VII.D. Technology for Group Dialogue and Social Choice*

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Introduction

Usually the best way to discuss and resolve the choices that arise within groups of people is face-to-face and personally. For this reason, city planners and educators alike are calling for new kinds of communities for working, living, and learning, based more on familial relationships between people than on contractual relationships. When people get to know one another, conflicts have a way of being accommodated.

Beyond the circle of intimacy the problem of communication is obviously much greater; and while social issues can still be resolved more or less arbitrarily, it is more difficult to resolve them satisfactorily.

The "circle of intimacy" is constrained in its radius. One analyst has estimated that the average person in his lifetime can get to know, on a personal, face-to-face basis, only about seven .hundred people-and surely one can know well only a much smaller number. The precise number is not important: the point is that it is dictated by the limitations of human behavior and is not greatly affected by urban population growth, by speed of transportation and communication, by affluence, or by any other technologically induced change in the human condition.

Indeed, these changes underlie the problem As we know it. Although the number of people with whom we have intimate face-to-face communication during a lifetime remains constant, we are in close proximity to more and more people.

We are, moreover, a great deal more dependent on one another than we used to be when American society was largely agrarian. We are all committed together in planning and paying for highways and welfare. We pollute each other's water and air. We share the risks and the costs of our military-industrial complex and the foreign policy which it serves. Technology, while aggravating the selfishly independent consumption of common resources, has made communications beyond the circle of intimacy both more awkward and more urgent.

Beyond the circle of intimacy, what kind of communications make sense? Surely most of us do not demand personal interactions with "all those other people." Yet in order to participate realistically in the decisions of industry and commerce, and in government programs to aid and regulate the processes which affect us intimately, we as citizens need to communicate with and understand the whole cross-section of other citizens.

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Does technology help us in this? Can it help us do it better? We may now dial on the telephone practically anywhere in the world, to hear and be heard with relatively high fidelity and convenience. We may watch on our television sets news as it breaks around the world and observe our President as though he were in our living room. We can communicate individually with great flexibility; and at our own convenience we can be spectators en masse to important events.

But effective governance in a democracy requires more than this. It requires that citizens, in various ways and with respect to various public issues, can make their preferences known quickly and conveniently to those in power. We now have available two obvious channels for such "citizen feedback." First, we go to the polls roughly once a year and vote for a slate of candidates; second, we write letters to our elected representatives.

There are other channels by which we make our feelings known, of course - by purchasing power, by protest, etc. But the average citizen wields relatively . little influence on his government in these latter ways. In terms of effective information transmitted per unit time, none of the presently available channels of citizen feedback rivals the flow from the centers of power outward to the citizens via television and the press.

What is it that stands in the way of using technology for greater public participation in the important compromise decisions of government, such as whether we build a certain weapon, or an S.S.T., or what taxes we should pay to fund what federal program, or where the law should draw the line which may limit one person's freedom in order to maintain that of others?

Somehow in an earlier day decisions were simpler and could involve fewer people-especially when it came to the use of technology. If the problem was to span a river and if materials and the skills were available, you went ahead and built the bridge. It would be good for everyone. Thus with other blessings of technology. There seemed little question that higher-capacity machines of production or more sophisticated weapons were inherently better. There seemed to be an infinite supply of air, water, land, minerals, and energy. Today, by contrast, every modern government policy decision is in effect a compromise-and the advantages and disadvantages have to be weighed not only in terms of their benefits and costs for the present clientele, but also for future generations. We are interdependent not only in space but in time.

Such complex resource-allocation and benefit-cost problems have been attacked by the whole gamut of mathematical and simulation tools of operations research. But these "objective" techniques ultimately depend upon subjective value criteria-which are valid only so far as there are effective communication procedures by which people can specify their values in useful form.

The Formal Social Choice Problem

The long-run prospects are bright, I think, that new technology can play a major role in bringing the citizenry together; individually or in small groups, communicating and participating in decisions, not only to help the decision makers but also for the purpose of educating themselves and each other. Hardware in itself is not the principal hurdle.

