it is difficult to excuse them this flaw on the basis of their expertise. Howe (1993) is useful in illustrating this point:

In our enthusiasm for testing as the sole measurement of schooling, we have managed to create a new academic industry based on arguing about the meaning of test scores. It is a highly technical enterprise. Many ordinary educators are repelled by its complexity. There are responsible and able people engaged in it, and others whose contributions are driven by ideology rather than objective analysis. The result is that the messages received by the public are frequently without merit. One of the real needs to keep in mind in our future thinking about schools is the need for intermediaries who understand psychometricians and can translate their ideas for the rest of us. (pp. 18-19)

If the objective is to insure that the messages received by the public have merit, it

is uncertain whether more intermediaries or more "objective analysis" will accomplish the transformation. As Howe (1993) notes, ordinary educators are "repelled" by the complexity of the issues surrounding test scores and their interpretation. However, contrary to Howe's view, I would argue that translation is only superficially the problem. Though misunderstanding can indeed go far in explaining why public argument can break down, the quality of public argument does not turn exclusively upon knowledge of the objective truth, but instead is enacted in the character of its participants and the structure and quality of the company shared.

In this case, knowledge of statistical fact is granted such a superior deliberative status by the contrarians that other components of their characters are rendered invisible. In this sense, the *company* offered by the contrarians may be alienating to other stakeholders in the U.S. system of public education as statistical imperatives edge-out the moral and practical concerns intrinsic to schooling (Habermas, 1987, p. 325). Most people do not understand schooling from a technical standpoint. Instead, we have extensive personal experiences to draw upon from our own educational backgrounds. We are aware of the close connection between our schooling and our life's meaning and prospects. It requires a leap of the imagination to think of education in strictly technical terms, so the contrarians invite a suicide of the imagination by misapplying their expertise.

The contrarians do make some non-fact-based arguments. One such claim is that ideology drives the misuse of statistical reasoning. Nevertheless, in stating the obvious, this position is arguably a truism. Thus, the contrarians' total offering is reduced mainly to a set of detailed statistical arguments interspersed with straightforward complaints about the government and the media. Unless one is careful to relish the brief respites from churning the numbers, the company available from the contrarians is markedly circumscribed. On the one hand, they offer an intricate web of technical meaning far removed from the moral import of education. On the other hand, they provide the most simple minded of moral complaints: The media pays too little attention to the good news. The government lies. The misuse of data is unfair.

The rhetorical failing described here is not intended to be read as total. If one is to take education reform arguments seriously from a virtue-based moral standpoint, it makes little sense to hold them accountable to a strict standard of

success or failure. The moral quality of rhetoric is separate from narrow evaluations of its effectiveness. In addition, since the United States has a long history of blaming schools for its problems, very few reform arguments enjoy undisputed success anyway (Cuban, 1990; Bracey, 1995a; Tyack & Cuban, 1995; Hodgkinson, 1996). The public discourse about education may be over-saturated with arguments no one expects to succeed, which lends credence to Barber's (1993) observation that the education crisis stems from Americans not taking education seriously. On the contrary, I would argue that Americans take it entirely seriously, but that this gravity is wasted by many public advocates – like the contrarians – who award expert virtue supreme status in what more properly should be understood as an untidy value-ridden human controversy. My central concern therefore is not the success of contrarian arguments per se, but rather the possibility of a more meaningful rhetorical practice aimed at modifying the widespread paucity of expectations for public argument in this context.

3. Keeping Company With The Bracey Reports

From October, 1991 to the present, Bracey has published an "Annual Report On the Condition of Public Education" in *Phi Delta Kappan*. A separate discussion of the Bracey Reports develops an exemplar of contrarian rhetoric and a means of evaluating it over time. The discussion further develops the idea that translation is only part of the problem with experts in public moral argument, that the problem with experts may be less about expertise and more about a misplaced conception of virtue on the part of experts.

In what became the first Bracey Report, "Why Can't They Be Like We Were?" Bracey opens with "Schools stink. Says who? Virtually everyone" (1991, p. 105). Observing that A Nation at Risk spawned a "floodtide" of reports criticizing the U.S. system of public education, Bracey argues that educational failure has become a non-debatable proposition. Following the introduction, Bracey goes on to delineate personal objections to A Nation at Risk. The report's findings "didn't ring true to my experiences as an educator, as a parent, or, for that matter, as a student" (p. 106). He observes the curious nostalgia represented in the public complaints about education, arguing that there was in fact no "Golden Age" of education to which we should want to return (p. 106). Additionally, the main standardized test data do not indicate educational decline, nor should these tests be treated as significant measurements of educational factors at all, since the scores are most directly related to demographic variables like "family size,

income level, and so on" (p. 107).

Moving beyond testing issues, Bracey remarks that college attendance is up (p. 110), college admission rates are higher (p. 111), and Americans may be said to have become over-educated for the economy (p. 111). "Overeducation," he writes, "poses queasy social problems because well-educated people tend to shy away from occupations that require them to sweep the streets, unclog sewers, scrub toilets, pick up trash, bus tables, or mop floors" (p. 111). As for educational expenditures, Bracey demonstrates that the high cost of special education is hidden by the aggregate spending numbers used to support the view that the U.S. spends too much on education. Based on this point and others, Bracey concludes "there is little evidence of largesse from any governing body or of increased burden on the taxpayer for general education" (p. 112).

He next argues that comparisons of educational *systems* do not exist and would be overly complicated and meaningless if they were available (pp. 112-113). While test score comparisons among nations are obtainable, he claims that "the comparisons are so flawed as to be meaningless" because the components of various national systems – including students, curricula, test questions, and drop-out rates – are not comparable (p. 113). Comparisons unrelated to international standardized testing show the U.S. leading the world, according to Bracey. The final main section of the first Bracey Report concerns the relationship between education and the workforce. Bracey is careful to point out that "much of the discussion surrounding the future skill levels of the workforce confuses *rates with numbers*" (p. 115). The fastest growing jobs, measured as a *rate*, do require high skills, but only account for a small proportion of the total *number* of jobs available.

Bracey comments that the data he uses are publicly available to anyone, but that people must have heard the bad news about education for so long that they have grown to assume its truth (p. 115). He closes optimistically: "There are plenty of problems in education that we ought to be working on . . . Let's work to make things better. But let's not do it while telling people in the schools what a crummy job they're doing" (p. 117). This optimism appears elsewhere in the reports, but is never accompanied by reflection concerning the relevance of technical reason.

