

COMPUTER-ASSISTED INFORMATION SYSTEMS AND
COMPUTER-ASSISTED CARTOGRAPHY:
TOOLS OR TINKER TOYS OF URBAN GOVERNANCE

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INTRODUCTION

The Urban and Regional Information Systems Association (URISA) based its 1974 Conference on the themes of Resources and Results. Examination of Conference Proceedings 1/ makes it apparent that managers and operators, professionals and laypersons, and users and suppliers have only begun to deliberate the extent to which computer-assisted information systems are tools or tinker toys in the processes of urban governance. The activities of the Panel on Information Technology and Urban Management of the Organization for Economic Cooperation and Development (OECD) 2/ will most likely go a long way towards generating much needed facts, and insightful interpretations in this regard. Further, a ministry-sponsored symposium 3/ will further explore this topic. However, it does remain that the universe of interested parties (for example, elected officials, government personnel, the public) is by no means convinced that computer-assisted information systems (C-AIS) can be assigned, by selected criteria, to the appropriate tool or tinker toy bin of urban governance capabilities. 4/

As far as computer-assisted cartography (C-AC) is concerned, the overall assessment must be somewhat the same. 5/ We are all aware, as with computer-assisted information systems, that some aspects of the capability or configuration are being utilized (as tools), and some parts/activities represent the tinkering phase or stage. What is of primary consequence in a discussion of computer-assisted cartography as a tool or tinker toy in urban governance is, of course, the purposes, ways and extent of the roles. That is, the amount of tooling or tinkering must be examined in the context of ends to which C-AC is put.

CONTEXT FOR ASSESSING C-AIS AND C-AC UTILITY IN URBAN GOVERNANCE

The ends to which computer-based information systems and computer-assisted cartography are put is the focal talking point of this statement. During the past

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several decades increasing amounts have been expended on computer-driven means of specifying, acquiring, processing, disseminating, displaying and applying urban data. 6/ Hence, the topic warrants serious debate.

There are a number of criteria (data or transactions volume, cost per unit of activity, cost of physical space and amenities for accommodating 200 or 2,000 clerks versus one computer and peripherals, etc.) associated with the desire to shift from manual to computer-assisted information systems. However, personal communications and experiences, as well as the extant literature, indicate that the ranking criterion may very well be that of time. Concern about the time factor has involved, in the main, attempts to ensure the timeliness of data and transactions, and to bring them on line with user needs (human or otherwise) in decreasing time spans. Bearing these criteria in mind, and particularly that of time, let us look to the urban agent or activity served by computer-assisted information systems and computer-assisted cartography.

RELATING TECHNOLOGIES AND THEIR USERS AND USES

If we look upon urban government change agents in human terms, then we are speaking about managers, operators, planners, researchers, administrators, etc. Translated into functions, they are management, operations, planning, research, administration, etc. The fundamental point of concern, when relating C-AC and C-AIS to these persons and functions, is to determine the why and how which underlie the ways and extent that both the technologies and the agents and functions have shifted on their respective manual-to-automated spectra.

The distinction being made between people (agents) and functions (what people do) is by no means new, but it is very important in the context of this paper. That is, both the agents and/or the functions can legitimately be considered in manual-cum-automated terms when examined from the standpoints of what is done (product orientation) and how things are done (process orientation). 7/

Due to the significance attached to this point, a brief elaboration is offered. A function or application may readily lend itself to an algorithmic expression. As a result it can be automated, leading to real time or near real time outputs or determinations. That is not to say that the human agent relates to the function or application in the same fashion. The human agent may perceive the function via a mental process which defies algorithmic representation. Further, it may simply be beyond mental human capacity to handle the function or application (e.g., traffic control) in the way that a computer-assisted or computer-driven capability could.