No new breakthroughs are required. What is needed, rather, is a concerted effort in applying present technology to a very classical problem of economics and politics called "social choice" - the problem of how two or more people can communicate, compare values or preferences on a common scale, and come to a common judgment or preference ordering.

Even when we are brought together in a meeting room it is often very awkward to carry on meaningful communication due to lack of shared assumptions, fear of losing anonymity or fear of seeming inarticulate, etc. Therefore, a few excitable or most articulate persons may have the floor to themselves while others, who have equally intense feelings or depth of knowledge on the subject, may go away from the meeting having had little or no influence.

It is when we consider the electronic digital computer that the major contributions of technology to social choice and citizen feedback are foreseen. Given the computer, with a relatively simple independent data channel to each participant, one can collect individual responses from all participants and show anyone the important features of the aggregate-and do this, for practical purposes, instantaneously.

Much of technology for such a system exists today. What is needed is thoughtful design-with emphasis on how the machine and the people interact: the way questions are posed to the group participants; the design of response languages which are flexible enough so that each participant can "say" (encode) his reaction to a given question in that language, yet simple enough for the computer to read and analyze; and the design of displays which show the "interesting features" or "pertinent statistics" of the response data aggregate.

This task will require an admixture of experimental psychology and systems engineering. It will be highly empirical, in the same way that the related field of computer-aided learning is highly empirical.

The central question is, how can we establish scales of value which are mutually commensurable among different people? Many of the ancient philosophers wrote about this problem. The Englishmen Jeremy Bentham and John Stuart Mill first developed the idea of "utility" as a yardstick which could compare different kinds of things and events for the *same person.* More recently the American mathematician Von Neumann added the idea that not only is the worth of an event proportional to its utility, but that of an unanticipated event is proportional also to the probability that it will happen [1]. This simple idea created a giant step in mathematically evaluating combinations of events with differing utilities and differing probabilities-but again for a single person.

The recent history of comparing values for *different people* has been a discouraging one-primarily because of a landmark contribution by economist Kenneth Arrow [2]. He showed that, if you know how each of a set of individuals orders his preferences among alternatives, there is no procedure which is fair and will always work by which, from these data, the group as a whole may order its preferences (i.e., determine a "social choice"). In essence he made four seemingly fair and reasonable assumptions: (1) the social ordering of preferences is to be based on the individual orderings; (2) there is no "dictator" whom everyone imitates; (3) if every individual prefers alternative A to alternative *B,* the society will also prefer A to *B;* and, (4) if A and *B* are on the list of alternatives to be ordered, it is irrelevant how people feel about

some alternative C, which is not on the list, relative to A and *B.* Starting from these assumptions, he showed (mathematically) that there is no single consistent procedure for ordering alternatives for the group which will always satisfy the assumptions.

A number of other theoreticians in the area have challenged Arrow's theorem in various ways, particularly through challenging the "independence of irrelevant alternatives" assumption. The point here is that things are never evaluated in a vacuum but clearly are evaluated in the context of circumstance. A further charge is a pragmatic one: while Arrow proves inconsistencies can occur, in the great majority of cases likely to be encountered in the real world they would not occur, and if they did they probably would be of minor significance.

There are many other complicating factors in social choice, most of which have not been, and perhaps cannot be, dealt with in the systematic manner of Arrow's "impossibility theorem"[2]. For example, there is the very fundamental question of whether the individual parties involved in a group-choice exercise will communicate their true feelings and indicate their uncertainties, or whether they will falsify their feelings so as to gain the best advantage for themselves.

Further difficulties arise when we try to include in the treatment the effects of differences among the participants along the lines of intensity-of-feelings vs. apathy, or knowledge vs. ignorance, or "extended-sympathy" vs. selfishness, or partial vs. complete truthfulness; yet these are just the features of the social-choice problem as we find it in practice.

To take as an ultimate goal the precise statement of social welfare in mathematical terms is, of course, nonsense. The differing experiences of individuals (and consequently differing assumptions) ensure that commensurability of values will never be complete. But this difficulty by no means relieves us of the obligation to seek value-commensurability and to see how far we can go in the quantitative assessment of utility. By making our values more explicit to one another we also make them more explicit to ourselves.