All of these themes are developed in excruciating detail in "Why Can't They Be Like We Were," which is a blueprint for the remaining ten (and counting) Bracey

Reports. Bracey's writing is clearly dominated by statistical issues, though there are some exceptions. His point about the non-debatability of school failure, for example, seems to be a moral complaint about the character of public discourse. His personal account of how the public arguments did not "ring true" with experience is different from statistics-as-usual, as is the view that educational failure is mainly assumed out of nostalgia for a time that never existed. Bracey periodically surprises us with brief sparks of intense feeling that are only accessible after swimming through the mountains of data. We connect with him – because we have already suffered the details – as he provides satisfying bits of transitional understatement like, "Given these complaints, it is interesting to see where business puts its money for training" (1991, p. 115). In this respect, Bracey does find some space to provide a different, even pleasurable, kind of friendship from that typical of the contrarians. The following passage is exemplary:

Are the schools responsible for the management decisions that kept Detroit turning out self-destructing, two-ton gas guzzlers until it lost its dominance of the market? Did the schools' sloppy pedagogy prevent industry from automating until it was too late? Does the schools' failure to teach students to delay gratification explain why far too many businesspeople keep their eyes focused on the quarterly profit sheet and not on the strategic plan?… To reread A Nation at Risk eight years after its publication is to see it as a xenophobic screed that has little to do with education. (1991, p. 116)

The passage provides refreshing company in several respects. Firstly, one's engagement with it is more intense. One absorbs the rhythm of the questions while digesting the volumes of data reported on the previous pages. The engagement is heightened by a feeling of disunity as the prose breaks free for a few lines from the tightly structured, step-by-step workings of statistical argument. Instead of the spelled-out, wordy, and tiresome explanations of statistical reasoning flaws, we are offered concentrated meaning in the form of hard driving questions.

In reading the remaining ten Bracey Reports, one can discern several instances similar to this one, where Bracey shows signs of possibly enriching his rhetorical ethos, but such exceptions are never sustained consistently, or are subverted by his commitment to the facts. For example, in discussing the second Bracey Report's handling of social problems in the cities, he writes, "the ensuing year provided additional evidence – as if any were needed – that our cities are in dire straits"(1993, "Events" section, para. 9). If no additional data are needed in

Bracey's opinion, why does he maintain his practice of packing in as much data as possible? In another case, he speculates, "One can also wonder what kind of a Dickensian novel might move American policy makers and politicians to take appropriate action. *Savage Inequalities* is quoted everywhere – but, apparently, to no effect" (1993, "The Cites, Again" section, para. 14). Faced with evidence that the "facts" do not move the world, Bracey's faith in the facts falters not.

I am arguing that this is more a moral failing than a natural entailment of Bracey's expert status. The lapse is most manifest in his treatment of the goals of education. He is fond of quoting Israel Scheffler's definition of education, "the formation of habits of judgment and the development of character, the elevation of standards, the facilitation of understanding, the development of taste and discrimination, the stimulation of curiosity and wondering, the fostering of style and a sense of beauty, the growth of a thirst for new ideas and visions of the yet unknown" (1993, "Events" section, para. 5). He has the following to say about the definition:

The extent to which we accept Scheffler's definition is the extent to which we must realize that, for all the test scores and graduation statistics presented here and elsewhere, we really do not have the appropriate indices of how the system functions or doesn't. The tests we do have – virtually all of them decontextualized collections of multiple-choice questions – do not measure the traits, qualities, values, and habits that we cherish most. It is to be hoped that the new interest in various kinds of performance assessment will carry us toward measurement of these valued outcomes. (1993, "Events" section, para. 6)

It is curious that Bracey places such faith in new and improved assessment since he and the other contrarians extensively critique test scores as school performance measures. More troubling still, Bracey rarely moves beyond the easy step of quoting Sheffler's definition. While he certainly could explore it more detail, he does not. He could report on more fronts of different kinds, but tragically clings to the hope that, if only he is thorough enough in his objective attack, the edifice of school bashing will come crashing down.

Bracey continues to assume his arguments are "knock-down" arguments, but fails to come to grips with why opposition continues to persist. After cataloguing the progress made in all the previous reports, Bracey (1994b) writes, "Conditions now allow us to lay to rest, once and for all, the misbegotten notion that schools are dragging our economy down – or, for that matter, pushing it up" ("Education and

the Economy" section, para. 1). Given the data alone, many contrarian arguments are "knock-down" arguments. Bracey is regularly in a position, technically, to "lay to rest" many commonplace notions "once and for all." Statements of this kind persist in spite of themselves. If we are in fact in a position to move on to the real problems of schools and to start building a healthier public discourse about education, one wonders when Bracey will start contributing to that vision. Further, ought we to continue thinking of his neglect as a case of technical argument's translatability in the public sphere rather than as a simple failure in human virtue?

An occasionally enriched company is inadequate to warrant a positive overall evaluation of Bracey's contributions to public moral argument. Certainly, one can at least recommend more of what is only hinted at in the Bracey Reports. Regardless of how important the facts are, Bracey role as an expert in the public controversy over school reform requires more of him than his training provides, but this is no essential fault of his training per se. Part of what Bracey's public role does require, in fact, is a closer connection to the depths and nuances of the issues contained within the controversy over schooling, because they are *not* resolvable with straight reference to the numbers.

To that extent, Bracey's deliberative vision is quite ordinary. As Booth (1988) admonishes, "whenever our descriptions reveal intentions, however obscurely, they will be caught up into the world of values that we all in fact are created by and dwell in" (p. 97). Bracey's rhetoric draws extensively upon facts, but he decisively narrows the effective moral import of those facts by neglecting the values necessary to ground judgments that a particular fact is extraordinary. The topics most moral in quality for Bracey are such issues as the misuse of data, the imperative toward consistency, and a version of fairness which asks the media to report the good with the bad. Unfortunately, all these are merely straightforward moral complaints. A morally rich public deliberation about school reform is not advanced. In Habermas' (1987) terms, Bracey lets system imperatives intrude upon the lifeworld but, tragically, these imperatives are not even particularly complex in character.

Bracey's principal failing is that, as an expert, he serves as a medium of colonization while purporting to fight it. Because he elevates facts to a status superior to values – in a particularly value-laden and highly divisive context – he fails to advance the quality of public deliberation about education. He fails to do so even in the face of success in the technical sphere. One would ideally expect

his communicative practice to develop more sophistication and breadth as the statistical battles turned his way, but something constrains his ability to do so. This is not to say that a desire to see such a change is not induced in reading Bracey. In spite of the constraints identified in this paper, it is difficult to read the contrarians' story without viewing them as heroes. Unfortunately, it seems they are heroes in a tragic narrative, their tragic flaw simply being their inability fully to play the role of heroes in public moral argument.

4. Conclusion

The contrarians defend the significance of what they do by asserting that, in order for us to attend to the real problems of schooling, it is first necessary to protect the schools from capricious abuse by politicians and the media. They maintain that their effort is well spent even if it does not directly aid the schools. In this paper, I have endeavored to identify the limitations of this stance from a moral perspective concerned with the meaningfulness of public deliberation. If public moral argument proceeds as if the term, "moral," does not belong, as if education reform were a straightforward technical problem, than it naturally trivializes the deeper value concerns implicated in any discussion of education.

