THEATRE WORKSHOP

&

SYSTEM RESEARCH

Proposals for a Cybernetic Theatre

Gordon Pask

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1. 1. BACKGROUND DATA

The crux of a Cybernetic Theatre is that its audience should genuinely participate in a play. This possibility of participation is a prerogative of the theatre since any realistic feedback from an audience is prohibited by inherent restrictions in the comparable entertainment media of the Cinema and of Dramatic Television.

Surprisingly enough, little advantage has been taken of this one aspect of the theatre in which the medium stands alone, though it is true enough that a great deal of lip service has been paid to the ideal of a participant audience.

My own thoughts in this matter stem from communication models and chiefly concern methods by which the participation of an audience and the control it exerts upon a performance could be substantially increased. I am fascinated by the consequences of a participant system and the wealth of dramatic situations which can be woven in such a fabric, using one or another of the procedures cited in this discussion.

Joan Littlewood has entertained very similar ideas and has instrumented some of them in theatre workshop. But the limitations imposed by present-day theatrical techniques are severe and consequently her notions have developed in the direction of architecturally novel structures to accommodate a novel form of dramatic activity. In the long run such a telling and considerable innovation has great merit. Its sole disadvantage, perhaps, is lack of short term practicality due to our ignorance of what might be done, our inability to demonstrate what can be done without a very large monetary investment and the fact that public as well as personal financiers avoid venturing their money upon unrealised projects.

It is a sentimental attachment to Roccoco Mausoleums rather than an urge for practicality which drew my notions into the narrower compass of a Cybernetic Theatre that could be realised within a conventional building. At any rate a particular system recently became obvious. Joan Littlewood, Jerry Raffles and I discussed it. A few of its rough edges were knocked off in the process and it flourished into a joint project to be undertaken by Theatre Workshop and System Research.

The physical mechanism of this system is described in 1.5. and the organisation, by way of script and plot structure, in 1.6. In 1.7. some difficulties are dealt with and some potential criticisms are countered. The system, of course, is incomplete and the required experimentation is outlined in 1.8. Before all this, in 1.2., 1.3., and in 1.4., some attempt is made to provide a Cybernetic analysis of the problem that is solved by the system and to demonstrate certain of its predictable characteristics. The latter part of the discussion is more detailed. Thus in 2.1. there is a brief technical specification, in 2.2. and 2.3. a derivation of the proposed physical mechanism and

programming system as the least elaborate that will realise the postulated "abstract organisation" and in 2.4. there is a discussion of scripting procedures. We are in need of sponsorship for this programme and for those in a position to offer sponsorship. A "Financial and organisational statement" has been prepared and is available as a separate document that also contains details of the project schedule.

Briefly, a Cybernetic Theatre involves a couple of innovations.

(1) A physical communication system which is fairly inexpensive and capable of installation in any conventional theatre and

(2) A special procedure, for programming a dramatic performance which involves a number of techniques entailed in plotting and scripting any play that is performed in the Cybernetic Theatre system. Thus existing plays could not be performed in the system though some of them could be modified and adapted for this purpose.

So far as the project is concerned, an initial experimental system (a physical communication system) is being constructed and will be used to determine a number of unknown values required for the efficient realisation of the mechanism. The experimental system will be used informally in Theatre Workshop and will accommodate an invited audience of between 50 and 100 people. Next, it is proposed to build and install a large system accommodating an audience of between 550 and 750 people and to use it for a public presentation. Whereas the informal system will be constructed as cheaply as possible the large system must be reliable and well designed. Even so it is, to some extent, experimental, for an audience of 50 or 100 is not, in any sense, a typical audience and there are many intriguing dramatic problems that can only be solved when a suitable performance has been developed and a large system is available to embody it.

1. 2. INTRODUCTORY COMMENT

When making a Cybernetic analysis of a scientific problem, it is customary to start the discussion with certain axioms or definitions. Although a rigorous axiomatic method is unsuited to the broader applications of Cybernetics, in artistry and dramatic communication, its principles are just as valuable in these fields. Hence, although we all have vague and often dissonant ideas of what we mean by "an actor" or "an audience" or "a play", I propose to start with some loose axioms about these entities.

You may or may not agree with them. If you agree, then the crucial features of the argument can be rationally demonstrated with as much nicety as required. If you disagree in detail, most of the argument will seem plausible, although some of it may not be demonstrable in the strict sense. If you disagree completely, you will accept or reject the system we propose on grounds of taste alone.

1. 3. BASIC AXIOMS

(1) A dramatic presentation like a play, an opera, or a musical show, is built from the thoughts that are voiced and the actions that are displayed by the characters in its cast, when they are placed in the situations determined by its plot.

(2) Most of these situations occur, ostensibly, as the outcome of choices made jointly by the characters. Hence, the presentation involves not only interaction between characters and situations that are predetermined but an interaction between character and character and a further controlling interaction whereby the supposed thoughts of the characters lead to actions which supposedly determine what takes place. But a few situations must always depend upon events that are uninfluenced by the characters. Let us call them structural situations.

(3) An important, but crudely realised, component of most dramatic presentations is auxilliary information, distinguished from the flux of discourse by such gambits as the "soliloquy" and the calculated "aside", which indicates the supposed thinking of some of the characters, (in anticipation of the actions they will later supposedly choose). Since this auxilliary information always describes a state of the actor, we shall call it metainformation.

(4) A theatrical audience is not entirely receptive. At least in this respect an audience which is being entertained differs

from an audience like a lecture audience which (at the worst kind of lecture at any rate) is merely being instructed.

(5) A theatrical audience is not completely passive, in which respect, amongst others, it differs from a Cinema audience or a Television audience. There is a well attested but badly defined "Feedback" whereby the actors can sense the mood of the audience (and play their parts in order to effect it).

(6) Hence, an actor is not an automaton. The point is obvious in rehearsal, when an interpretation of his part is created. It applies with less cogency in actual performance, due to the constraints of the dramatic medium.

In the most restricted case, the plot is fixed and the dialogue is fixed and the actor is allowed to vary only details of emphasis or interpretation, in response to his "feedback" from the audience.

(7) The chief reason for maintaining an utterly invariant dialogue is not aesthetic. It is simply, that the dialogue performs a cueing function that organises the dramatic presentation. If the presentation is constructed and rehearsed to embody other cueing procedures, the dialogue can be rendered correspondingly flexible.

This occurs, of course, when ad lib comments are interpolated or ad lib variations are introduced. The script becomes akin to a comedian's script (which is open to variation chiefly because the comedian acts individually, and need not be concerned too much with organising a composite presentation). In the limit it would be possible to reduce the essentially invariant dialogue to material associated with the structural situations although this is unlikely to be desirable on aesthetic grounds.

(8) Similar comments apply to the plot of a dramatic presentation. There must, of course, be a sequence of structural situations, often engendered by uncontrollable events. But the paths from one structural situation to another could, given adequate methods of organising the performance, depend upon <u>actual</u> rather than <u>supposed</u> choices made by the characters concerned.

(9) A theatrical audience is asked to participate in a dramatic presentation and the presentation is only successful if a measure of participation is achieved.

One prerequisite of participation is that a member of the audience should identify himself with a character (or

occasionally with a group of characters) who acts as his agent in the dramatic situations of the plot. He may, after some experience of the presentation, alter his identification and thus his agent (or group of agents).

(10) Another prerequisite for participation is that a member of the audience should aim to control the thoughts and actions of the character with whom he is identified at a given moment and since thoughts anticipate actions it is obviously necessary for such a participant to receive adequate information from his agent about the actions that are contemplated and the preference that the agent has for one choice or another. This, of course, is the metainformation of (3).