Potential Contributions of Electronics

Electronic media notwithstanding, none of the newer means of communication yet does what a direct face-to-face group meeting (town meeting, class bull session) does-that is, permit each participant to observe the feelings and gestures, the verbal expressions of approval or disapproval, or the apathetic silence-which may accompany any proposal or statement. As a group meeting gets larger, observation of how others feel becomes more and more difficult; and no generally available technology helps much. Telephone conference calls, for example, while permitting a number of people to speak and be heard by all, are painfully awkward and slow and permit no observation of others' reaction to any given speaker. The new Picture-Phone will eventually permit the participants in a teleconference to see one another; but experiments with an automatic system which switches everyone's screen to the person who is talking reveals that this is precisely what is not wanted - teleconferees would like most to observe the facial expressions of the various conferees who are not talking!

One can imagine a computer-aided feedback-and-participation system taking a variety of forms:

(1) A radio talk show or a television "issue" program may wish to enhance its audience participation by listener or viewer votes, collected from each participant and fed to a computer. Voters may be in the studio with electronic voting boxes or at home where they render their vote by calling a special telephone number. The NET "Advocates" program has demonstrated both.

(2) Public hearings or town meetings may wish to find out how the citizenry feel about proposed new legislation-who have intense feelings, who , are apathetic, who are educated to the facts and who are ignorant-and correlate these responses with each other and with demographic data which participants may be asked to volunteer. Such a meeting could be held in the town assembly hall, with a simple pushbutton console wired to each seat.

(3) Several P.T.A.s or alternatively several eighth grades in the town may wish to sponsor a feed-back meeting on sex education, drugs, or some other subject where truthfulness is highly in order but anonymity may be desired. Classrooms at several different schools could be tied together by rented "dedicated" telephone lines for the duration of the session.

(4) A committee chairman or manager or salesman wishes to present some propositions and poll his committee members, sales representatives, etc., who may be stationed at telephone consoles in widely separated locations, or may be seated before special intercom consoles in their own offices (which could operate entirely independently of the telephone system).

(5) A group of technical experts might be called upon to render probability estimates about some scientific diagnosis or future event which is amenable to before-the-fact analysis. This process may be repeated, where with each repetition the distribution of estimates is revealed to all participants and possibly the participants may challenge one another. This process has been called the "Delphi Technique" after the oracle, and has been the subject of experiments by the Rand Corporation and the Institute for the Future, [3] and by the University of Illinois [4]. Their experience suggests that on successive interactions even experts tend to change their estimates on the basis of what others believe (and possible new evidence presented during the challenge period).

(6) A duly elected representative in the local, state, or national government could ask his constituency questions and receive their responses. This could be done through radio or television or alternatively could utilize a special van, equipped with a loudspeaker system, a rear-lighted projection/display device, and a number of chairs or benches which could be set up rapidly at street corners prewired with voter-response boxes and a small computer.

These examples point up one very important aspect of such citizen feedback or response-aggregation systems: that is, that they can *educate and involve* the participants without the necessity that the responses formally determine a decision. Indeed the teaching-learning function may be the most important. It demands careful attention to how questions are posed and presented, what operations are performed by the computer on the aggregated votes and what operations are left out, how the results

are displayed, and what opportunity there is for further voting and recycling on the same and related questions.

Some skeptics feel that further technocratic invasion of participatory democracy should be prevented rather than facilitated-that the whole idea of the "computerized referendum" is anathema, and that the forces of repression will eventually gain control of any such system. They could be correct, for the system clearly presupposes competence and fairness in phrasing the questions and designing the alternative responses.

But my own fear is different. It is that, propelled by the increasing availability of glamorous technology and spurred on by hardware hucksters and panacea pushers, the community will be caught with its pilot experiments incomplete or never done.