My central argument was that a confounding of expert and human virtues hinders the meaningfulness of the contrarians' rhetoric. What counts as evidence for the contrarians is usually grounded in statistics or empirical fact, which may be a natural constraint of their field specific training. However, this view's inefficacy is constituted in the complexity of education reform as a moral issue. In a public controversy rife with value commitments, the character of those participating in deliberation should not be systematically constrained by habits of thought generated in their field specific training and loyalties to technical standards. While there may be a context for such a narrowing of rhetorical virtue, the public sphere is no such place.

NOTES

[i] This is a reference to Booth's otherness/familiarity scale. Booth's scales – or spectrums of quality – are: quantity/concision, reciprocity/hierarchy, intimacy/cool reserve, intensity/slack charm, tight coherence/explosive disunity, otherness/familiarity, breadth of range/concentration.

REFERENCES

Barber, B. (1998, November). America skips school: Why we talk so much about education and do so little. *Harper's Magazine*, 39-46.

Berliner, D. C., & Biddle, B. J. (1995). *The manufactured crisis: Myth, fraud, and the attack on America's public schools.* Menlo Park, CA: Addison-Wesley Publ. Company.
Booth, W. (1988). *The company we keep: An ethics of fiction*. Berkeley: UC Press.
Bracey, G. W. (1991, October). Why can't they be like we were? *Phi Delta Kappan*, 104-117.
Bracey, G. W. (1992, October). The second Bracey report on the condition of public education. *Phi Delta Kappan 74* (2), 104-117. Retrieved March 30, 1996 from the FirstSearch: FastDoc database.
Bracey, G. W. (1993, October). The third Bracey report on the condition of public education. *Phi Delta Kappan 75*(2), 104-117. Retrieved March 28, 1996 from the Journal Express database.
Bracey, G. W. (1994a). *Transforming America's schools: An Rx for getting past blame.* American Association of School Administrators.
Bracey, G. W. (1994b, October). The fourth Bracey report on the condition of public education. *Phi Delta Kappan 74*, 114-128. Retrieved March 30, 1996 from FirstSearch, FastDoc database.
Bracey, G. W. (1995a). *Final exam: A study of the perpetual scrutiny of American education*. Bloomington: TECHNOS Press: Agency for Instructional Technology.
Bracey, G. W. (1995b, October). The fifth Bracey report on the condition of public education. *Phi Delta Kappan 77*(2), 149-160. Retrieved March 28, 1996 from the US/Pacific Information Access Company: Journal Express database.
Bracey, G. W. (1996, October). The sixth Bracey report on the condition of public education. *Phi Delta Kappan 78* (2), 127-138. Retrieved December 4, 1996 from the US/Pacific Information Access Company: Journal Express database.
Bracey, G. W. (1997, October). The seventh Bracey report on the condition of public education. *Phi Delta Kappan 79*(2), 120-136. Retrieved December 7, 1997 from the US/Pacific Information Access Company: Journal Express database.
Chubb, J., & Moe, T. (1990). *Politics, markets, and America's schools*. Washington, D.C.: Brookings Institute.
Cuban, L. (1990, January). Reforming again, again, and again. *Educational Researcher,* 3-13.
Dewey, J. (1932). *Democracy and education*. New York: MacMillan (Orig. published in 1916).
Dewey, J. (1988). *The public and its problems*. Chicago: Swallow Press (Orig. published in 1927).
Doxtader, E. (1995). Learning public deliberation through the critique of

institutional argument. *Argumentation and Advocacy 31* (Spring), 185-203.
Fabj, V. & Sobnosky, M.J. (1995). AIDS activism and the rejuvenation of the public sphere. *Argumentation and Advocacy 31* (Spring), 163-184.
Farrell, T. B. & Goodnight, G.T. (1981, December). Accidental rhetoric: The root metaphors of three mile island. *Communication Monographs 48*, 271-300.
Fisher, W. R. (1994). Narration as a human communication paradigm: The case of public moral argument. In T. Enos & S. Brown (Eds.), *Professing the New Rhetorics: A Sourcebook* (374-396), Prentice Hall: Blair Press.
Fraser, N. (1989). *Unruly practices: Power, discourse, and gender in contemporary social theory.* Minneapolis: Univ. of Minnesota Press.
Goodnight, G. T. (1982). The personal, technical, and public spheres of argument: A speculative inquiry into the art of public deliberation. *Journal of the American Forensic Association 18* (Spring), 214-227.
Habermas, J. (1987). *The theory of communicative action- volume two: Lifeworld and system: A critique of functionalist reason*. (T. McCarthy Trans.). Boston: Beacon Press (Original Work Published 1981)
Hodgkinson, H. (1996, May). Why have Americans never admired their own schools? *The School Administrator 5*(53), 18-22.
Howe, H. (1993a). Thinking about our kids. New York: Macmillan.
Howe, H. (1993b, May). The continuing question: Will public schools make it in America? *The School Administrator 5*(53), 14-17.
Jaeger, R. M. (1994). Evaluating policy inferences drawn from international comparisons of students' achievement test performances. *Studies in Educational Evaluation 20*. 23-39.
Jaeger, R. M. & Hattie, J. A. (1996, May). Artifact and artifice in education policy analysis: It's not all in the data. *The School Administrator 5*(53), 24-29.
Jensen, C. and Project Censored. (1994). *Censored: The news that didn't make the news and why*. New York: Four Walls Eight Windows.
Mosle, S. (1996, June). What we talk about when we talk about education. *The New Republic 17*, 27-36.
National Commission on Excellence in Education. (1983). *A nation at risk.* Washington, DC: Dept. of Education.
Olson, K. M. & Goodnight, G. T. (1994). Entanglements of consumption, cruelty, privacy, and fashion: The social controversy over fur. *Quarterly Journal of Speech 80*(3), 249-276.
Rose, M. (1995). *Possible lives: The promise of public education in America.* New York: Houghton Mifflin Co.

Rotberg, I. C. (1996, May). Five myths about test score comparisons. *The School Administrator 5*(53), 30-35.
Ruenzel, D. (1995, November/December). Is the education crisis a fraud? *Teacher Magazine*, 28-33.
Sandia National Laboratories. (1993, May/June). Perspectives on education in America. (reprint) *Journal of Education Research 86*(5), 259-310.
Schiappa, E. (1989). 'Spheres of argument' as topoi for the critical study of power/knowledge. In B. E. Gronbeck (Ed.), Spheres of Argument: Proceedings of the Sixth SCA/AFA Conference on Argumentation, 20-25. Annandale, VA: SCA. The School Administrator 5 (53) (May 1996).
Sommerville, J. A. (1989). Experts in moral argument. In B. E. Gronbeck (Ed.), *Spheres of Argument: Proceedings of the Sixth SCA/AFA Conference on Argumentation,* 81-85. Annandale, VA: SCA.
Tanner, D. (1993). A nation 'truly' at risk. *Phi Delta Kappan 75*(4), 288-297.
Toker, C. W. (2002). Debating "what ought to be": the comic frame and public moral argument. *Western Journal of Communication*, 66 (1), 53-84. Retrieved June 12, 2002 from Expanded Academic ASAP database.
Tyack, D., & Cuban, L. (1995). *Tinkering toward utopia: A century of public school reform*. Cambridge: Harvard Univ. Press.