(11) Most dramatic situations are simple and all of them are finite in the sense that the attributes or "dimensions" of a choice are rather few for any character at a given instant (but the "dimensions" of choice may change from situation to situation). Thus, in principle, if a member of the audience actually could control the character with whom he is identified (by conveying suggestions or instructions as in (10), then these suggestions or instructions could be conveyed as a preference ordering over rather few attributes, such as "like or dislike" or "steal the money or do not", the actual name of the relevant attribute on a given occasion depending upon the metainformation of (3) about the thoughts of this character.

(12) A dramatic presentation is thus a control system.

In the first place, actors, playing the parts of given characters, aim to control their audience. Next, any member of the audience aims to control the character with whom he is at the moment identified as in (9), (10) and (11). Finally, the actions of the characters either purport to or, as in (7) and (8), actually do control the sequence of dramatic situations. Since competitive and co-operative interaction takes place between each form of control, the entire system is very elaborate. The crucial point is that this control system is embedded in the organisation of any dramatic presentation although its adequacy may be in doubt and its effectiveness is hampered by arbitrary restrictions. To remove these restrictions would not render a dramatic presentation something other than a dramatic presentation although it might open up the possibility for a novel art form.

1. 4. MAIN CONTENTION

The chief features of a dramatic presentation are its form and the degree of participation it induces. Regarded as vehicles for a control system in which the competitive and co-operative

interplay of participation (on the part of audience and of actors) is taking place, the present methods of dramatic presentation are not very efficient. Further, the inflexibility of dialogue and plot (as normally conceived) unduly restrict the potentially available forms or patterns of events. The remedies for each of these defects turn out to have a great deal in common. So far as participation is concerned, the trouble is that many of the communication pathways we have mentioned exist vestigially, if at all, in real-life conditions. The remedy, in this case, is to provide communication pathways that allow members of the audience to choose agents (with whom they are identified for a certain interval), to know the thinking carried on by these agents in anticipation of the actions they will perform, and to express their preferences in order to determine or influence the chosen action. One essential component of this system must be the provision, in the plot, of real rather than supposed choices so that the influence exerted by members of the audience (upon their chosen agents) can be observed in terms of the outcomes of the joint action of these characters. Amongst a number of other implications this provision entails flexible plot structures with many choice points and a very much richer structure than is customary in the theatre at the moment.

Although it is true that the proposed innovations render a dramatic presentation more flexible, they do not necessarily render it less specific. At a more subtle level it is possible to reinterpret the whole idea of "writing a play". As we shall demonstrate,"writing a play" may come to involve writing a programme akin to a computor programme and writing the "thoughts" of the characters involved over and above the construction of dialogue. But these possibilities will be considered later when we have outlined the technical requirements of our system.

1. 5. TECHNICAL SPECIFICATION

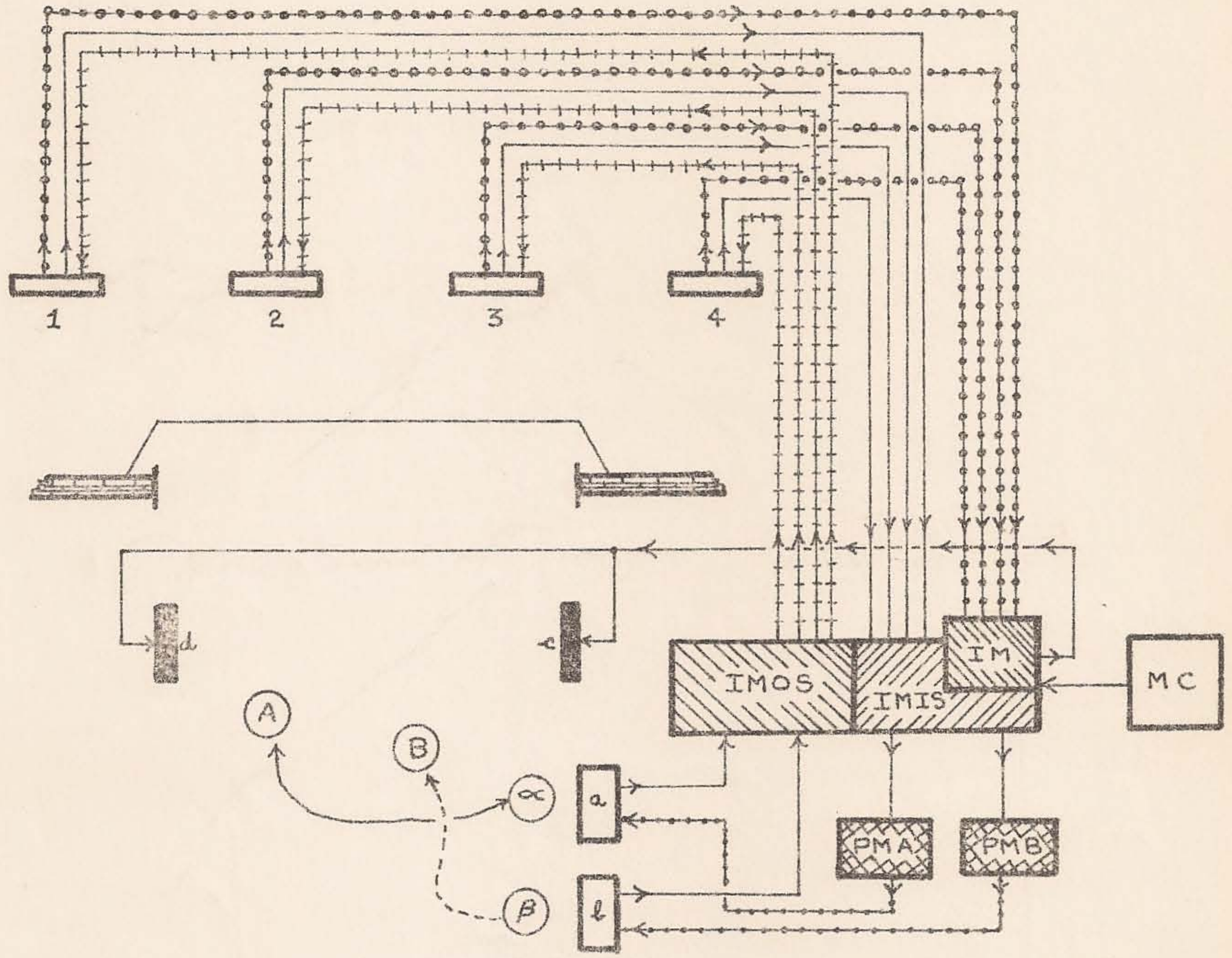
Obviously a number of technical aids are needed in order to establish the "missing" channels of communication. The present proposals constitute a logically minimum system. The proposals are indicated in DIAGRAM 1 which is shown in 2.2. to minimally satisfy axiom (12). In order to satisfy the identification of axiom (9) each member of the audience is provided with a pair of buttons so that he can (on occasions called "identification points" which we shall cite in a moment but which are ten or twenty minutes apart) identify himself with one of a pair of characters A and B (the actual number of alternative characters may be greater but in view of the limited number of leading characters in a real dramatic presentation, the actual number should not exceed four at the most). To satisfy axiom (10) any member of the audience who has chosen to identify himself with character A, so that A is his agent, must receive the metainformation of axiom (3) regarding the thoughts of A. Similarly, any member of the audience who has chosen to identify

himself with character B, so that B is his agent, must receive the metainformation that is available regarding the thoughts of B. This data is delivered through headphones or similar but more convenient earpieces of the kind used in some continuous translation facilities. In DIAGRAM 1 the object labelled "Identification Memory Output Selector" connects the various A identified members of the audience to a source α of A thinking metainformation and the B identified members of this audience to a source β of B thinking metainformation. The object labelled "Identification Memory" retains an image of the identifications achieved by the audience at the last "identification point" in this dramatic presentation. To satisfy axiom (10) the audience must be able to express their preference for one or another possibility of action anticipated by the metainformation they receive. Thus an A identified member of this audience must be able to influence A's choice of action by expressing his preference regarding the data he receives from α and any B identified member of this audience must be able to influence B's choice of action by expressing his preference for the data he is receiving from β. We have made the assumption that one co-ordinate of preference is sufficient (this may be unrealistic but axiom (11) guarantees that only a few co-ordinates are needed). Due to the assumption that one co-ordinate is sufficient each member of the audience is provided with a convenient spring loaded hand lever on which he can represent assent or dissent (it has been found in laboratory experiments that people are prepared to rate situations in this fashion but it may be necessary to alter this response coupling, for example, by providing rating buttons to be pressed or some other readily accepted response selection which soon becomes a matter of habit). In any case the preferences of the A identified audience and the B identified audience are separated by the "Identification Memory Input Selector" and registered in a "Preference Memory" which, <u>unlike</u> the Identification Memory, has a <u>short</u> persistence.