With regard to the human agents of urban governance (and I do not apologize for the apparent triteness of the statement), the job does not necessarily define the person. This means that we must bear in mind, then, the ways and extents, and reasons behind them, that people have changed in terms of self-perception or perceptions about computers, as a consequence of the evolution of this technology. To repeat, and emphasize the point, it is necessary to appreciate two kinds of ends to be served -- people and functions -- when considering C-AIS and C-AC as tools, tinker toys, or some combination thereof as they relate to the products and processes of urban governance.

INVENTORY AND ASSESSMENT OF C-AIS AND C-AC TECHNOLOGIES IN URBAN GOVERNANCE

The contents of this section are based on a discussion of Figure 1, "Relationships Between Urban Users and Usage of Computer-Assisted Information Systems and Computer-Assisted Cartography." A cursory look at Figure 1 reveals immediately a high degree of aggregation. First, there is no distinction made between levels of government (Federal, provincial or State, county, regional, municipal) which play a role in affairs urban. Second, there is no elaboration with regard to either agents or functions of urban governance.

These jurisdictional and functional distinctions were developed in detail in earlier papers, 8/ and are not central to the general arguments of this report. Rather, they are important in the development of supporting statements for the series of "impressions" advanced, and summarized in Figure 1. The work "impressions" is chosen advisedly, it is noted, as the observations set forth are not based on a statistically valid empirical study. Instead, they represent findings based on experience with and reading about C-AIS and C-AC developments, users, and usages in both Canada and the United States, and in Europe to a lesser extent.

By way of explanation of what is depicted in Figure 1, consider the entries manager-management, and researcher-research. In my view, most urban managers have a relationship with the technologies that is becoming mentally comfortable. I do not propose that managers as a whole have an electronic symbiosis with the technologies, but only that over the years an attitude of "live and let live" has developed. Further, the managers' mental sets of "acceptables" have reached the point where the technologies are regarded as something more than mere tinker toys.

As far as urban management functions are concerned, however, relationships with the technologies have not undergone a similar progression. In my view, the management function still uses and regards the technologies as tinker toys, and has not yet rendered itself (or been rendered by exogenous forces) as a series of activities which extend much beyond a kind of lock-step body of events that do not lend themselves to an automated mode of replication and decision-taking.

With regard to researchers, I perceive there to be a relatively different state of affairs in place. Researchers, and particularly those who have engaged in modeling activities, or have been trained in the use of quantitative techniques and dynamic systems, relate very well to the technologies in mental or orientation terms, and perceive the technologies to be tools of their trade.

Insofar as technology usage in the research function is concerned, it is well up the manual-automated ladder, but has advanced somewhat less quickly along the Tinker Toy-Tool axis. My explanation of this is that while researchers have an affinity for time compression in carrying out tasks (e.g., large-scale simulation exercises), desire to use the technologies is not sufficient to readily make them serve those ends. That is, it is one thing to conceptualize and design an application on paper or in principle, and often something else to make the technology serve that end, in practice.

As a final remark in this section, a two-fold reminder is offered. This is, we must look to the purposes, ways, and extent of C-AIS and C-AC roles in urban governance, and we must bear in mind changes occurring in both the fields of technology (C-AIS and C-AC) and of urban governance (people and functions and activities). To ignore these difficult to handle but fundamental points is to opt for tinker toy evaluation by default.