ISSA Proceedings 2002 – Linguistic Criteria For Demarcation And Hierarchical Organization Of Episodes In A Problem Solving Task

Introduction

Argumentation implies reasoning, and an important aspect of this process involves processes of reorganization of the adressee's representation. The same processes of reorganization happen in the course of problem solving, a traditional topic of research in cognitive psychology. Traditionally, in the study of problem solving processes, with or without interaction between partners, the reorganization of the subject's representation was drawn from impasses, viz from the situation where the AI system simulating the problem failed. The system was considered to set the right representation when the resolution was optimal, and to shift into the wrong representation when the strategy moved aside from the optimal one. More recent researches in this area try to focus on the study of the reorganisation of the representation and to elaborate criteria for a more refined approach of its definition, in terms of pauses, backtracks, illegal moves, constraints (Richard, 1982, 1993), or in terms of adjustments to the external world through preliminary simulations of the planning, for example SOAR (Rosenbloom & al., 1991), case based planning (Hammond, 1989). Let us notice some more deepened studies focus on particular steps of the strategy (Allport, 1989; Welsh, 1991; Begoin-Augereau, 2002).

Some other studies focused on the analysis of concurrent verbal reports following Newell & Simon (1972) and Ericsson and Simon's model (Ericsson & Simon, 1979, 1984), which had the peculiarity to link the linguistic form to the content of the memory of attentional processes (Short Term Memory). In spite of Nisbett & Wilson's criticisms (Nisbett & Wilson, 1977) and without falling into the trap of introspection, they demonstrated that thinking aloud verbalizations during a problem solving task have to be considered as a coding of the information available in short term memory. In this line Vanlehn (1991) showed that the reorganization of the representation is not linked only to impasses, and that several linguistic marks, notably interjections, point to reorganizations of the subject's representation, according to the insights of the Gestalt approach (Ohlsson, 1984a, 1984b ; Simon, 1987).

Some approaches in the line of Situated Action (Clancey, 1991) suggest that language plays a mediating role in the actualisation of internal representations through the situation and that internal, external and actual representations cannot be reduced to a representational flatland. The subject is interacting not

only with others but also with external and physical objects. The external representation does not fit to the external world, but has to be internally constructed before being deposited into environment.
These two last approaches suggest that the study of the reorganization of the representation is linked to the elaboration of linguistic criteria enabling to cut the verbal protocol into episodes and to yield a structuration of these.

Current research (Caron-Pargue &Caron, 1989; Caron-Pargue & Fièvre, 1996; Bégoin-Augereau & Caron-Pargue, 2001) improved Ericsson & Simon's minimal model and considered not merely the content of verbalizations but their linguistic forms as marks of the cognitive operations by which utterances and representations are constructed and processed in working memory. In this view the hierarchical organization of episodes can be interpreted as the hierarchical organization of chunks in working memory. But whereas behavioral criteria give only a partial vision of the solving process, a more refined approach of the reorganizations in the subject's representation based on Culioli's enunciative model (Culioli, 1990, 1995, 1999) may be achieved through a study of the linguistic markers in the subject's verbalizations. It leads to characterize elementary actions as well as aggregates and emergent objects at the different levels, internal or external, of the process of construction of the actual representation (Bégoin-Augereau & Caron-Pargue, 2001, 2002).

Our purpose in this paper is to formulate some linguistic criteria for cutting protocols into episodes, to interpret them cognitively, and to show the existence of a hierarchical organization of these criteria, in the case of a well known problem solving task, the problem of the tower of Hanoi solved by 7, 10 and 14 years olds during four successive trials. On the basis of linguistic markers, cuts into episodes will lead to a demarcation of the units of cognitive processing ; the links and boundaries between utterances will define the elementary actions made by the subject . Furthermore the acquisition of expertise through age and successive trials gives rise to the construction of automatizations and simplification of representations and to a transfer of processing from internal to external problem space both defined from linguistic criteria (Bégoin-Augereau & Caron-Pargue, loc. cit.).

Our hypothesis relies on the assumption that differences through age and expertise in the repartition of criteria for cutting into episodes evolve according to the acquisition of automatizations and to the simplification of initial

representations. Therefore a hierarchical structuration of these criteria can be established and matched to the underlying organization and structuration of chunks in working memory.

The tower of Hanoi

Every subject has in front of him a wooden board to which are fixed three vertical pegs aligned from right to left (A, B and C; cf. fig 1). Four discs of decreasing size and different colours are stacked on the peg A: pink for disc 1, the smallest one; green for disc 2; yellow for disc 3; black for disc 4, the biggest one. The goal is to carry all the discs from peg A to peg C, under the following two constraints: only one disc must be moved at a time, and a disc may not be placed on top of another smaller than itself. The subjects have to keep on with their research until the problem is completely solved. They are asked to think aloud, that is to say, they have to tell aloud whatever they think during the solving process.

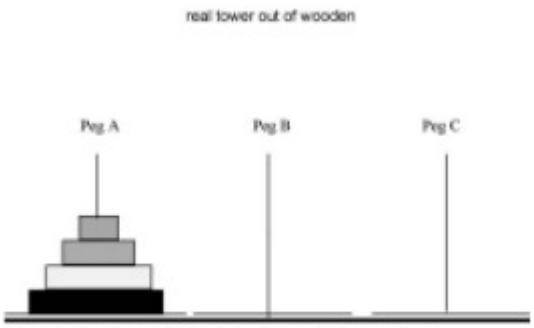

Figure 1 Configuration of 4-disks Tower of Hanoi: initial situation.

Subjects: Three groups of 20 novice participants each (French speaking subjects) respectively 7, 10 and 14 year-olds. Every subject resolved the problem of the tower of Hanoi during four consecutive trials. So we obtained a total of 240 verbal protocols. The examples presented below are translated in English with the original verbalization put into parentheses. As much as possible the translation was done in order to preserve the different linguistic cues from which cuts into episodes were done.

Three complete verbal protocols will be presented here after with the current state of the problem coded as follows. For example (3)(4)(12) means: that disk 3, the yellow one, stands on peg A; that disk 4 stands on peg B; and that the two last disks, disk one and disk two, the pink one and the green one, stand on peg C.