Let us assume that α and β are a couple of people called "interpreters" who have rehearsed with the pair of characters A and B and who are in possession of a metainformation script, probably constructed throughout the rehearsing, which "interprets" A's attitude (in the case of α) to each outcome situation in the plot and B's attitude (in the case of β). Now in this case A is really a composite character of A on the stage and α, his interpreter, in a booth in the wings and B is a composite character of B on the stage and β, his interpreter, in a booth in the wings. In order to satisfy axiom (5), axiom (6), and axiom (7) it is necessary to provide certain information to these composite characters, namely:

(I) To A and α, the location, in the audience, of all the A identified members of this audience, that is, the state of the identification memory

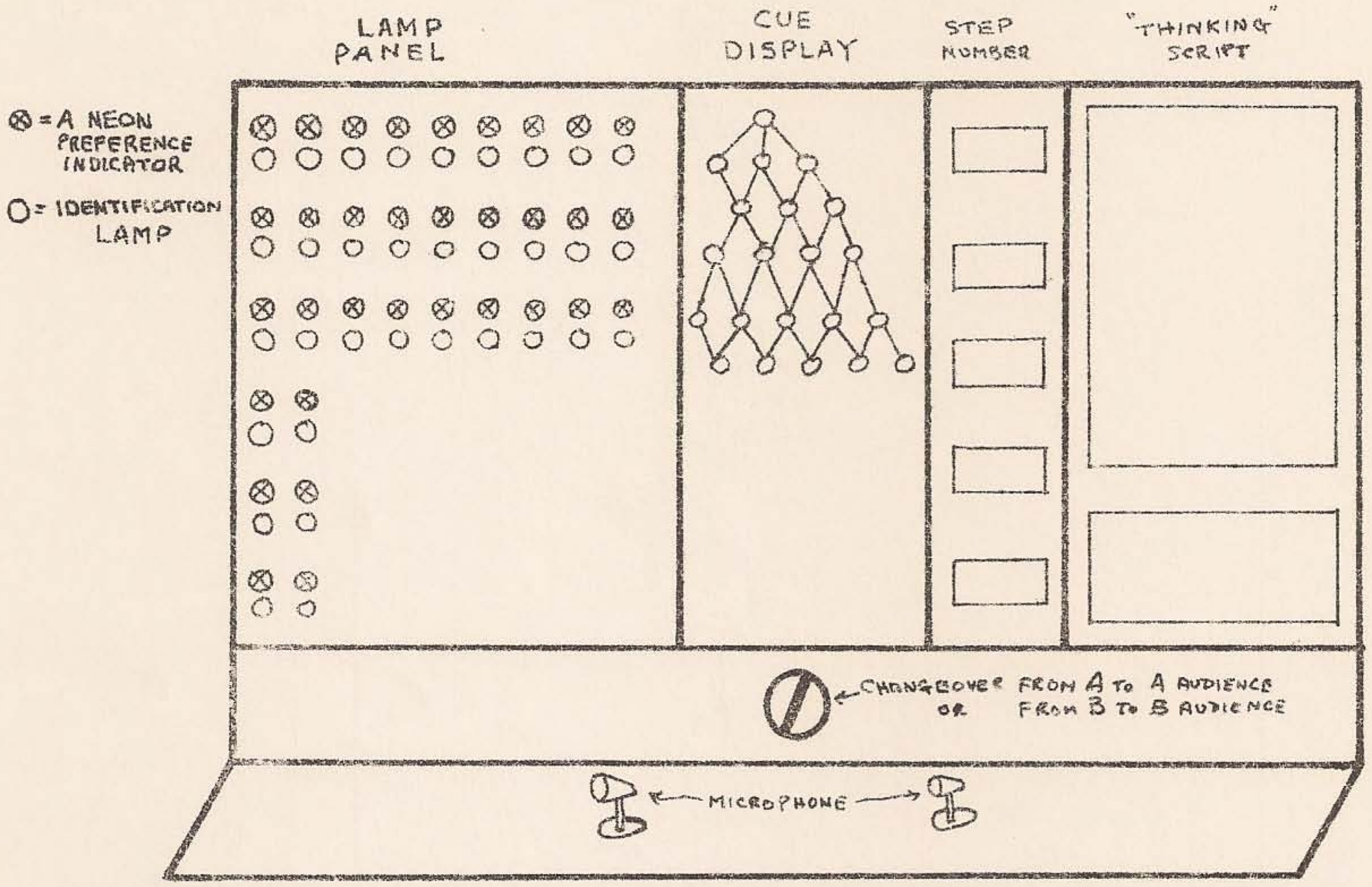
(II) To B and β, the location, in the audience, of all the B identified members of this audience, that is, the state of the identification memory.



1,2,3,4 -- Representative Members of the Audience
IMOS - Identification Memory Output Selector
IMIS - Idnetification Memory Input Selector
IM - Identification Memory
PMA - Preference Memory A
PMB - Preference Memory B
MC - Memory Control and Cueing Programme

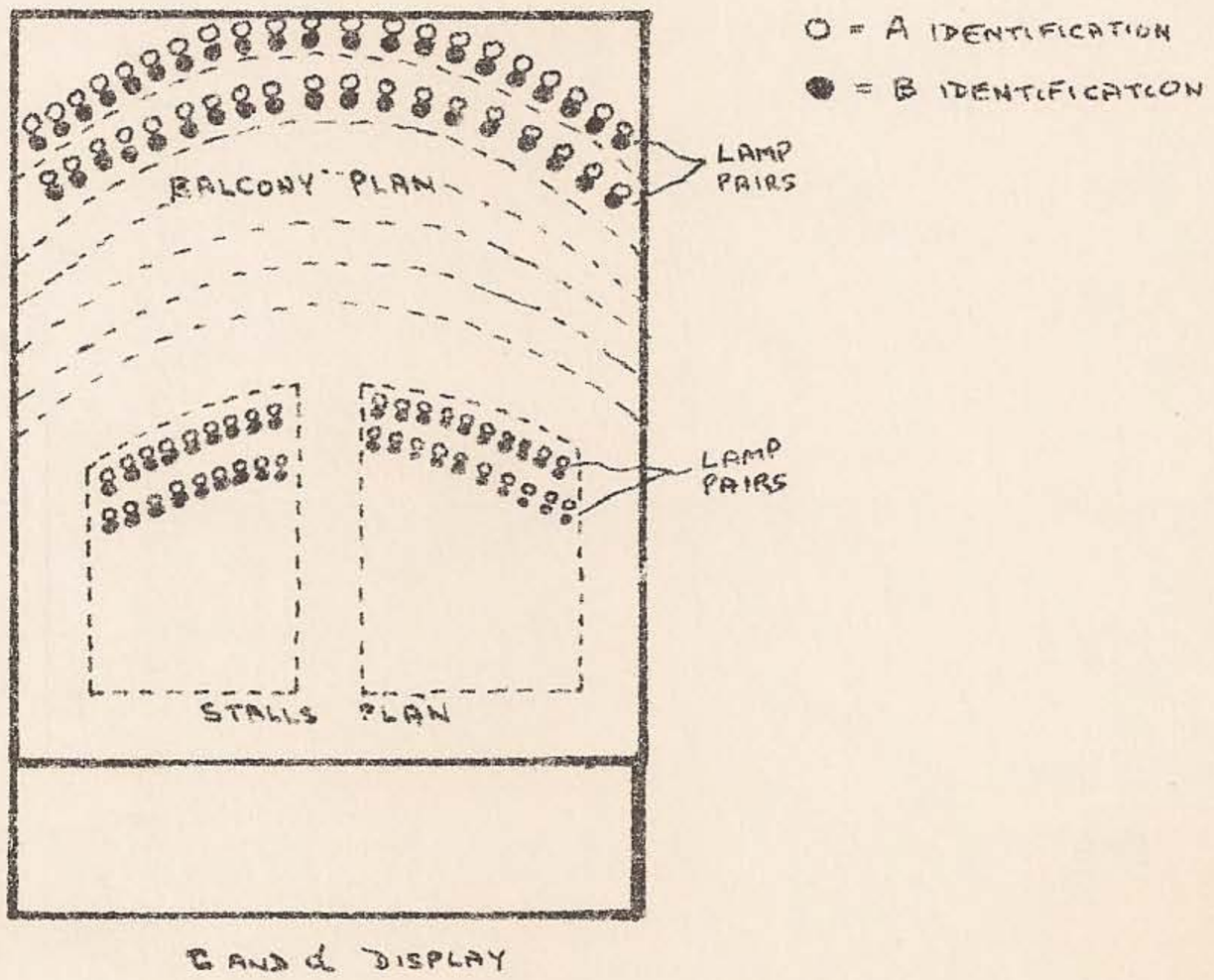
- Identification Input from Audience
- Preference Input from Audience
- Audio Metachannel

