THE SHIFT OF CYBERNETICS FROM THE U.S. TO EUROPE: IMPLICATIONS FOR CREATING AN INFORMATION SOCIETY

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Abstract

People in the field of information systems occasionally say that there is no theory in their field. However, the field of cybernetics, which has been developing since the late 1940s, provides a general theory of information and regulation. The theory provides a foundation for understanding the behavior of individuals, groups, organizations, nations, and machines. Such a theory is essential in developing an information society. Although, important early work in cybernetics was done in the U.S., in recent years the location of cybernetics education and research has moved to other countries. This article presents data that reveals the shift of research in cybernetics from the U.S. to Europe and Asia. The decline in U.S. participation in the development of cybernetics may well put the U.S. at a disadvantage in the further development of an information society.

Background

Currently there is concern in the U.S., particularly among government agencies which fund scientific research, that other countries are moving ahead of the U.S. in technology education. U.S. universities train many foreign students in information technology (IT), and China and India are currently producing far more engineering graduates than the U.S. A shift of research in cybernetics from the U.S. to Europe and Asia is another undesirable trend.

In the 1960s it seemed that cybernetics would become the foundational discipline for the social sciences, computer science, library science, and the design disciplines, in somewhat the same way that physics is the foundational discipline for engineering fields. This has not happened. People speak about cyberspace and cyber-infrastructure, but they seem not to know about cybernetics. The field of cybernetics was created in the U.S. in the 1940s and 1950s largely by people from Europe, who came to the U.S. before, during and after World War II (Umpleby, 2005). They did excellent academic work, but when they retired and died, the programs they started were closed. Cybernetics still exists in the U.S. in the form of annual conferences and journals, but conference attendance is low and the cybernetics literature, if it is taught at all on university campuses, is offered only in elective courses. There are no degree programs in cybernetics in the U.S. Meanwhile, in Europe interest and activity in cybernetics is growing. Given the current concern with international competitiveness in science and engineering education, some attention to European and Asian leadership in cybernetics may be wise.

Why cybernetics is important

Cybernetics provides a general theory of information processing, decision-making, perception, cognition, learning, adaptation, and understanding. It provides principles for understanding information-related behavior at all biological and social levels. Apparently the reason cybernetics has prospered among Europeans but not Americans is that Europeans and Americans have different ways of establishing meaning (Tsay, *et al*., 2009). If one presents a theoretical proposition to an American audience, the first question will be, How can the principle be applied in practice? If one presents the same theoretical proposition to a European audience, the first question will be, From what philosophical position is that proposition derived? Hence, Europeans think that creating more general theories is appropriate and useful. Americans do not. Given the different intellectual habits of Americans and Europeans, encouraging cooperative research among Americans and Europeans would be one way to maintain American understanding of how this key field is developing.

Testing the hypothesis

Is the hypothesis that cybernetics research is moving to Europe and Asia supported by the locations of authors of articles in cybernetics journals? Articles over thirty years in three journals *Cybernetics and Systems*, *Kybernetes* and *Systems Research and Behavioral Science* were studied.

Articles in *Cybernetics and Systems: an International Journal* were sampled in approximately five year intervals. The years used as samples were 1988, 1992, 1997, 2002, and 2007. If an article had more than one author, the article was counted only once. If an article had authors from more than one country, the country of the corresponding author was chosen. Table 1 shows the number of articles in each sampled year written by authors from the countries listed. The countries were then grouped by region. See Table 2. Table 3 presents the number of articles from each region for the sampled years. Figure 1 shows how the amount of cybernetics research in the various regions has changed in recent years. Table 4 lists the number of articles in 1988, the number of articles in 2007, and the change. In 1988 North America had the largest number of articles. In 2007 the US was tied with the Middle East and ahead of only Latin America. Europe and Asia had become the leading regions.

Articles in the journal *Kybernetes* were studied from 1974 through 2010. Table 5 groups the countries in Kybernetes by region. Table 6 lists the number of articles by country from 1974 to 2010, sampled every three years. Table 7 presents the number of articles from each region, every three years. Figure 2 shows how activity in the various regions has changed. Table 8 lists the number of articles in 1974, the number of articles in 2010, and the changess. In 1974 North America had 12 articles, Europe had 15, and Asia had 2. In 2010 North America had 10 articles, Europe had 38 and Asia had 49. Hence, comparing the number of articles in 1947 and 2010, the number of North American articles declined, the number from Europe more than doubled, and the number from Asia increased more than 2000 percent.