Linguistic criteria

The linguistic criteria used for the analysis are the following: starting terms,

constituent locators, connectives, interjections, changes of naming and double naming. This set of markers, common to the verbal protocols of the subjects, has already been considered and defined through Caron-Pargue & Caron's psycholinguistic model of language production and comprehension, relying on the formal linguistic approach of Culioli (Caron-Pargue, Caron, 1989):
– Starting term : the starting term is the term around which the predicative relation is organized, that is to say the term about which something is predicated. It corresponds to the choice of one of the two arguments of the predicative relation ; it is by reference to this choice that the structuration of predicate starts (Culioli, 1982). In our protocols of the tower of Hanoi, the criterion which allows to recognize starting terms is the presence of an anaphora, such as *it* or *that* (in French, *le* or *que*). In the following examples *the pink disk* is a starting term because of the presence of anaphora *it* in [1] and [3], and of *that* in [2]; *the green disk* is a starting term because of it in [3]

[1] I take *the pink disk* and I put *it* on the yellow disk (je prends *le disque rose* et je *le* mets sur le disque jaune)
[2] *the pink disk that* I put on the yellow disk (*le disque rose que* je mets sur le disque jaune)
[3] *the pink disk* I put *it* on B so that the green disk I put *it* on the C (*le disque rose* je *le* mets sur le B pour que *le disque vert* je *le* mette sur le C)

– *Constituent locator*: The constituent locator corresponds to the construction of the locator around which the utterance is organized. It is the topic, the given information. It introduces the current topic to which the new information will have to be referred. Different cases could be observed: it can introduce a double topic referring to the implicit situation without an explicit content word, as showed in examples from [4] to [7], or with a content word which has not the property of being a starting term as *the green one* in [8] or which has this property as *the yellow one* in [9] with the anaphora *it;* it can be also a triple topic composed of two content words as *the yellow disk the B it* in [9]

[4] *that it is* the yellow disk at C (*ça c'*est le disque jaune au c)
[5] *that the one at C* (*ça le un* au b)
[6] *there it* is impossible (*là c'est* impossible)
[7] *the yellow one* no *the yellow one* still there (*le jaune* non *le jaune* toujours là)
[8] *the green one it* is the green one on the A (*le vert c'est* le vert sur le A).
[9] *the yellow one* I put it at C (*le jaune je* le mets au C)

– *Connectives*: Connectives have to establish links between utterances. But even from a rather general approach two sorts of qualitative links attributed to two different sorts of connectives have to be distinguished. First the connectives such as *and, then, next, after, therefore, afterwards, and afterwards (et, alors, ensuite, après, donc, puis, et puis)* demarcate and punctuate the successive units of processing. Second the connectives such as for example *because, so that, since, but (parce que, pour que, puisque, mais)* mark the integration of two successive utterances in a single unit. For example *so that after* establishes an integrating link between the two utterances in [10] while *after* points to the beginning of a new unit in [11]

[10] the yellow disk I put it on the B *so that after* the black one I leave it where it is(le disque jaune je le mets sur le B *pour qu'après* le noir je le laisse ou il est)
[11] *after* I take the pink one that I put on the B (*après* je prends le rose que je mets sur le B)

– *Interjections*: Interjections have to be considered as traces of storing or recovering knowledge in memory (Caron-Pargue & Caron, 1995, 2000). They occur always in case of an insight, viz a reorganization, which bears either on the content of knowledge itself or on the contextual constraints which characterize the access to this knowledge. The subject focuses and recognizes some contextual features or compares a current state with an expected situation or a purpose. In fact most of the time interjections won't mark a cut of episodes because they mark the surprise of the participant while an integration of new and old informations occurs and when the reorganisation of representation will work just later. Nevertheless some linguistic marks such as well, *why, wait (bon, ben, attends)* and some contextual cases of *yes (oui)* point either to an aperture or a closure of the text (Caron-Pargue & Auriac, 1997, Caron-Pargue & Caron, 2000). In this special case interjections demarcate episodes in a similar way as connectives themselves, but as the same time with a control of the selected information in short term memory, that is to say that the units other than the unit introduced by the interjection would be temporary inhibited and refocused later. Such a treatment allows to concentrate cognitive efforts on a critical step, as in example [12].

[12] the green one on B the pink one on B *well* what must I do the yellow one here to put the green one with the yellow one *yes* at first one takes the small one
(le vert sur le B le rose sur le B *bon* qu'est ce que je dois faire le jaune ici pour

mettre le vert avec le jaune *oui* d'abord on prend le petit)

– *Change locator, Change located, Double locator, Double located*: The terms 'locator' and located' are referring to the basic enunciative operation of *location (repérage)* in Culioli's linguistic model. It means that a lexis – more commonly known as a proposition – composed of two elements x, y and a predicative relation R, constitutes an oriented relation xRy from x to y, and therefore involves an operation of location, with the located element y relative to the locator x. When a change in the naming of locator or located element or as well a double naming of them occurs, it introduces a double point of view on the considered element of the situation by referring it to two different concepts (Caron-Pargue, in press). So it introduces a reorganisation of the representation. A change in the naming of the located element occurs in example [13] where *the* C points to the fact that the disk is moved from peg C to another peg, while precedent namings referred to the color of the disks. In [14] a similar change of naming occurs this time for the locator with *the green disk* which points to the peg where the disk has to go by mentioning a disk which is already on that peg. In [15] the two different namings *avec le deux* and *sur le C* point to two different points of view on the same peg.

[13] the pink one I put it on the peg C the green one on the peg B *the C* on the peg B
(le rose je le mets sur le piton C le vert sur le piton B *le C* sur le piton B)
[14] the yellow one I put it on the peg A the green one on the B the pink one on *the green disk*
(le jaune je le mets sur le piton A le vert sur le B le rose sur *le disque vert*)
[15] I take the one I put it on *with the two on the C*
(je prends le un je le mets sur *avec le deux sur le C*)

– *Others*. In this category are gathered the criteria which are not very representative of cutting into episodes for the collected data. These criteria concern the appearance or disappearance of a term modifying the structure of the sentence such as changes of verbs, of grammatical subjects, of prepositions. For example the preposition *on (sur)* can be replaced by *with (avec)*. These criteria are interacting with other criteria and some more work is needed in order to study them. Moreover pauses equal to or higher than 20 seconds are also gathered in this category because they cannot be studied properly with the data collected for this research.

Cutting into episodes

Each linguistic mark defined above will constitute a criterion for cutting verbal protocols into episodes. Three examples are presented in Table 1. It can be noticed that the various cuts appear right before the appearance of the criterion except in the case of the connective *and (et)* which points to the last utterance having to be integrated at this level of representation and for which the cut stands right after this integration as the cut between lines (8) and (9) in example b.