DIAGRAM 1.



a AND A DISPLAY

DIAGRAM 2.



B AND b DISPLAY

DIAGRAM 3.

(III) To α, the preferences exhibited by the A audience in response to his metainformation script AND the actions of A, regarding the situations anticipated by the α metainformation script. This amounts to the state of the preference memory.

(IV) To β, the preferences exhibited by the B audience in response to his metainformation script AND the actions of B, regarding the situations anticipated by the β metainformation script.

(V) A coupling between α and A and β and B. This coupling could be of various kinds, for example, it might amount to a few hand signals. It will be convenient to envisage it as a radio link whereby it is possible for α to provide verbal hints to A and for β to provide verbal hints to B regarding the action to be chosen as a result of the preferences exhibited by the A audience to α and by the B audience to β. It seems reasonable to assume a great deal of rapport if α and A and β and B have rehearsed jointly so that their discourse can be practicably terse.

The information cited in (I) and (II) is delivered by the displays labelled d and c and the information in (III) and (IV) by the displays labelled a and b. One form of d and c display is illustrated in DIAGRAM 2 and one form of a and b display (an α and β console in the α and β booth) is illustrated in DIAGRAM 3. The lamps in the stage displays of DIAGRAM 2 deliver "yes or no" signals of different colours. The lamps in the console displays are duplicated. One lamp in each pair indicates that a given position in the audience is A identified and is α's business or B identified and β's business. The A preferences (exhibited by "variable intensity" lamps) are delivered only to α and the B preferences are only delivered to β. In order to satisfy axiom (8) and axiom (7) it is necessary to impose a certain organisation upon the plot and the remaining part of the DIAGRAM 3 display is a cueing facility involved in realising this organisation.

1. 6. STRUCTURAL ORGANISATION

The structural organisation of a dramatic presentation suitable for this system closely resembles the branching programmes used extensively in teaching machines. When such a programme is used for teaching it consists of a sequence of instructional items after each group of which there is a multiple choice test item. The student responds to the multiple choice test item and depending upon his response selection one or another of the available branches of the programme is displayed by the teaching machine. For teaching the selection of a

branch is normally designed to remove misconceptions that the student has made apparent by mistakes in his response selection. The organisation of a typical teaching machine programme is shown in DIAGRAM 4. Also, in DIAGRAM 4, we have relabelled this programme to represent a dramatic presentation in which the possible outcomes depend upon the choices made, at each choice point, by A on the advice of α and by B on the advice of β.

In a real life dramatic presentation, some of the outcomes are determined by the Structural Situations of axiom (8). Thus the initial scene is necessarily always determined by a structural situation. Similarly, in a musical show, most of the songs and all of the large production numbers would be of this calibre. This programme does not, of course, account for the complete organisation of a dramatic presentation but a sufficiently accurate account is provided by the programme in DIAGRAM 5. Given an outcome, say the n-th outcome, the A audience receives metainformation from α and the B audience receives its metainformation from β. The A audience preferences and the B audience preferences are interpreted by α and β to yield advice to A and B who choose amongst the allowed alternatives at the n-th stage in the plot to determine the n+1-th outcome. In DIAGRAM 5 we have shown the set of n+2th outcomes as the end of a scene to indicate the position of an identification point at which members of the audience are allowed to reidentify themselves with the characters. Thus the composition of the A audience and of the B audience is able to change at this instant and when the plot is continued the identification memory will contain an image of the audience choice of identification resulting from their experience up to the n+2th stage in the dramatic presentation.

Now the actual path, or set of outcomes selected, is one of several (how many depends upon the extent of the divergence and convergence used in programming this dramatic presentation). We may, perhaps, assume that A and B will have no real difficulty (each "path" is one "life" they might have led) but α and β are provided with a cueing display that indicates the position reached and the path taken by this performance. This position determines a particular item in the metainformation script and thus tells α what A should be thinking and tells β what B should be thinking. Some comments upon the realisation of such a programme are cited in 2.4. where the issue is discussed in greater detail.

It is true that such an organisation imposes a number of constraints upon the plot, for example, each of the leading characters A and B must be on stage for an appreciable part of the performance and there must be moments, interposed between the choice points, in which the stage dialogue is sufficiently unimportant to allow for receipt of the metainformation. On the other hand the system allows for many possibilities that do not appear in the present medium. Thus the thoughts as well as the speech and actions of a character can be