The Steps in a Group Feedback Session

Seven formal steps are involved in a technologically aided interchange of views on a social-choice question:

(1) The leader states the problem, specifies the question, and describes the response alternatives from which respondents are to choose.
(2) The leader (or automated components of the system) explains what respondents must do in order to communicate their responses (including, perhaps, their degree of understanding of the question, strength of feeling, and subjective assessment of probabilities).
(3) The respondents set into their voting boxes their coded responses to the questions.
(4) The computer interrogates the voting boxes and aggregates the response data
(5) Preselected features of this response-aggregate are displayed to all parties.
(6) The leader or respondents may request display of additional features of the response-aggregate, or may volunteer corrections or additional information.
(7) Based upon an a priori program, on previous results and/or on requests from respondents, the leader poses a new problem or question, re-starting the cycle from Step 1.

The first step is easily the most important-and also the most difficult. Clearly the participant must understand at the outset something of the background to any specific question he is asked, he must understand the question itself in nonambiguous terms, and he must understand the meaning of the answers or response alternatives he is offered. This step is essentially the same as is faced by the designer of any multiple-choice test or poll, except that there is the possibility that a much richer language of response can be made available than is usually the case in machine-graded tests. Allowed responses may include not only the selection of an alternative answer, but also: an indication of intensity of feeling, estimates of the relative probability or importance of some event in comparison with a standard, specification =of numbers (e.g., allowable cost) over a large range, and simple expressions of approval ("yea!") or disapproval ("boo!").

The leader may have to explain certain subtleties of voting, such as whether participants will be assumed to be voting altruistically (what I think is best' for everyone) or selfishly (what I think is best for me alone, me and my family, etc.). Further, he may wish respondents to play roles other than themselves (if you were a person under certain specified circumstances, how would you vote?).

He may also wish to correlate the answers with informedness. He may do this by requesting those who do not know the answer to some test question to refrain from voting, or he can pose the knowledge test question before or after the issue question and let the computer make the correlation for him.

Ensuring the participants "play fair," own up to their uncertainties, vote as they really feel, vote altruistically if asked, and so on, is extremely difficult. Some may always regard their participation in such social interaction as an advocacy game, where the purpose is to "win for their side."

The next two steps raise the question of what equipment the voter will have for communicating his responses. At the extreme of simplicity a single on-off switch generates a response code which is easily interpreted by the computer, but limiting to the user. At the other extreme, if responses were to consist of natural English sentences typed on a conventional teletypewriter-which would certainly allow great flexibility and variety in response-the computer would have no basis for aggregating and analyzing responses on a commensurate basis (other than such procedures as counting key words). Clearly something in between is called for; for example, a voting box might consist of ten on-off switches to use in various combinations, plus one to indicate "ready," plus one "intensity" knob.

An unresolved question concerns how complex a "single question can be. If the question is too simple, the responses will not be worth collecting and will provide little useful feedback. If too complex, encoding the responses will be too difficult. The ten switches of the voting box suggested above would have the potential (considering all combinations of on and off) for 2^{10}=1024 alternatives but that is clearly too many for the useful answers to any one question.

It is probably a good idea, for most questions, to have some response categories to indicate "understand question but am undecided among alternatives" or "understand question and protest available alternatives" or simply "don't understand the question or procedures," three quite different responses. If a respondent is being pressured by a time constraint, which may be a practical necessity to keep the process functioning smoothly, he may want to be able to say, "I don't have time to reach a decision"; this could easily be indicated if he simply fails to set the "done" switch. Some arrangement for "I object to the questions and therefore won't answer" would also be useful as a guide to subsequent operations and may also subsume some of the above "don't understand" categories. Figure 1 indicates various categories of response for a six-switch console.

The fourth step, in which the computer samples the voting boxes and stores the data, is straightforward as regards tallying the number of votes in each category and computing simple statistics. But extracting meaning from the data requires that someone should have laid down criteria for what is interesting; this might be done either prior to or during the session by a trained analyst.