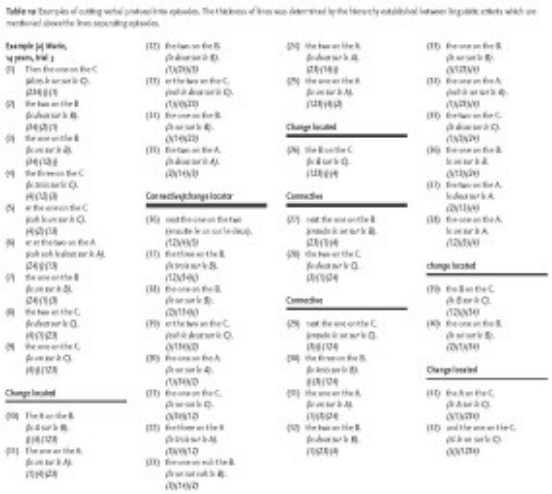

Table 1A

In the very simple example a (cf. *Table 1a*), cuts on the right were done before line (16) for the criterion of *change in the naming of locator*, viz of the peg. Cuts on the left were done before lines (10), (26), (39) and (41) for change in the naming of located element, viz of the disk. Cuts before lines (16), (27), (29) were done because of *connectives*. Finally one can notice the presence of two criteria *connective* and *change in the naming of locator* before line (16). This example is very interesting because it compels us to take into consideration some kinds of cuts such as *change of naming*, if not there would be almost no halt during all the problem solving, and even no cut at all in some protocols.

Table 1B & 1C

In example b (cf. Table 1b), beyond the two precedent criteria, one can find cuts with *Double locator* before line (3), with *Starting terms* before lines (6), (9), and (15), and with *Constituent locators* in their more or less complex form before (6), (11) and (13). Let us notice that in (11) and (13) the *Constituent locators* are also composed of starting terms, because of the anaphora, but could not be taken into consideration because of the preceding utterances which are both composed of starting terms. In this case the presence of a starting term cannot point to a change of representation. A similar case will arise each time as a specific criterion will be repeated in the following utterance. Finally this protocol shows a cut with four criteria before (9) which corresponds at the level of the problem solving to the achievement of the main step 'move the biggest disk to the goal peg'.

The interest of example c lies first in the difference between the two kinds of connectives, with demarcation of units for some of them, before lines (5), (8), (10), (16), whereas others are integrated in (1), (3), (5), (9), (14), (15), (16) with *so that, for after, because, for*. Furthermore another interest lies in the fact that in (4) the connective *therefore* cannot introduce a new unit because of the repetition of the naming of the disk *the yellow one* already present in the preceding utterance (3). Such a repetition introduced a linguistic link between the two utterances. Finally this protocol shows a case of cut with interjection before (11).

Results

We now intend to show the psychological relevance of the linguistic criteria used

in the division into episodes. The results concern the number of episodes established according to the various linguistic criteria defined above, as a function of age and of the acquisition of the expertise through the successive trials.

First, we made a survey of all the cuts for a given criterion, namely the number of times when each of the criteria gave rise to a cut within the protocol. In a second time, we made a survey of all the cuts for more than one criterion, namely when each of the criteria appeared in conjunction with another criterion. The dependent variable was the total number of times that a specific criterion was accompanied by other criteria for all protocols for a specific age or a specific trial. For each protocol this number was computed as follows. For example the criterion *Connective* appears 2 times as one single criterion in protocols a and c and 0 time in protocol b (see Table 1). As more than one criterion it appears 1 time in protocol a, 2 times in protocol b and 3 times in protocol c. Therefore the number associated to *Connectives* for the three protocols presented in table 1 was 4 for one criterion and 6 in case of more than one criterion. Nevertheless in case of more than one criterion, the number of uses of the criteria *Change of naming* and *Double naming* is low and moreover these two criteria appear very often together in both cases located and locator. It leads us to consider in this case only two criteria *located* and *locator* without differentiating Change of naming and *Double naming*.

Evolution with trials

The data concerning the evolution with trials are presented in table 2. As well for one criterion as for more than one criterion, the difference between Starting term and Constituent locator, and between the four kinds of criteria where the located and locator elements were concerned are not significant. Therefore after a regroupment of these criteria, a significant improvement with the acquisition of expertise can be shown both for one criterion ($Khi^2 = 127.4$, d.f. = 12, $p < .0001$), and for more than one criterion ($Khi^2 = 174.1$, d.f. = 9, $p < .0001$).

Table 2 Evolution with trials. 2a: Cuts with one criterion. 2b: Cuts with more than one criterion. ST: Starting term. CL: Constituent locator. Cn: Connectives. Interj: Interjections.

(a)	Trials	1	2	3	4
CAT 1	ST	8	5	3	0
	CL	6	8	6	2
	Cn	99	32	18	22
CAT 2	Interj	80	13	9	2
CAT 3	Change located	37	34	47	25
	Double located	12	15	7	12
	Change locator	56	43	55	38
	Double locator	16	20	13	18
CAT 4	Others	32	26	19	11

(b)	Trials	1	2	3	4
CAT 1	ST	123	37	25	4
	CL	109	36	22	4
	Cn	119	25	9	3
CAT 2	Interj	83	11	4	3
CAT 3	Located	4	7	12	12
	Locator	7	9	15	9

Table 2: Evolution with trials. 2a: Cuts with one criterion. 2b: Cuts with more than one criterion. ST: Starting term. CL: Constituent locator. Cn: Connectives. Interj : Interjections.

In a more detailed way it can be observed that:

– the total number of single cuts, more important for the criteria Change or Double locator or located than for other criteria, remains constant in the course of the trials. Nevertheless the total number of Change of naming and of Double naming independently of the located or locator element differs significantly during trial 3 as the number of Change of naming increases while the number of Double naming decreases. Concerning Connectives, their number is always high, particularly on trial 1, but begins to decrease from trial 2, whereas the number of Starting terms and Constituent locators is consistently low across the trials (Khi ^{2} = 12.05, d.f. = 3, $p < .01$). As for Interjections, if their number evolves in parallel with connectives, it decreases much faster from trial 2 on (Khi ^{2} = 13.95, d.f. = 3, $p < .01$). Finally the criteria *Others* decrease regularly with trials.
– the number of cuts for more than one criterion decreases gradually with trials for Starting terms, Constituent Locator, Connectives and *Interjections*, nevertheless the two last criteria Connectives and Interjections decrease faster from trial 2 than Starting terms and Constituent locator (Khi ^{2} = 18.1, d.f. = 3, $p < .001$).

Evolution with age

The data concerning the evolution with age are presented in table 3. The difference between the number of Starting terms and Constituent locator did not differ significantly as well for one criterion or more than one criterion. But two differences arise between one criterion and more than one criterion. First whereas Connectives did not differ from the two precedent criteria but differ from Interjections for the case one criterion (Khi ^{2} = 6.76, d.f. = 2, $p < .05$), with an higher but later increase of its number for the 14 year-olds, it is the reverse for the case more than one criterion: whereas Connectives did not differ significantly from Interjections, their total number increased with age while the total number of Starting terms and Constituent locator decreased (Khi ^{2} = 6.95, d.f. = 2, $p < .05$). A second difference stood in the fact that a significant difference was shown between Located and Locator criteria with Change of naming or Double naming for more than one criteria, with an increase of Locator for the 14 year-olds, while no significant difference appear for one criterion.