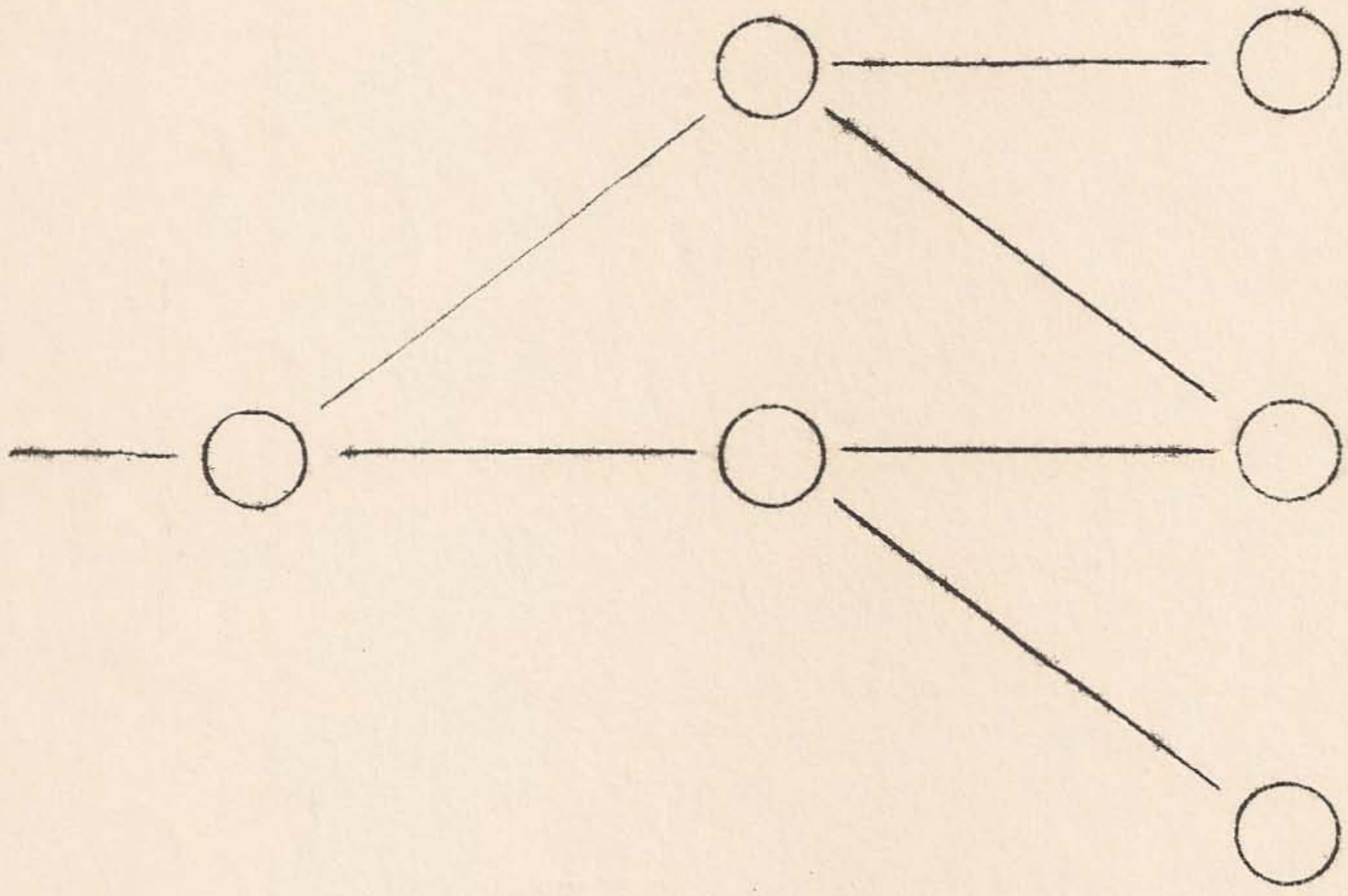


DIAGRAM 4.

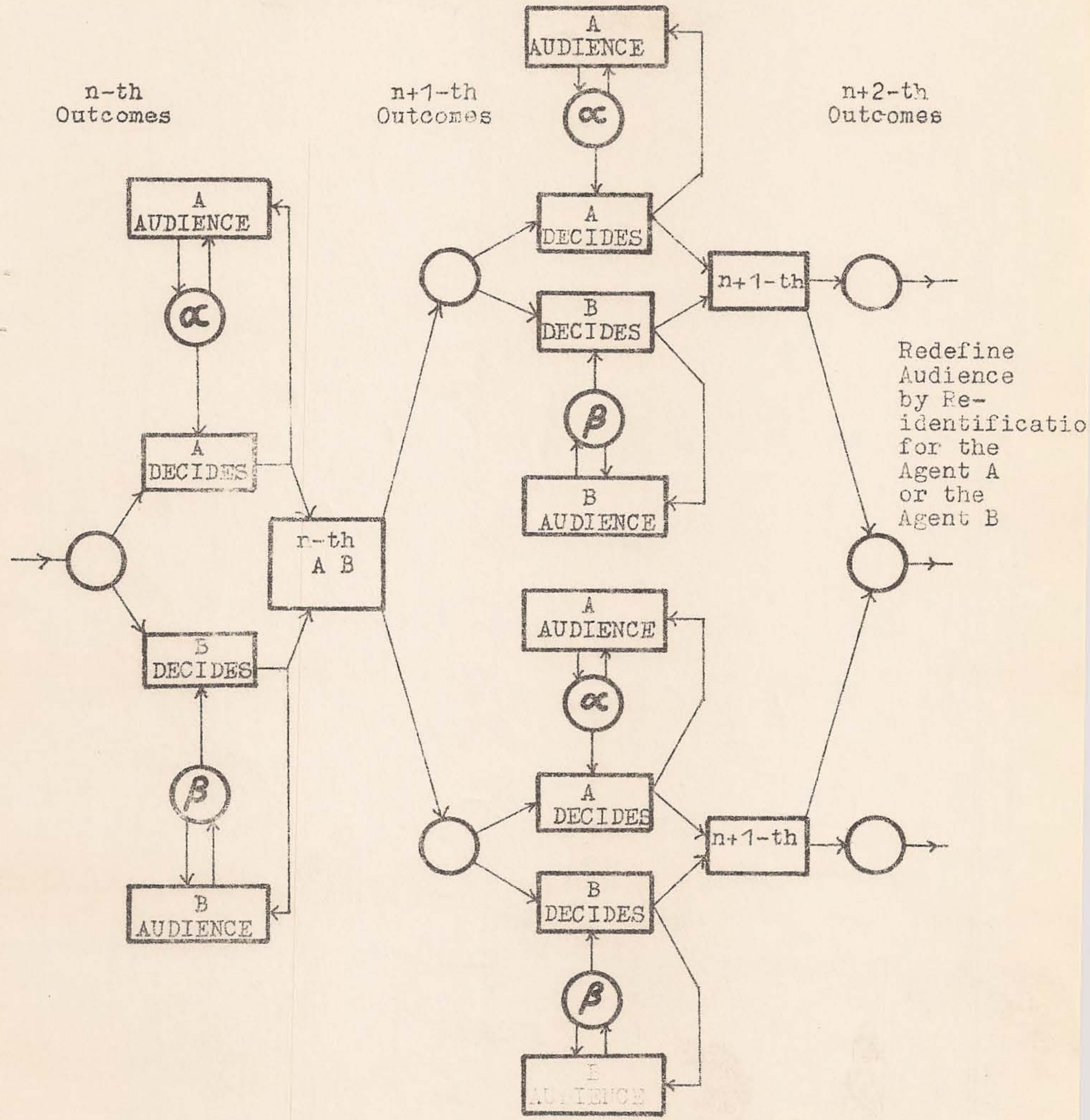

n-th
Outcomes
n+1-th
Outcomes
n+2-th
Outcomes
A
AUDIENCE
α
A
DECIDES
n+1-th
B
DECIDES
β
B
AUDIENCE
Redefine
Audience
by Re-
identificatio
for the
Agent A
or the
Agent B
r-th
A B
A
AUDIENCE
α
A
DECIDES
n+1-th
B
DECIDES
β
B
AUDIENCE

DIAGRAM 5.

scripted. A play may end in one or in several ways, and it is possible to discard the distinction between thought and reality by the expedient of returning to a previously used point in the programme and reinacting the plot from this point onwards, the previous enactment being delegated to the realm of something thought, rather than something done.

1. 7. VARIOUS DIFFICULTIES

There are no real technical difficulties in realising this system. A number of ergonomic points need to be settled (what is the optimum coupling between the audience and the system) and a number of issues of presentation require experiment (how are the audience asked to identify themselves). Further, we know very little about the behaviour of this system. What, for example, is entailed by interpretation. Are the interpreters A and B necessary or could we simply record the metainformation and provide the actors A and B with some index, like the mean value, of the A audience preference or the B audience preference. Again, we know very little about the construction of the dramatic presentation. It may turn out to be desirable to maintain certain relationships amongst the audience. Suppose, for example, it was found experimentally that an audience in which at any instant there were 50% A identified members and the other 50% B identified members was, on average, taking greater pleasure than an audience characterised by any other distribution of identification. In this case it would be reasonable to compute the ratio of A identified and B identified audience and, if its value departed appreciably from 50% and 50% to modify the action of the play in order to stabilise the ratio at its optimum value. We certainly anticipate control procedures of this kind and regard their specification as part of the complete programme for a dramatic presentation. However, considerable experimentation is needed, to discover the most profitable control procedures to carry out.

The most serious difficulties have been raised regarding the capacity and the compatibility of the feedback channels and fortunately any objections on these grounds can be countered without experimentation.