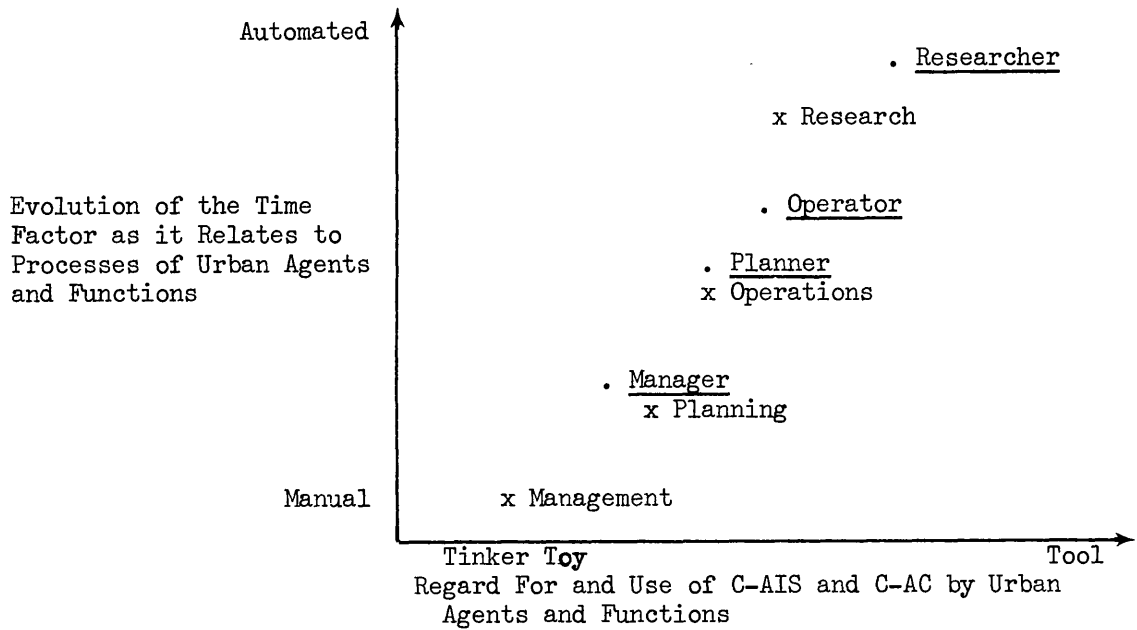


Figure 1. Relationships Between Urban Users and Usages of Computer-Assisted Information Systems and Computer-Assisted Cartography

Purpose of C-AIS and C-AC Use	Legislation		Policies		Programs		Projects	
	Introduce		Introduce		Introduce	Manage & Administer	Introduce	Execute
Transportation		L	L	M	M	M	H	
Engineering				M	M	H		
Environmental Control			L	L	L	L	L	
Building Inspection				M	M	M	M	
Land Records		L		M	M	M	H	
Public Utilities				L	M	L	M	
Finance		L		M	H	M	H	
Assessing		L		L	H		M	
Revenue Collection				L	H	M	H	
Welfare				M	H	L	H	
Library					M	L	M	
Voter Registration					M		M	
Police				M	H	H	H	
Fire				M	H	M	M	
Code Enforcement		M					L	

Notes: 1/ L=Low, M=Medium, H=High. An empty cell conveys the impression of either trace or nil C-AIS or C-AC use for the activity.
 2/ The list of activities is illustrative rather than exhaustive.

Figure 2. Purpose and Extent of Use of C-AIS and C-AC for Selected Activities of the Urban Operations Function 1/

C-AIS & C-AC VIS-A-VIS URBAN OPERATORS AND OPERATIONS

The earlier acknowledgement about risks in inferring what people are, based on an analysis of what they do, points up a problem inherent in this type of "impressions" paper. That is, while one can go to the literature to find out what is being done by someone or by an agency, that is very far removed from learning anything about that entity. Unfortunately, symposium objectives as well as time and space constraints are such that a detailed examination of pertinent materials, or on-site visits to installations to discourse with people are neither warranted nor feasible. Hence, the reader must be content with an unbalanced treatment of operators and operations in the context of C-AIS and C-AC usage.

For reasons of complexity, both analytical and cartographic, Figure 1 is not used as the model for further diagrams in the paper. Instead, for example, operations are considered in terms of 1) what they are (types of functions), 2) the status of C-AIS and C-AC usage by function (high, medium, low), and 3) the use made of C-AIS and C-AC during the course of the operations process. To further reduce the magnitude of this task, without loss of generality, discussion is limited to four outputs: legislation, policies, programmes, and projects. Again, since this topic has been addressed in an earlier paper, 9/ the various aspects of product evolution (recommend, introduce, manage and administer, and execute) are not elaborated upon here. The final qualifier is that inputs from operations to the management, planning and research functions are precluded due to space constraints. (It is strongly recommended, however, that any follow-ups to this paper investigate 1) the connections between combinations of process functions and the output of products, and 2) changes in the process functions themselves as a result of C-AIS and C-AC outputs linking the functions. Discussions with a variety of officials point this up as a crucial urban policy research activity area).