Table 3 Evolution with age. 3a: Cuts with one criterion. 3b: Cuts with more than one criterion. ST: Starting term. CL: Constituent locator. Cn: Connectives. Interj: Interjections.

(a)	age	7	10	14
CAT 1	ST	6	3	7
	CL	7	7	8
	Cn	47	62	62
CAT 2	Interj	25	25	54
CAT 3	change located	29	63	51
	Double located	11	21	14
	Change locator	32	86	74
	Double locator	14	37	16
CAT 4	Others	44	22	22
(b)	age	7	10	14
CAT 1	ST	77	51	61
	CL	65	50	59
	Cn	43	62	51
CAT 2	Interj	32	27	42
CAT 3	Located	12	13	10
	Locator	11	5	24

Table 3: Evolution with age. 3a: Cuts with one criterion. 3b: Cuts with more than one criterion. ST: Starting term. CL: Constituent locator. Cn: Connectives. Interj : Interjections.

Finally the difference between the four main criteria was significant:
– for one criterion, between: a) Starting terms, Constituent locator, Connectives, b) Interjections, c) Located or Locator elements and Others (Khi ^{2} = 56.943, ddl = 6, $p < .0001$). While the number of Starting terms, Constituent locator,

Connectives and Interjections increase with some little differences between them, the total number of Located and Locator element shows a sudden and very high maximum for the 10 year-olds and then tends to decrease for the 14 year-olds. Furthermore the number of criteria Others decreases suddenly for the 10 year-olds.
– for more than one criterion, between: a) Starting terms, Constituent locators, b) Connectives, Interjections, c) Located, d) Locator (Khi ^{2} = 19.9, d.f. = 6, $p < .005$). In this case, the total number of Starting terms and Constituent locators shows a minimum for the 10 year olds and tends to increase again for the 14 year-olds. The total number of Connectives and Interjections increases with age, while the number of Located and Locator elements remains constant except for a sudden increase for the 14 year-olds in the case of the Locator.

In summary, the number of cuts into episodes done with Connectives for both cases (one single criterion and more than one criterion) is higher at the beginning of the learning at every age, then it decreases gradually in the course of the acquisition of expertise. The cuts with Starting terms and Constituent locator in case of more than one criterion appear especially with the youngest participants and at the beginning of the learning and then their number decreases. The number of cuts with Interjection increases with age, but decreases with the acquisition of expertise for one or more than one criterion. The cuts with Located or Locator characterize especially the cuts with one single criterion in a constant manner through the acquisition of expertise and show a sudden increase for the 10 years olds. The Others criteria appear especially at the beginning of the learning, for the youngest participants and in the case of one single criterion.

Discussion
Several differences appeared according to age, acquisition of expertise, and the context of use. We have now to draw out regularities at the level of the linguistic criteria.
A first remark is that the number of occurrences of each linguistic criterion does not increase with expertise. If some of them, Connectives or Interjections increase with age, it concerns the beginning of the learning process. Therefore this fact does not contradict our working assumption according to which the task representation had to become less and less complex as the expertise increases.
The fact that the total number of Change of naming or Double naming for the Located and Locator elements is rather constant through the learning process

and that most of them appears in isolation, leads us to consider these criteria as characterising the simplest and automatic representations constructed through expertise.
Other linguistic criteria such as Starting terms, Constituent locators, Connectives, Interjections gradually decrease in number with the acquisition of expertise. But this decrease shows two distinct speeds, with the higher speed for the Interjections and the lower one for the other criteria.
Another argument re-inforce a little more the need of making a differentiation between these last kinds of criteria. Indeed the differences of use as single criterion or with other criteria allow to assign them a more or less complex role in the construction and successive reorganizations of the task representation. It is the same for the differences observed in the progression of the number of Connectives and of Interjections through age.

We can now link these results to previous data concerning the progressive structuration and simplification of the representation in a problem solving task (Begoin-Augereau & Caron-Pargue, 2001, in press; Bégoin-Augereau, 2002). This representation appears as the result of a true interaction between the subject and the physical environment. The criteria which allowed to differentiate an external space from an internal one were as follow. The external space was identified from the absence of starting term, itself recognizable from the absence of anaphora. An intermediary space through which the interaction is carried out occurs when starting terms appear, even if there is no link between them. The linguistic definition of a starting term considers it as a distinguished element, and the interpretation on the cognitive level was to consider it as pointing to the cognitive operation of selection of information. Furthermore direct or indirect links can be established between starting terms: direct ones as for example with the connective *so that* (see Table 1c, line 3) with a link establish around the verb; indirect with for example the repetition of the naming *with the C* (see Table 1b, lines 6-7) which marks a link based on the preposition. Direct links between starting terms construct the internal space from the physical environment. Indirect links between starting terms work through the intermediary space either to construct the internal one or to progressively simplify and reduce it to an external space non reducible to the physical environment.

Then the criteria established for cutting a protocol into episodes can be situated through these cognitive processes of constructing and reorganizing the

representation. The basic cuts corresponding to a maximal reorganization correspond to the case where multiple criteria coexist in order to demarcate a main unit. Starting terms and Constituent locators play a major role in these operations specific of the internal space. Local cuts arise in the external space with Changes of naming and Double namings. And the reorganization of the representation is still more basic when these two sorts of cuts coincide. Interjections as a kind of modal markers play a specific role in these constructions. They point to a disengagement of the current representation in order to establish links through the parts, embedded in a more or less complex fashion, of the representation. So the corresponding cuts correspond to intermediary steps. Connectives can work at different levels according to the current structuration, internal or external, of the representation.

In Table 1, these different levels of hierarchy were marked with the more or less thickness of the lines separating the episodes. Thus in Table 1c, two main cuts done with the conjonction of the two criterion Connectives and Constituent locator point to three separate representations of the problem among which the more complex and the more hierarchically organised is the middle one. In Table 1b, a single main cut occurs just before line (9), and corresponds to the achievement of a main subgoal of the problem. In Table 1a, still a single basic cut, before line (16), belonging to the external space, leads to consider this step as a state of the problem space where the subject is controlling her / his strategy by the anticipation of an adjustment occurring in the next episode, from line (16) to line (25) without another cut.