Articles in the journal *Systems Research and Behavioral Science* were studied from 1998 through 2010. Table 9 shows the number of articles every three years from 1998 to 2010. Table 10 shows the number of articles from each region in each of the sampled years. Figure 3 shows how activity in the various regions has changed in recent years. Table 11 shows the number of articles from each region in 1998 and 2010 and the percentage change. In 1998 North America had 10 articles, Europe had 13. Asia had 2. In 2010 North American articles had declined 60 percent, European articles had increased 15% and Asian articles had increased 350 percent.

These three journals, *Cybernetics and Systems*, *Kybernetes,* and *Systems Research and Behavioral Science*, are the leading journals in the field of cybernetics. In all three the number of articles written by North American authors has declined while the number of articles written by authors in Europe and particularly in Asia has increased. It appears that cybernetics is becoming a European and Asian field of study.

References

Tsay, Han-Huei, Mateo Ruggia and Stuart Umpleby. "Convergers and Divergers: A Dimension of Cultural Difference between the U.S. and Europe." Proceedings of the Annual Meeting of the Society for the Advancement of Socio-Economics, Paris, France, July 16-18, 2009.

Umpleby, Stuart A. "A History of the Cybernetics Movement in the United States*." Journal of the Washington Academy of Sciences*, Vol. 91, No. 2, Summer 2005b, pp. 54-66.

Table 1. Number of articles per year and per country in the journal *Cybernetics and Systems*

Country	1988	1992	1997	2002	2007
Argentina	0	0	0	2	0
Australia	0	0	2	2	5
Austria	1	0	2	1	0
Bulgaria	0	1	1	0	0
Canada	3	1	1	1	0
Chile	0	0	0	0	1
China	3	1	3	3	2
Croatia	0	0	0	0	1
Czech Republic / Slovakia	0	3	0	0	0
France	0	0	2	1	1
Germany	0	3	3	0	2
Greece	0	2	0	0	0
India	0	0	1	0	3
Iran	0	0	0	0	1
Israel	1	2	0	0	1
Italy	2	1	1	0	2
Japan	0	0	2	1	1
Jordan	0	0	0	1	0
Mexico	0	0	0	1	0
New Zealand	0	0	0	0	1
Norway	0	1	0	0	0
Oman	0	0	0	1	0
Poland	0	0	0	2	4
Russia	0	0	0	1	0
Serbia	0	0	1	0	0
Singapore	1	0	1	1	0
Slovenia	0	0	1	0	1
Spain	1	10	1	4	3
Sweden	0	0	0	0	2
Switzerland	1	0	0	1	0
Taiwan	0	3	2	8	3
Turkey	0	0	0	0	1
UAE	0	0	0	1	0
UK	1	1	2	5	2
USA	7	7	7	1	3
Yugoslavia	0	1	0	0	0

Table 2. Countries grouped by region, *Cybernetics and Systems*

Area	Symbol	Countries
Asia	A	Australia, China, India, Japan, New Zealand, Singapore, Taiwan
Europe	E	Austria, Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Italy, Norway, Poland, Russia, Serbia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, Yugoslavia
Latin America	LA	Argentina, Chile, Mexico
Middle East	ME	Iran, Israel, Jordan, Oman, Turkey, United Arab Emirates
North America	NA	Canada, United States of America

Table 3. Number of articles per year and per region in *Cybernetics and Systems*

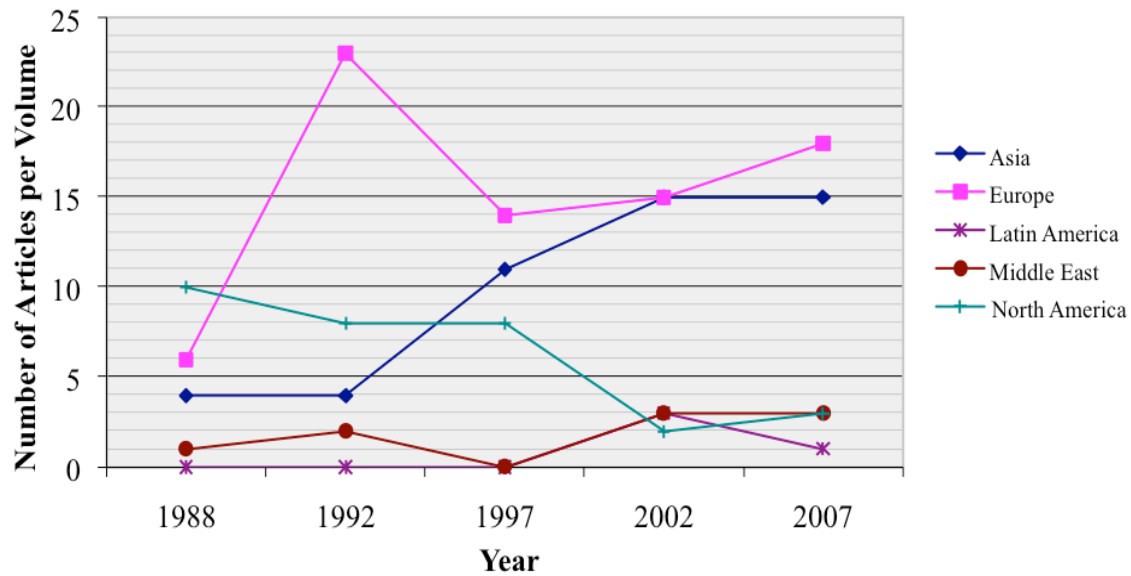| Area	Symbol	1988	1992	1997	2002	2007
Asia	A	4	4	11	15	15
Europe	E	6	23	14	15	18
Latin America	LA	0	0	0	3	1
Middle East	ME	1	2	0	3	3
North America	NA	10	8	8	2	3