Regarding capacity it can be plausibly argued that about 2 minutes is occupied in a "step" in the dramatic presentation, this "step" involving the choice of some outcome, presentation of metainformation dialogue and action, interpretation of a response from the audience, and choice of a further action and further dialogue leading to the next outcome in the plot. This figure is a lower bound upon the maximum rate at which a dramatic presentation can ellicit preference decisions from an audience. It is not necessarily true that we should aim to achieve this figure (even though the system aims to maximise participation). But this lower

(its calculation is briefly outlined in 2.3.) indicates that the system should permit a sufficient decision rate to maintain attention and participation since it is considerably above the rate at which people seem to make relevant preference decisions in a conversation.

The issue of compatibility and consequently of relevance is much more involved. We enquire whether a typical member of the audience really feels he is participating. The trouble is that he might participate in many different ways and it is necessary to make certain unrealistic assumptions, as we shall do in 2.3., in order to estimate the chances that participation will be maintained.

In the first place, realistically enough, we shall assume that there are more than five, roughly speaking, equally spaced opportunities for a member of the audience to change his identification and that the first of these occurs after there has been an opportunity to characterise A and B. Next, and on this occasion not so realistically, we assume that on any one occasion, between a pair of identification points, any member of the audience can identify himself with A or B in the sense that he will agree with the decisions actually made by his agent upon 80% of the choice points. It is possible, of course, that A has been chosen in place of B or B in place of A. In fact, it will be necessary to increase the number of characters until this condition applies to an appreciable proportion of a typical audience. On the other hand, with good characterisation, it should not be too difficult to achieve this objective using less than four characters, since we do not require adherence to a given agent, once chosen. We shall assume that agreement with the metainformation will elicit either no response or approval whereas disagreement will elicit definite disapproval. Finally, we assume that a member of the audience is reinforced or motivated to participate if his response apparently induces his agent to behave as he wishes and that disparity between his wishes and the outcomes will lead him to change his identification at the next identification point. Admittedly this kind of behaviour is a little pedestrian and many people will participate in a more experimental or mischevious fashion. But unless there are statistically well defined and concerted attempts to upset the system this should not pose a real problem. The trouble may be with the participant who becomes bored because he does not feel he is participating and influencing his agent and he is passably defined by our pedestrian model. Finally, we assume the least ambitious interpretation procedure, namely that the interpreter advises A to satisfy the majority of the A identified audience and advises B to satisfy the majority of the B identified audience. Hence any member of the A identified audience will agree with his agent if he agrees with the majority of this A identified audience. If he does not agree on 80% of the occasions for choice, by assumption, he will become a member of the B identified audience and, in this case, by assumption there will be 80% agreement.

It is easy to argue that if people in the audience and the characters in the dramatic presentation were consistent there would be a very rapid convergence to a state in which people agreed with their chosen agents. Further there is good evidence that for rather tedious jobs, a degree of confirmation over 80% is sufficient to maintain a certain motivation and rapport.

Fortunately, neither people in the audience nor characters are consistent. Although our choice model may apply, fairly well, over one choice of identification, people undoubtedly become bored and after a couple of scenes of complete (or over 80%) agreement, this tedium is likely to induce experimental reidentification which may either lead to agreement (when this member of the audience can agree with either of A or B) or alternatively to disagreement when he changes back to his original identification at the next available identification point. Hence, if the characters are consistent, agreement can be maintained providing that the interval between identification points is not great enough to trap a member of the audience in a state of voluntarily risked disagreement. By assumption, the length of trapping state, for five identification points and fifty preference choices is ten preference choices and this value is marginal in practice. The actual number of identification points could be increased with advantage but a limit is set by the plot.

When the characters as well as members of the audience change their characteristics in different scenes, the system is very difficult to analyse but its probable pattern of behaviour can be investigated by a computor simulation.

The chief value of all this is to indicate that providing the characters are reasonably akin to people and that a reasonably small number of groups of people in the audience can be placed in mutual agreement on 80% of their preference choices, then these choices will be made about relevant data and the rate of relevant choices is likely to maintain the participant's attention. Certain recommendations (like varying the interval between identification points or replacing the majority interpretation rule, by another) can be made if the system fails to act in a stable fashion. If (for a particular dramatic presentation) none of these recommendations yield a satisfactory result, it may be necessary to introduce feedback in response to <u>preference</u> choices through the <u>metainformation</u> channel before an outcome is determined thus coupling the audience more closely into the system. However, on practical grounds, we are unlikely to run into trouble since a much more favourable picture can be obtained if our rather stringent conditions are relaxed.

1. 8. EXPERIMENTATION NEEDED

A miniature system for 2 characters capable of accepting an audience of between 50 and 100 people is being constructed at the moment and will be used for initial experiments intended to provide detailed design data for a much larger system and some experience in dealing with suitable plots and dialogue. This miniature system is too small to test audience response but it should allow us to settle a number of issues.

(1) Ergonomic investigation of the optimum response mode and auditory metainformation channel. Simple points like whether or not individual volume controls are needed and whether or not various devices are needed to prevent absurd responses.

(2) Perceptual characteristics of the various displays.

(3) Whether α and β are necessary or whether their job could be done by A and B given tape recordings of the metainformation and majority computed interpretation of preference choices conveyed as a signal to A and to B.

(4) If α and β are necessary what decision should be made in interpretation. The majority decision is the least subtle possible, and in some ways is the least likely to prove successful. Nor is there any reason why the form of interpretation should be invariant. It may be possible to programme interpretation to suit the plot.

(5) What kinds of audience "parameter stabilisation" or "control procedure" can be built into the programme of a dramatic presentation (this matter can only be settled in part. for experiments with a large system are necessary in addition).

(6) How is the metainformation script to be written (can we, for example, merely record what the actors A and B say that they are thinking in their rehearsal).

(7) What programming tricks are likely to prove effective.

(8) Roughly speaking, what values must be assigned to parameters like the preference choice rate and the average distance between identification points.

The first realistic system will be designed for 3 or 4 characters and will accept an audience of between 550 and 750 members. Unlike the experimental system, it will have to be reliably engineered. Further, provision must be made for sufficient duplication to overcome any reasonable breakdown. Although this system will serve as a piece of theatrical equipment, it is also, to some degree, experimental because there is a great deal to learn about this medium and a great deal which only can be learned in the realistic conditions provided by a large audience.

2. DETAILED SPECIFICATIONS

2. 1. TECHNICAL EQUIPMENT

Relay circuitry is sufficiently reliable for this application and has many advantages in a system of this kind. Relays provide the identification memory, some of which is physically located in the audience member response boards. The circuitry for a 3 character system is indicated in DIAGRAM 6 and it may be possible to simplify DIAGRAM 6 by a special electromechanical device.

The circuitry for the stage located memory is indicated in DIAGRAM 7. Apart from the common channels, a pair of wires is received from each individual member of the audience, one to sense identification and the other to sense preference choice. The number of wires required by DIAGRAM 7 is fairly large (in the order of 1200 or so) for 550 members of an audience (but this number is well within the bounds of possibility). The programming and cueing arrangement is suggested by DIAGRAM 8 which illustrates one method of organising the system. In DIAGRAM 8 we also indicate certain cueing inputs that have not been mentioned explicitly in the discussion but which are needed in a practical system.

Various devices have been embodied in this design to avoid "illegal" manipulation of the response boards. We assume that "illegal" manipulation is bound to occur either mischievously or by accident.

The wiring itself is all low voltage, low current, and (in the case of the auditory metainformation channels) low impedance. Hence, no great expense or difficulty is likely to be involved. Although plugs and sockets (for attaching the response boards) and similar details have not been depicted, they have been embodied in the cost estimates for the system.