In summary the criteria defined above can be hierarchically structured into three main categories:
– Category 1 composed of Starting terms, Constituent locators and of Connectives demarcates the main structurations and reorganizations of the representation, generally occurring in the internal or intermediary representational spaces;
– Category 2 composed of Interjections, points to the resolution of critical steps and local adjustments contributing to the whole construction;
– Category 3 is composed of Change of naming and Double naming of the element located or locator which are either chosen or not in the organization of the predicative relation. If the context of these cuts is an external space composed with an internal one, the corresponding reorganizations are very local ones, just automatically controlling the internal processes. But if the context is only an

external space, these cuts point to the external steps and implicit constraints automatically controlling the working of automatic procedures (see Caron-Pargue, in press).

Surely a lot of work has still to be done in order to clarify these results as well in the area of problem solving, as in the study of interactive processes, a study which has just been tangentially prepared with a temporary restriction of these processes to the interaction with the physical world. Beyond the problem of cutting a protocol into episodes which can be extended to argumentative ones, the more interesting connections lie in the demarcation and the construction of automatic links, susceptible to conduct reasoning.

REFERENCES:

Allport A. (1989). Visual Attention. In M.I.Posner (Ed.) *Foundations of cognitive science.* Cambridge MA: MIT Press.

Bégoin-Augereau S. (2002). *Effets des labels verbaux dans la résolution d'un problème : approche énonciative*. Doctoral dissertation, University of Poitiers.

Bégoin-Augereau S., Caron-Pargue J. (2001). Interaction sujet-environnement physique. La structuration progressive de la situation-problème définie à partir des verbalisations. In. H. Paugam-Moisy, V. Nyckees, J. Caron-Pargue (Eds). ARCo'2001. *La cognition entre individu et société*. Paris : Hermès. pp. 69-81

Bégoin-Augereau S., Caron-Pargue J. (in press). Effets de la dénomination d'un objet caractérisés à partir des verbalisations dans la structuration post-visuelle d'une situation problème. *Visio 7*(3). N° Special 'Le visuel à l'ère du post-visuel'.

Caron-Pargue J. (in press). Structuration post-visuelle d'une situation problème sémiotisée à travers les verbalisations simultanées à la résolution de la tâche. *Visio 7*(3). N° Special 'Le visuel à l'ère du post-visuel'.

Caron-Pargue J., Auriac E. (1997). Etude psycholinguistique de la marque conversationnelle "bon" dans une interaction cognitive. In J. Bernicot, J. Caron-Pargue et A. Trognon (Eds): *Conversation, interaction et fonctionnement cognitif*. Nancy: P.U.N.

Caron-Pargue J., Caron J. (1987). Towards a psycholinguistic approach of argumentative operators : the "thinking aloud" procedure. In : F.H.Van Eemeren, R.Grootendorst, J.A.Blair & C.A.Willard (Eds.), *Argumentation, Perspectives and Approaches*, Dordrecht: Foris Publications, 170-178.

Caron-Pargue J., Caron J. (1989). *Processus psycholinguistiques et analyse des verbalisations dans une tâche cognitive*. Archives de Psychologie, 57, 3-32.

Caron-Pargue J., Caron J. (1991). Psychopragmatics vs sociopragmatics : The function of pragmatic markers in thinking aloud protocols. In J.Verschueren (Ed.), *Pragmatics at issue* (Selected papers from the 1987 International Pragmatics Conference, Part 1). Amsterdam: J.Benjamins, Vol.1, 29-36.
Caron-Pargue J., Caron J. (1995). *La fonction cognitive des interjections. Faits de Langues*. No special sur L'exclamation, 6, 111-120.
Caron-Pargue J., Caron J. (2000). *Les interjections comme marqueurs du fonctionnement cognitif.* Cahiers de Praxématique, 34, 51-76.
Caron-Pargue J., Fièvre M.D. (1996). *Psycholinguistic analysis of a 10-years-old's verbal protocol*. Antwerp Papers in linguistic, 85, 45-74.
Clancey W.T. (1991). Situated cognition: How representations are created and given meaning. IN: R. Lewis and P. Mendelsohn, (eds) *Lessons from Learning*, Amsterdam: North-Holland, p. 231-42. http://cogprints.soton.ac.uk/
Culioli A. (1982). *Rôle des représentations métalinguistiques en syntaxe*. Tokyo. In : Culioli (1999a): 95-114.
Culioli A. (1990). *Pour une linguistique de l'énonciation. I. Opérations et représentations*. Paris: Ophrys.
Culioli A. (1995). *Cognition and Representation in Linguistic Theory*. Amsterdam: Benjamins.
Culioli A. (1999a). *Pour une linguistique de l'énonciation. II. Formalisation et opérations de repérage*. Paris: Ophrys.
Culioli A.(1999b). *Pour une linguistique de l'énonciation. III. Domaine notionnel*. Paris: Ophrys.
Ericsson K.A., Simon H.A. (1979). *Verbal reports as data*. Psychological ReviewI, 87, 215-251.
Ericsson K.A., Simon H.A. (1984) *Protocol analysis*. Cambridge, MA : M.I.T.Press.
Hammond K. (1989). *Case-Based Planning: Viewing Planning as a Memory Task*. Academic Press. Chapters 1. http://www.cc.gatech.edu/~jimmyd/summaries/
Newell A., Simon H.A. (1972). *Human problem solving*. Englewood Cliffs, NJ : Prentice Hall.
Nisbett R. E., Wilson T. E. (1977) : *Telling More Than We Can Know : Verbal Reports on Mental Processes*. Psychological Review. 84, 231-259.
Ohlsson S. (1984a) . *Restructuring revisited. I. Summary and critique of the Gestalt theory of problem solving*. Scandinavian Journal of Psychology, 25, 65-78.
Ohlsson S. (1984b) . *Restructuring revisited. II. An information processing theory of restructuring and insight*. Scandinavian Journal of Psychology, 25, 117-129.
Richard J-F. (1982). *Planification et organisation des actions dans la résolution du*

problème de la tour de Hanoï par des enfants de 7 ans. L'année Psychologique ,82, 307-336.
Richard J.F, Poitrenaud S., Tijus C (1993). *Problem Solving restructuration : Elimination of implicit constraints*. Cognitive Science, 17, 497-529.
Rosenbloom P.S., Laird J. E., Newell A., McCarl R. (1991). *A preliminary analysis of the Soar architecture as a basis for general intelligence*. Artificial Intelligence, 47, 289-325. See also : http://ai.eecs.umich.edu/cogarch0/soar/metod.html
Simon H.A. (1987). *The information-processing explanation of Gestalt phenomena*. Computers in Human Behavior, 2, 1-15. (Repr. in H.Simon, Models of thought, vol.2, New Haven, Yale University Press.)
Van Lehn K. (1991). *Rule acquisition events in the discovery of problem-solving strategies*. Cognitive Science, 15, 7-47.
Welsh M.C. (1991). *Rule-Guided Behavior and Self-Monitoring on the Tower of Hanoï Disk-Transfer Task*. Cognitive Development, 6, 59-76.