Identification of self (note: if one of 1, 2, 3 not switched assume unregistered or other party; if one of 4, 5, 6 assume other or none)		1) Republican 2) Democrat 3) Independent 4) Protestant 5) Catholic 6) Jew
Expressions of feeling and experience		1) Am intensely interested 2) Am mildly interested 3) Am uninterested 4) Daily experience 5) Occasional experience 6) No experience
Four numerical categories Two administrative categories		1) Less than 10% 2) 10 to 30% 3) 30 to 60% 4) Greater than 60% 5) Don't know 6) Don't understand
Three alternatives plus Three administrative categories		1) I want plan 1 2) I want plan 2 3) I want plan 3 4) Undecided as to plans 5) Object to available plans 6) Confused by procedure
Rank ordering of three alternatives, A, B, C	first choice	1) A 2) B 3) C
	second choice	4) A 5) B 6) C
Response ↄ interpersonal communication of actors	as to	1) Miss Adams 2) Colonel Baker 3) Doctor Crank
	I	4) Agree 5) Disagree 6) Am bored

To select one of 8 on each of two questions

(dots under your answer indicate switches to be thrown)

	A	B	C	D	E	F	G	H
Question 1 1)					·	·	·	·
Question 1 2)		·	·				·	·
Question 1 3)	·		·		·			·
Question 2 4)					·	·	·	·
Question 2 5)		·	·				·	·
Question 2 6)	·		·		·			

Fig. 1. Sample categories of response for a six-switch console.

It is at this point that certain perils of citizen-feedback systems arise, for the analyst could (either unwittingly or deliberately) distort the interpretation of the voting data by the criteria he selects for computer analysis and display. Though there has been much research on voting behavior and on methods of analyzing voting statistics, instantaneous feedback and recycling pose many new research challenges.

That each man's vote is equally important on each question is a bit of lore that both political scientists and politicians have long since discounted-at least in the sense that voters naturally feel more intensely about some issues than about others. One would, therefore, like to permit voters to weight their votes according to the intensity of their feeling. Can fair means be provided?

There are at least two methods. One long-respected procedure in government is bargaining for votes-"1'11 vote with you on this issue if you vote with me on that one." But in the citizen-feedback context, negotiating such bargains does not look easy. A second procedure would be to allocate to each voter, over a set of questions, a fixed number of influence points, say 100; he would indicate the number of points he wished the computer to assign to his vote on each question, until he had used up his quota of 100 points, after which the computer would not accept his vote. (Otherwise, were votes simply weighted by an unconstrained "intensity of feeling" knob, a voter would be rather likely to set the "intensity of feeling" to a maximum and leave it there.)

A variant on the latter is a procedure developed at the University of Arizona [5] wherein a voter ,may assign his 100 points *either* among the ultimate choices *or among the other voters.* Provided each voter assigns *some* weight to at least one ultimate alternative an eventual alternative is selected, in some cases by a rather complex influence of trust and proxy.

Step 5, the display of significant features of the voting data, poses interesting challenges concerning how to convey distributional or statistical ideas to an unsophisticated participant, quickly and unambiguously.

The sixth step provides an opportunity for nonplanned feedback-informal exposition, challenges to the question, challenges to each other's votes, and verbal rebuttal-in other words a chance to break free of the formal constraints for a short time. This is a time when participants can seek to influence the future behavior of the leader-the questions he will ask, the response alternatives he will include, and the way he manages the session.

Experiments in Progress

Experiments to date have been designed to learn as much as possible as quickly as possible from "real" situations. Because the mode of group dialogue discussed above introduces so many new variables, it was believed not expedient to start with controlled laboratory experiments, though gradually we plan to make controlled comparisons on selected experimental conditions. But the initial emphasis has been on plunging into the "real world" and finding out "what works."

Experiments in a Semilaboratory Setting Within the University: In one set of experiments in the Man Machine Systems Laboratory at M.I.T. the group feedback

system consists of fourteen hand-held consoles, each with ten on-off switches, a continuous "adjust" knob and a "done" switch. The consoles are connected by wire to a PDP-8 computer with a scope display output. Closed circuit television permits simulation of a meeting where questions are being posed and results aggregated at some distant point (e.g., a television station in another city) and where respondents may sit together in a single meeting room or may be located all at different places. Various aggregation display programs are available to the discussion leader, the simplest of which is a histogram display indicating how many people have thrown each switch. Other data reduction programs are also available, such as the one described above permitting voters to give a percentage of their votes to' another voter. A variety of small group meetings, seminars and discussions have been held utilizing this equipment.