The functions shown in Figure 2 are representative of those carried out by municipal, Provincial State, and Federal governments. Those functions, as well as a number of others, represent the channels by which governments deliver goods and services to the public. Insofar as operations are concerned, the contents of Figures 1 and 2 are reasonably consistent. That is, C-AIS and C-AC are regarded as contributing more to projects than to programmes than to policies than to legislation, with the full range of high (H), medium (M), and low (L) being associated with the status of C-AIS and C-AC usage in the operations function.

The location of operations on the Tinker Toy-Tool axis is explained by the majority of H's and M's registered in the Execute Projects column of Figure 2. With regard to the Manual-Automated axis, it is my impression that much remains to be done before time savings or benefits are part and parcel of C-AIS or C-AC/operations-based activities. Clearly, the policy activity and several others are exceptions to this impression, but as a rule time savings or time compression remain more as potential than actual accomplishment.

With regard to persons in operations, that is, operators, they were touched upon in an earlier section. Figure 2 suggests that they are now using C-AIS and C-AC to introduce projects and programmes for a variety of functions, and for a very limited number of policy-related activities. Evidence contrary to my impressions is solicited, particularly since we are dealing with the catalysts (people) who will play a major role in the evolution of C-AIS and C-AC in the operations component of urban governance. In sum, operators use C-AIS and C-AC in carrying out existing responsibilities (probably set in place during the days of manual methods), and in initiating new endeavours, and hence their placement away from the origin of Figure 1.

It merits noting that operators and operations are shown in Figure 2 to be very consistent with what they should be doing. That is, the matrix is skewed heavily in the direction of projects, which is most appropriate given the nuts-and-bolts responsibilities of this component of urban governance. If the distribution were not of that general order, then there would be great and justified cause for worry about the performance of the agents and activities comprising this function.

C-AIS AND C-AC VIS-A-VIS URBAN MANAGERS AND MANAGEMENT, PLANNERS AND PLANNING, AND RESEARCHERS AND RESEARCH

Each of the agents and functions of this section are intimately related to operators and operations, given that the latter constitute the basic agents and apparatus of urban governance. By way of explanation, management depends upon the operations function for the delivery of goods and services to the citizenry. On the other hand, operations is directed by management as to nature, timing, distribution, etc. of goods and services. Planning, among its other tasks, is involved in relating different operations functions (e.g., transportation, public works, and assessment) in an overall plan for the community. Conversely, operations activities as a rule are bound or constrained by the larger goals and objectives of the planning function. Similarly, the ultimate urban governance constituent for research outputs is the operations function. Operations, in turn, translates research outputs into goods and services to be delivered to the citizenry. Finally, operations specifies the nature of its problems to research, and thereby directs at least some aspects of the research function.

For those reasons, as well as space limitations, the three components are grouped in this part of the paper. It is necessary, as a result, to change slightly the format between Figures 2 and 3. Hopefully this will not reduce either the validity or utility of impressions which follow.

As an introduction to Figure 3, let us consider several questions in the context of suggested cell entries. Reading from the row (function, activity) and column (type of use) headings, illustrative questions would be as follows: 1) "To what extent does the Management Function employ C-AIS or C-AC to Analyse Data so that it may Introduce Policies?"; 2) "To what extent does the Planning Function use C-AIS or C-AC to Evaluate Operations so that it may Introduce Projects?"; and 3) "To what extent does the Research Function use C-AIS or C-AC to Analyse Trends so that it may Introduce Programmes?". As shown in Table 3, my impressions lead me to suggest that representative assessments are low, medium, and high, respectively.