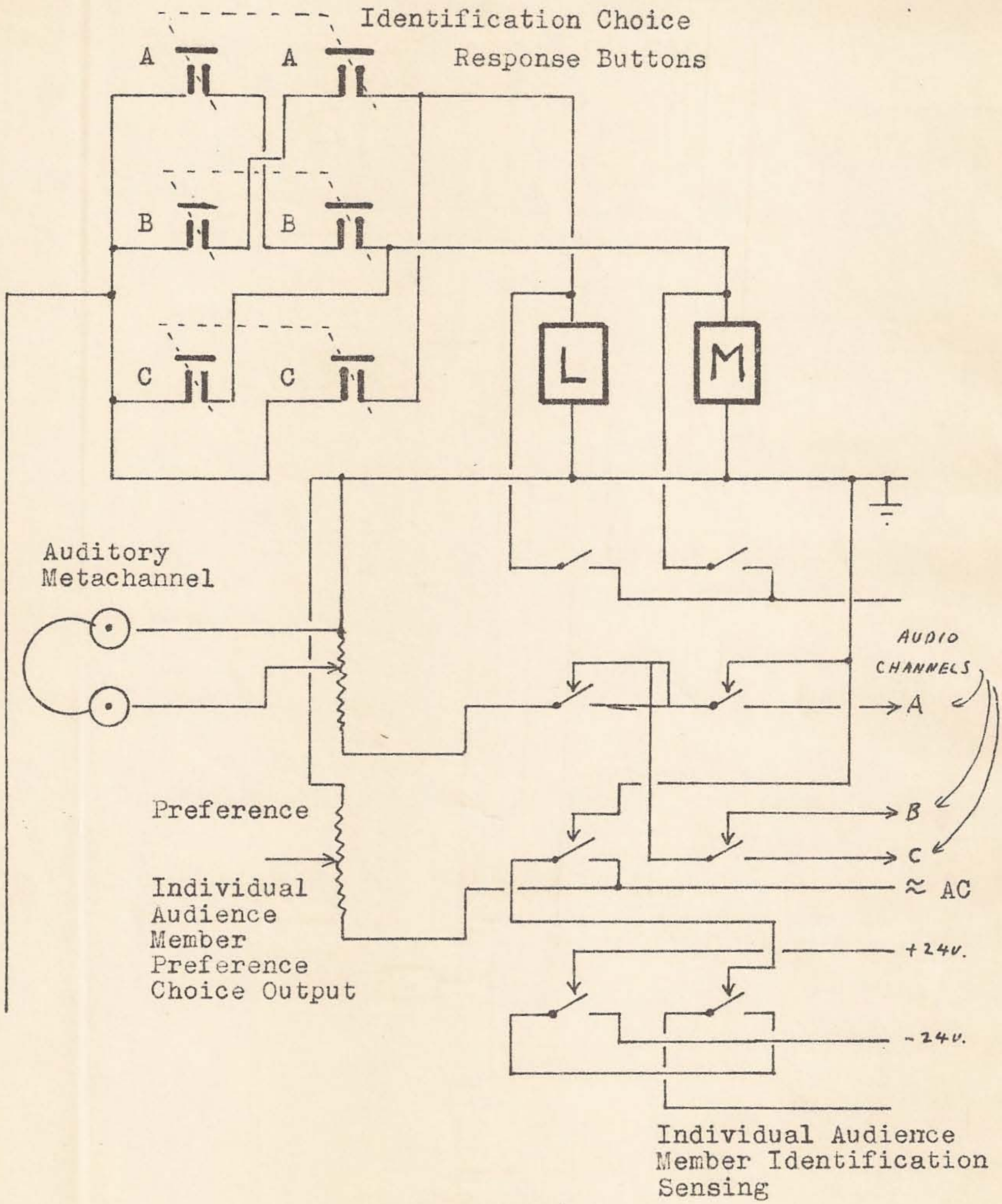

Identification Choice
Response Buttons
A
A
B
B
C
C
L
M
Auditory
Metachannel
AUDIO
CHANNELS
A
B
C
≈ AC
+24v.
-24v.
Preference
Individual
Audience
Member
Preference
Choice Output
Individual Audience
Member Identification
Sensing

DIAGRAM 6.

Preference Displays

→ To No Selection Count

A

B

C

Individual Audience Member Preference Choice Input Channels

Individual Audience Member Identification Input Channels

Start impulse for the Identification Sampling Uniselector Circuit

P

+ 24v.

RELAY P

OSCILLATOR

U

Identification Sampling Uniselector Coil

-24v.

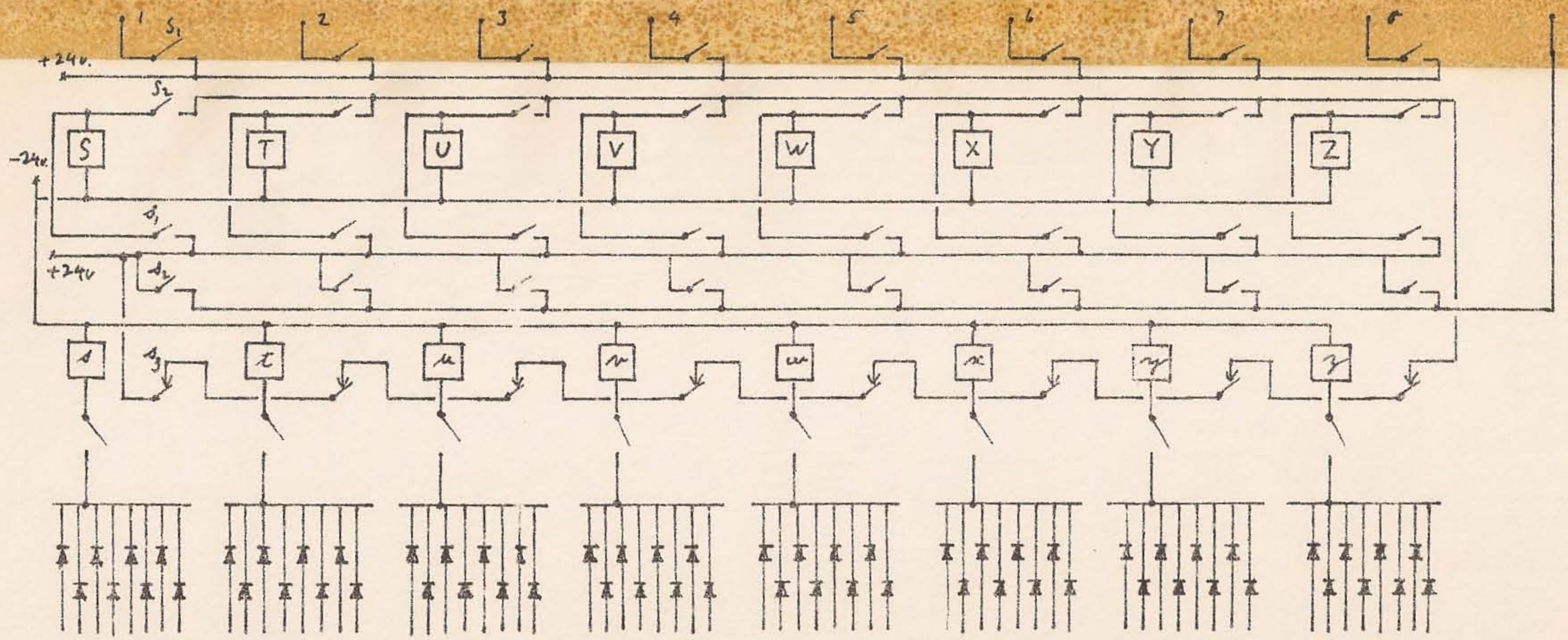
Z

RELAY Z

AMPLIFIER

+ 24v.