Two kinds of leadership roles have been tried. The first is where a single leader makes statements and poses questions. Here, among other things, we were concerned with whether respondents, if constrained to express themselves only in terms of the switches, can "stay with it" without too much frustration and can feel that they are part of a conversation. Thus far, for this type of meeting, we have learned the following:

(1) Questions must be stated unambiguously. We learned to appreciate the subtle ways in which natural language feedback permits clarification of questions or propositions. Often the questioner doesn't understand an ambiguity in his statement-where a natural language response from one or two persons chosen at random only for the purpose of clarifying the question is often well worth the time of others, though this by no means obviates the need to have some "I don't understand" or "I object" categories.

(2) The leader should somehow respond to the responses of the voters. If he can predicate his next question or proposition on the audience response to the last one, so much the better. Otherwise he can simply show the audience that indeed he knows how the vote on the last question turned out and freely express his surprise or other reaction. In cases where the leader seemed as though he was not as interested in the response and simply ground through a programmed series of questions, the audience quickly lost interest.

(3) Anonymity can be very important, and, if safe-guarded, permits open "discussion" in areas which otherwise would be taboo. For example, we have conducted sessions on drug use, in which students, faculty, and some total strangers quite freely indicated how often they use certain drugs and where they get them. Such discussions, led unabashedly by students (who knew what and how to phrase the key questions!) resulted in a surprising freedom of response. (We made the rule that voters had to keep their eyes on the display, not on each other's boxes, though a small voting box can easily be held close to the chest ,o obstruct others' view of which switches are being thrown.) It was found especially important, for this kind of topic, not to display any results until all were in.

In the same semilaboratory setting described above we have experimented with a second kind of leadership role. Here two or more people "discuss" or "act" and the audience continuously votes with "yea," "boo," "slow down and explain," "speed up and go on to another topic" type response alternatives. Voters were happy to play this

less direct role but perhaps for a shorter time than in the direct-response role described above. Again it proved of great importance that the central actors indicate that they saw and were interested in how the voters voted.

Experiments with Citizen Group Meetings Using Portable Equipment: As of this writing five group meetings have been conducted in the Massachusetts towns of Stoneham, Natick Manchester, Malden, and Lowell to assist the Massachusetts Department of Education in a program of setting educational goals. In each case cross sections of interested citizens were brought together by invitation of persons in each community to "discuss educational goals." Four similar meetings were conducted with students and teachers at a high school in Newton, Massachusetts. (A similar meeting was also held in a church parlor in Newton to help the members of that church resolve an internal political crisis.) All groups ranged in size from twenty to forty, though at any one time only thirty-two could vote, since but that number of voting boxes have been built.

The portable equipment used for these meetings, held variously in church assembly halls, school classrooms and television studios, features small handheld voting boxes, each with six toggle switches, connected by wire to substations (eight boxes to a substation each of the latter containing digital counting logic) which in turn are series connected in random order to central logic and display hardware. The display regularly used to count votes is a "nixie tube" type display of the six totals (number of persons activating each of the six switches). The meeting moderator, through a three-position switch, can hold the numbers displayed at zero, set it in a free counting mode, or lock the count so that it cannot be altered. A second display, little used as yet, is a motorized bar graph to be used either to display histogram statistics or to provide a running indication of affective judgments such as "agree with speaker," "disagree," "too fast," "too slow," etc.

The typical format for these meetings was as follows. After a very brief introduction to the purpose of the meeting and the voting procedure itself several questions were asked to introduce members of the group to each other (beyond what is obvious from physical appearance), such as education, political affiliation, marital status, etc. An overhead projector has been used in most cases to ask the questions and record the answers and comments (on the gelatin transparency), since, unlike a blackboard, it need not be erased before making a permanent record. Following the introduction, the meetings proceeded through the questions, such as those illustrated by Fig. 2 and those posed by the participants themselves. The categories of "object to question" or "other" were used frequently to solicit difficulties or concerns people had with the question itself-its ambiguity, whether it was fair, etc. Asking persons who voted in prepared categories to identify themselves and state, after the fact, why they voted as they did, was part of the standard procedure. Roughly twenty questions, with discussion, can be handled in 1 1/2 hours.