Before proceeding with an analysis of Figure 3, it is important to stress that the entries do not, by any means, imply that there is a "rightness" to what the functions are doing in terms of the type or extent of C-AIS or C-AC usage. Further, they should not be construed as suggesting that a "high" recorded for planning is more consequential than a "low" for management for a common activity and type of usage. They are, rather, impressions of the degree to which the technologies are employed by the functions as they carry out their activities in the various domains, and nothing more.

In this regard, and to ensure that the distinction being made is related to the earlier reference about algorithmic expression (p. 483), and the lock-step characterization of the management function (p. 484), a statement by Drucker merits repeating. That is, "The basic decisions of government - the substance of politics -

cannot be made subject to automatic rules, there would be no decision left." ^{10/} If one substitutes "management" for "government" with respect to "basic decisions," (a substitution which I would not readily propose for either "planning" or "research"), then the point is surely made even more apparent. Namely, one may equate management, planning, and research function activities, or regard them as synonymous, but in doing so one incurs the risk of comparing dissimilar entities. No such action is taken, nor can be logically inferred from the paper.

In looking at Figure 3 from an overall point of view, the entries fall in line in a general sense with the contents of Figure 1. Management, which as a rule has a legislation and policy focus, has not advanced much beyond the project and programme components in terms of using the technologies. Planning, on the other hand, has attained solid footing in the project and programme components, and is beginning to make modest inroads in the policy and legislative domains. As for the research function, it is perceived as having reached the state where C-AIS and C-AC are integral to virtually all aspects of activity associated with the research-sponsored legislation, policies, programmes, and projects.

Purpose of C-AIS and C-AC Use ^{1/}	Legislation	Policies	Programmes	Projects
	Introduce	Introduce	Introduce Manage & Administer	Introduce Execute
Management				
Interpret Constituents' Preferences and Needs				L
Analyse Data	L	L	L	M
Evaluate Recommendations	L	L	L	L
Allocate Resources			L	L
Evaluate Operations			L	L
Planning				
Collect Data	L	M	L	M
Analyse Data	L	M	M	H
Evaluate Operations			L	M
Prepare Plans	L	M	L	L
Prepare Forecasts		M	M	M
Research				
Collect Data	M	H	H	H
Test Hypotheses				H
Develop Theories	M	H		H
Develop and Calibrate Models		H		H
Analyse Trends	H	H	H	H
Prepare Forecasts	M	H		H

Notes: ^{1/} L = Low, M = Medium, H = High. An empty cell conveys the impression of either trace or nil C-AIS or C-AC use for the activity.
^{2/} The list of activities is illustrative rather than exhaustive.

Figure 3. Purpose and Extent of Use of C-AIS and C-AC for Selected Activities of the Urban Management, Planning, and Research Functions

So as to be consistent with the previous section, it is not appropriate to refer specifically to the axes of Figure 1. If the foci of management are the legislation and policy domains, then Figure 3 substantiates the placement of that function along the Tinker Toy axis. That is, management is using the technologies for purposes not in its prime purview, i.e., it is clearly in the tinker toy stage. With regard to the Manual-Automated axis, it is my impression that management is not using the technologies to perform activities which are consequential and heavy consumers of management time.

With regard to the research function, I perceive it to have fully incorporated C-AIS and C-AC in its primary domain, projects (in the sense of research projects). Further, it has reached the stage where the technologies are becoming an increasingly integral part of the ways and means for advancing thrusts in the legislation, policy, and even programme spheres. In addition, the research function uses the technologies for activities which lend themselves exceedingly well to time compression for the full range of purposes.

Planning, our third function, is placed between the management and research functions. This is perceived to be the case for reasons which are situated between those set out in the two preceding paragraphs. That is, planning uses the technologies in modest degree to carry out tasks which are amenable to time compression, and has gone beyond its conventional domains (projects and programmes) to make inroads in the legislation and policy spheres via C-AIS and C-AC.