Figure 1. Articles per year by region over time in *Cybernetics and Systems*

Table 4. Changes in activity by region between 1988 and 2007, *Cybernetics and Systems*

Area	Symbol	1988	2007	Change	% Change
Asia	A	4	15	+11	+275%
Europe	E	6	18	+12	+200%
Latin America	LA	0	1	+1	N/A
Middle East	ME	1	3	+2	+200%
North America	NA	10	3	-7	-70%

Table 5. Countries grouped by region, *Kybernetes*

Area	Countries
Asia	Bangladesh, China, India, Indonesia, Japan, Korea, Singapore, Taiwan
Europe	Austria, Belarus, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Finland, France, Georgia, Germany, Greece, Ireland, Italy, Lithuanian, Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, Yugoslavia
Latin America	Argentina, Chile, Colombia, Mexico
Middle East	Algeria, Iran, Israel, Jordan, Morocco, Pakistan, Saudi Arabia
North America	Canada, United States of America
Oceania	Australia, New Zealand
Africa	Kenya, South Africa

Table 6. Number of articles per year and per country in the journal *Kybernetes*

Country	1974	1977	1980	1983	1986	1989	1992	1995	1998	2001	2004	2007	2010
Algeria										2	1	1	1
Australia												4	
Austria			2	1								2	2
Bangladesh									1				
Belarus												1	
Belgium										2			
Brazil			1	1				2				3	
Bulgaria	1	2											
Canada	1	1	3	2	1	1	3	7	2	3	4	2	3
Chile													1
China					2	1		4	10	7	35	2	43
Colombia											3	1	1
Czech Republic	1		2										
Denmark												2	
Finland						1		1	2	1		1	

France	1	1	3	4	3	1	7	2	5	2	5	1	1
Georgia	1		1										
Germany	1	3	2	1		1	1			2	1	6	3
Greece				3	1				1			3	1
India		1		2	1			1	2	2	1	4	
Indonesia	2												
Iran										1		2	1
Ireland			1									2	
Israel		1					2		2	3	4	2	
Italy	1	1		1	1					1		4	
Japan		2	1	1	1				1				
Jordan											1		
Korea									2				
Kenya									2				
Lithuanian	1												
Morocco	1												
Netherlands				1			1	1		5	1	1	
Norway		1								1			1
Pakistan											1		
Poland			2		3			1		2	1	1	1
Portugal												1	
Romania	4	1	1		1	1	1	1		1			
Russia		1			1			1				3	
Saudi Arabia					1	1							
Slovakia													1
Slovenia											1	3	2
South Africa		1									1	1	
Spain			1	1	2	2	1	2	2	1	4	8	2
Sweden										3	2		2
Switzerland	2	1					1			3	1	4	2
Taiwan													5
Turkey											1	1	2
UK	1	3	6	1	3	7	10	4	11	27	19	26	20
Ukraine	1	1											
USA	11	8	5	7	5	3	6	14	8	14	14	19	7
Yugoslavia		1								1			

Table 7. Number of articles per year and per region in *Kybernetes*

	1974	1977	1980	1983	1986	1989	1992	1995	1998	2001	2004	2007	2010
Asia	2	3	1	3	4	1	0	8	14	10	37	8	49
Europe	15	16	21	13	15	13	22	13	27	48	34	72	38
Latin America	0	0	1	1	0	0	0	2	0	0	3	4	2
Middle East	1	1	0	0	1	3	0	2	3	4	2	0	0
North America	12	9	8	9	6	4	9	21	10	17	18	21	10
Oceania	0	0	0	0	0	0	0	0	0	0	0	4	0
Africa	0	1	0	0	0	0	0	2	0	2	2	2	1