After the meeting, evaluations by the participants themselves have suggested that the procedure does indeed serve to open up issues, to draw out those who would otherwise not say much, and generally to provide an enjoyable experience-in some cases for three hours' duration.

How are preschool children best prepared for school?	(as school now exists)	(as school should be)
1) lots of parental love	9	11
2) early exposure to books	2	1
3) interaction with other kids	14	8
4) by having natural wonders and esthetic delights pointed out	1	5
5) unsure	4	3
6) object	0	1

Salient comments after vote ("as school now exists" and "as school should be" not part of question then): One man object to "pointed out" in 4), as it emphasized "instruction" rather than "learning." Discussion on this point. Someone else wanted to get at "encouraging curiosity." Another claimed, "That's what question says," and another "discover natural wonders." Consensus: "leave wording as' is." Then a lady violently objected that the vote would be different depending on whether voter was thinking of school as it now existed or as it should be. Others agreed. Two categories added. Above is final vote.

Student attendance should be:	
1) compulsory with firm excuse policy	11
2) compulsory with lenient excuse policy	0
3) voluntary, with students responsible for material missed	12
4) voluntary, with teachers providing all reasonable assistance to pupils who miss class	2
5) unsure	3
6) object	0

Comments centered on the feeling that some subjects require attendance more than others do. (Note the 0 vote on category 2) which is inappropriately self-contradictory.)

Fig. 2. Typical questions and responses from the citizen meetings on educational goals.

Extending the Meeting in Space and Time

The employment of such feedback techniques in conjunction with television and radio media appears quite attractive, but there are some problems.

A major problem concerns the use of telephone networks for feedback. Unfortunately telephone switching systems, as they presently work, do not easily permit some of the functions one would like. For example, one would like a telephone central computer to be able to interrogate, in rapid sequence, a large number of memory buffers (shift registers) attached to individual telephones, using only enough time for a burst of ten or so tone combinations (like touch-tone dial signaling), say about 1/2 second. Alternatively one might like to be able to call a certain number, and, in spite of a temporary busy signal, in a few seconds have the memory buffer

interrogated and read over the telephone line. However, with a little investigation one finds that telephones were designed for random caller to called-party connections, with a busy signal rejecting the calling party from any further consideration and providing no easily employed mechanism for retrieving that calling party once the line is freed.

For this reason, at least for the immediate future, it appears that for a large number (much more than 1,000) to be sampled on a single telephone line in less than fifteen minutes, even for a simple count of busy signals, is not practical.

One tractable approach for the immediate future is to have groups of persons, 100 to 1,000, assembled at various locations watching television screens. Within each meeting room participants vote using hand-held consoles connected by wire to a computer, which itself communicates by telephone to the originating television studio.

Ten or more groups scattered around a city or a nation can create something approaching a valid statistical sample, if statistical validity is important, and within themselves can represent characteristic citizen groups (e.g., Berkeley students, Detroit hardhats, Iowa farmers, etc.) Such an arrangement would easily permit recycling over the national network every few minutes and within any one local meeting room some further feedback and recycling could occur which is not shared with the national network.

Cable television, because of its much higher band width, has the capability for rapid feedback from smaller groups or individuals from their individual homes. For example, even part of the 0-54 MHZ band (considered as the best prospect for return signals [6]) is more than adequate theoretically for all the cable subscribers in a large community, especially in view of time-sharing possibilities.

The above considerations are for extensions in space. We may also consider extensions in time, where a single "program" extends over hours or days and where each problem or question, once presented on television, may wait until slow telephone feedback or even mail returns of an IBM card or newspaper "issue ballot" [7], variety come in.

Development of such systems, fraught with at least as many psychological, sociological, political, and ethical problems as technological ones, will surely have to evolve on the basis of varied experiments and hard experience.

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