CONCLUSION

The objective of this paper was to set forth a series of impressions on the purposes, ways, and extent whereby the management, planning, operations, and research functions of urban governance employ computer-assisted information systems and computer-assisted cartography in the performance of their associated activities. As noted at the outset, there is little if any solid, comparative documentation on this topic. In fact, we are only beginning to appreciate how enamoured we have been of the usage of the technologies in urban governance, to the virtual exclusion of hard looks at the ways and consequence of these usages. Hence, while cost-benefit, cost-effectiveness, etc. analyses are terms of long standing, we are just beginning to seriously consider how we might go about making broad scope determinations in these regards.

During the course of the paper the functions have been related to each other via a set of ends for activities -- legislation, policies, programmes, and projects. In that framework some impressions were advanced. The next step is to examine the framework and adopt it or modify it, with the understanding that we are long overdue to come forward with ways and means for rigorously examining the consequences of C-AIS and C-AC usages by purpose, ways, and extent. It seems eminently reasonable to suggest that the "counterfoil research" proposition of Illich may very well be the overriding principle that should direct our efforts towards that end. 11/

As for the impressions advanced, I look forward to hearing or reading other perceptions or facts of where we are at, as information exchange is one of the keys to the rational and sensitive evolution of this field.

REFERENCES

1. Urban and Regional Information Systems: Resources and Results, Volumes I and II. Papers from the Twelfth Annual Conference of the Urban and Regional Information Systems Association (Pomona, N.J.: Management Sciences, Stockton State College); 1975.
2. For further information contact Directorate for Science, Technology and Industry, OECD, Paris, France.
3. A symposium entitled Information Technology and Urban Governance is scheduled for the Conference Centre, Ottawa, in February of 1976. One of its objectives is to "Ascertain and subject to critical debate philosophies and methodologies underlying the evolution of information technology as a component of urban governance."
4. For an insightful and provocative discourse on this and related technological concerns, see Ivan Illich, Tools for Conviviality (New York: Harper and Row, 1973).
5. Under most institution-based circumstances, computer-assisted cartography would not be treated as something distinct from computer-assisted information systems, but would be considered instead as part of that generic field. They are treated as distinct entities here so as to be in concert with Symposium organizers who had automated cartography as their focus, and who sought relationships between auto-carto and urban information systems, uses of color, map reading, land use mapping, etc.
6. Details on this topic are provided by the International City Managers Association (ICMA), the International Union of Local Authorities (IULA), journals such as Public Administration Review, Proceedings of the Urban and Regional Information Systems Association, and, of course, governments at the Municipal, Provincial/State, and Federal levels.
7. For further discussion along these lines see B. Wellar and L. Lavallee, "A Methodology for Selecting R & D Studies in a Policy Oriented Organization," Computers, Local Government and Productivity. (Forthcoming) Papers of the Thirteenth Annual Conference of the Urban and Regional Information Systems Association, Seattle, Washington, 1975. (Pomona, N.J.: Management Sciences, Stockton State College).
8. See, for example, Wellar and Lavallee, op. cit., and A. Saumier and B. Wellar, "Results," Urban and Regional Information Systems: Resources and Results, Volume I Papers from the Twelfth Annual Conference of the Urban and Regional Information Systems Association (C. Davis, J. Rickert, V. Di Matteo, eds.). (Pomona, N. J.: Management Sciences, Stockton State College, 1975) pp. 7-22. Also published as "Results Accruing from Information Systems in Urban and Regional Governments: Contexts, Identification and Measurement, Appreciation." Discussion Paper B74.27. (Ottawa, Canada: Ministry of State for Urban Affairs, 1974).
9. Wellar and Lavallee, op. cit.
10. Peter F. Drucker, The Future of Industrial Man (New York: New American Library, 1970) p. 125.
11. Illich, op. cit., pp. 84-90.