Figure 2. Articles per year by region over time in *Kybernetes*
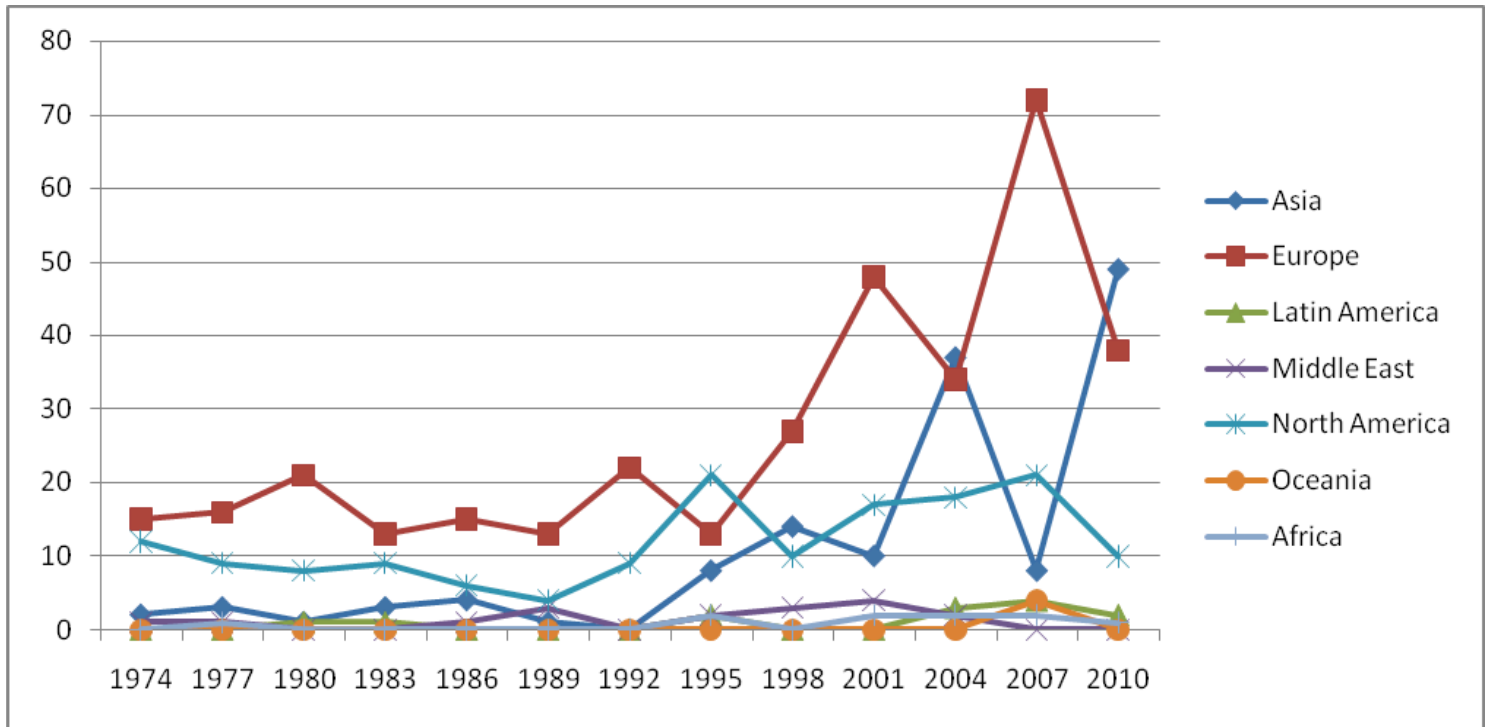
Table 8. Changes in activity by region between 1974 and 2010 for *Kybernetes*

Area	1974	2010	Change	% Change
Asia	2	49	+47	+2350%
Europe	15	38	+23	+153%
Latin America	0	2	+2	N/A
Middle East	1	0	-1	-100%
North America	12	10	-2	-16%
Oceania	0	0	0	0
Africa	0	1	+1	N/A

Table 9. Number of articles per year and per country in the journal *Systems Research and Behavioral Science*

Country	1998	2001	2004	2007	2010
Argentina	1		1		
Australia	6		1	7	5
Austria				1	2
Belgium				1	
Brazil		1			2
Bulgaria			1		
Canada					1
Chile			1		2
China				5	6
Colombia			2	1	
Cyprus		1			
Denmark		1			
Finland					1
Germany			3		
Greece	1			1	1
India	1	2			
Israel		1	2		1
Italy	1			1	1
Japan		1	2	1	1
Korea	1				
Mexico			1	1	3
Netherlands		1		2	1
New Zeland	1			4	1
Norway					1
Portugal					1
Russia			1		
Slovenia				1	2
South Africa	1				
Spain		1			
Sweden	2	6			
Switzerland		1	2		
Taiwan					2
Turkey			1		
UK	9	4	7	9	5
USA	10	10	15	10	3

Table 10. Number of articles per year and per region in *Systems Research and Behavioral Science*

	1998	2001	2004	2007	2010
Asia	2	3	2	6	9
Europe	13	15	15	16	15
Latin America	1	1	5	2	7
Middle East	0	1	2	0	1
North America	10	10	15	10	4
Oceania	7	0	1	11	6
Africa	1	0	0	0	0

Figure 3. Articles per year by region over time in *Systems Research and Behavioral Science*
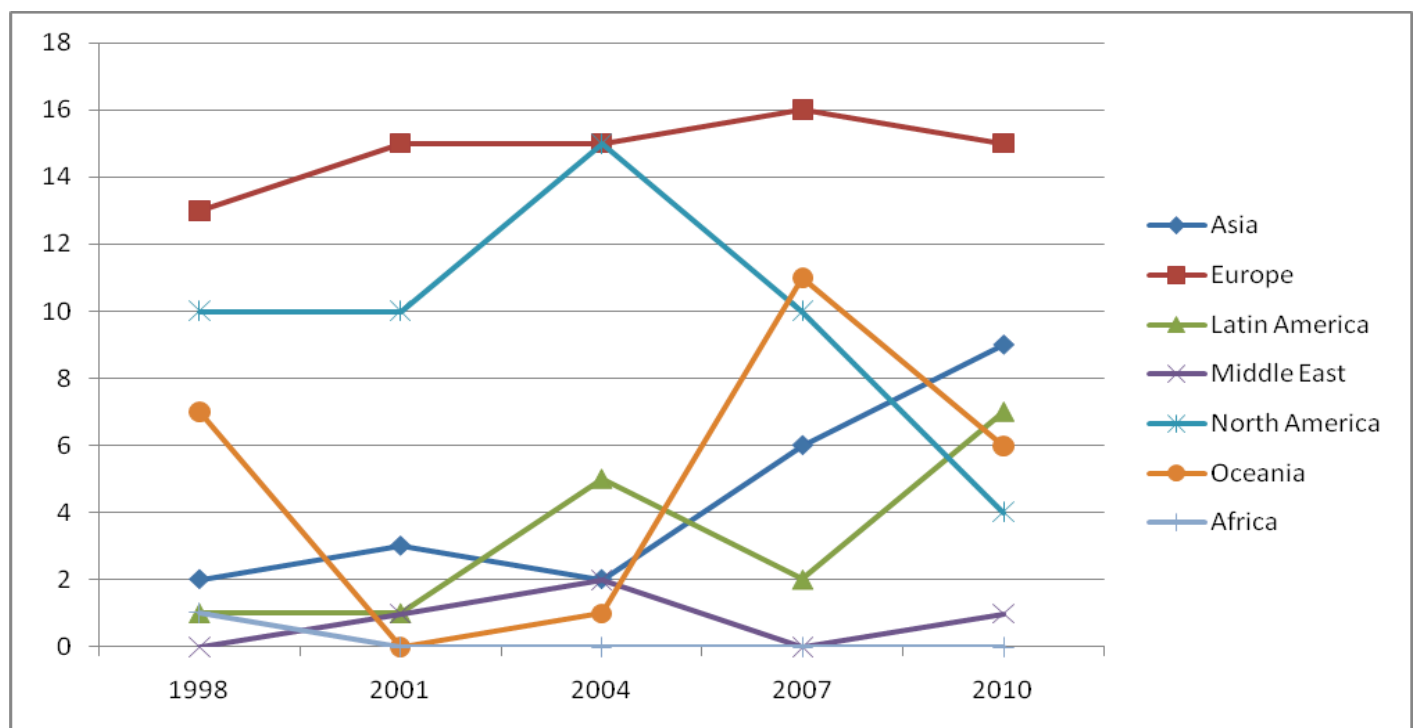
Table 11. Changes in activity by region between 1988 and 2010 for *Systems Research and Behavioral Science*

Area	1998	2010	Change	% Change
Asia	2	9	+7	+350%
Europe	13	15	+2	+15%
Latin America	1	7	+6	+6%
Middle East	0	1	+1	N/A
North America	10	4	-6	-60%
Oceania	7	6	-1	-14%
Africa	1	0	-1	-1%