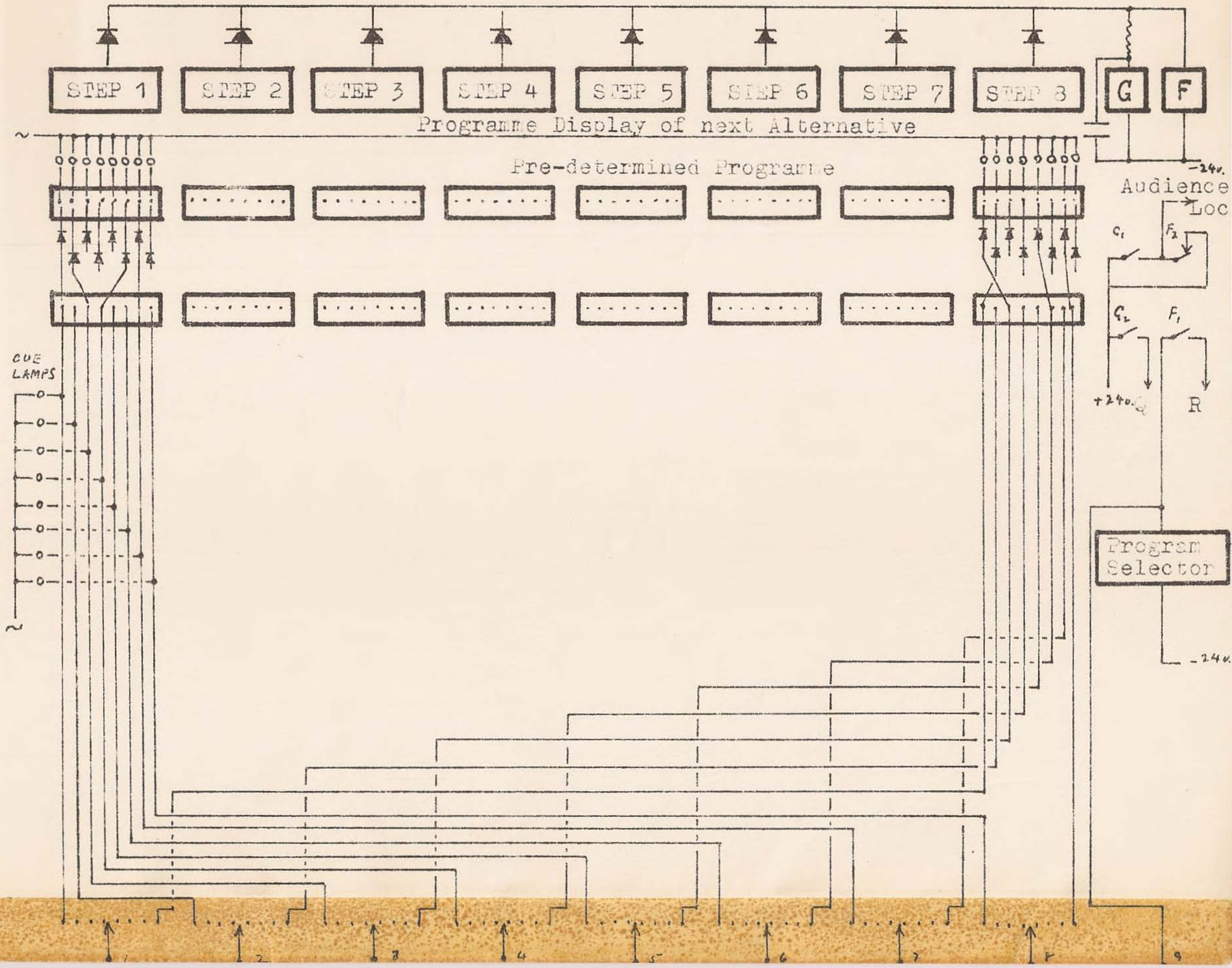
DIAGRAM 7.



To all Steps of Alternative 1

To all Steps of Alternative 8

DIAGRAM 8.


STEP 1
STEP 2
STEP 3
STEP 4
STEP 5
STEP 6
STEP 7
STEP 8
G
F
Programme Display of next Alternative
Pre-determined Programme
-24v.
Audience
Loc
C1
F2
C2
F1
+24v.
R
CUE LAMPS
Program Selector
-24v.
1
2
3
4
5
6
7
8
9

2. 2. MINIMALITY ARGUMENT

We now argue, in rather more detail, that the system indicated in DIAGRAM 1 is a minimal system for the effective practical realisation of Axiom (12). In the first place the feedback of preference choices from members of the audience is required to realise Axiom (5), Axiom (6) and Axiom (11) since it is not difficult to show that the present feedback channels for mood and attitude are unreliable and probably insufficient. Now where should the preference data be delivered? Obviously it must somehow change what goes on in a dramatic presentation and insofar as we take a Cybernetic view of the system, it must have the property of selecting amongst or modifying the form of operators that change the state of the system. This comment would be true of any feedback control or stabilisation procedure. In the case of a dramatic presentation the operators are the actors (in practice, a subset of the set of actors, acting leading characters). Hence this feedback of audience preference must, ultimately, be delivered to these particular actors.

Must there be more than one actor to whom this data is delivered? Suppose, initially, there is only one actor (who somehow receives all the preference data). In this case the dramatic presentation has the form of a monologue. We observe the story of one man through this man's eyes. There is no doubt that an audience can take part in the situation but we stress the fact that the situation is very restrictive indeed. If this is the situation, then it would be possible for the single relevant actor to convey his own thoughts to the entire audience, all of whom would be identified with him. On the other hand one of the restrictions of this situation is that many members of a normal audience would hardly regard him as an agent. They would tend to disagree with many of his actions and would adopt a critical or analytic attitude to his decisions. In Cybernetic terms the inherent competition and tacit co-operation required, by Axiom (12), between distinct factions of an audience sympathising with distinct agents could not form part of the system and would probably not be manifest. Hence, we regard the case of one relevant actor as a special and limiting case.

Next, suppose we have a couple or more relevant actors such as A and B in our previous discussion. In this case it is, by definition, impossible for any member of the audience to simultaneously identify himself with A and B also. For A and B represent distinct characters. Hence, if they were in the same relation (of being identified) to a given member of the audience, this relation would be undefined (in other words A identification would be a different relation to B identification) which is absurd.

Consequently, it is necessary to separate the preference choices from members of the audience who are identified with A and the preference choices from members of this audience who are identified with B. Further, it is necessary to provide a method for establishing this identification.

Need the identification be changed, once that it has been established? In other words, need there be identification points in a dramatic presentation.

Once again, there is a possible limiting case. We can perfectly well conceive a play in which the behaviour of the leading characters is completely consistent and in which this behaviour is exhibited unambiguously in the first part of the play. If so, and if, in addition, the preference choices of the audience are consistent, then it would be possible to offer the audience a single chance for A identification or B identification immediately after the first part of the play and it would be reasonable to assume that they could base their choice upon the evidence of this first part of the play. However, as with the special case of a single leading character the restrictions imposed upon the system are considerable and so far as audience consistency is concerned are unrealistic even if the characters in the play are consistently defined and are exhibited sufficiently at the outset.

In view of this, facilities for change of identification must be provided. We can also argue that they are necessary on the grounds that a coupling between the actors and the audience, as required in Axiom (12), implies a sufficient flux of relevant (or agent directed) choices on the part of the audience. But, unless the actor is a chosen agent (unless the audience choices are relevant) the concept of coupling does not make sense. If the audience is not entirely consistent it will be necessary to allow for reidentification, in order to maintain the relevance of the preference choices, whatever the play may be.

Given different identifications it is, of course, essential to convey the A audience preferences to A and the B audience preferences to B. The interpreters α and β may or may not prove essential components.

Would it be possible to discard the metainformation? Suppose that the individual auditory channels were disconnected. In Cybernetic terms we should achieve the system depicted by DIAGRAM 9 (I) where the connections represent paths or channels along which messages can be conveyed. The audience receives information only as a result of outcomes that are chiefly determined by A and B decisions and which are influenced by their preference choices. By dint of inference, the audience could conceivably work out what

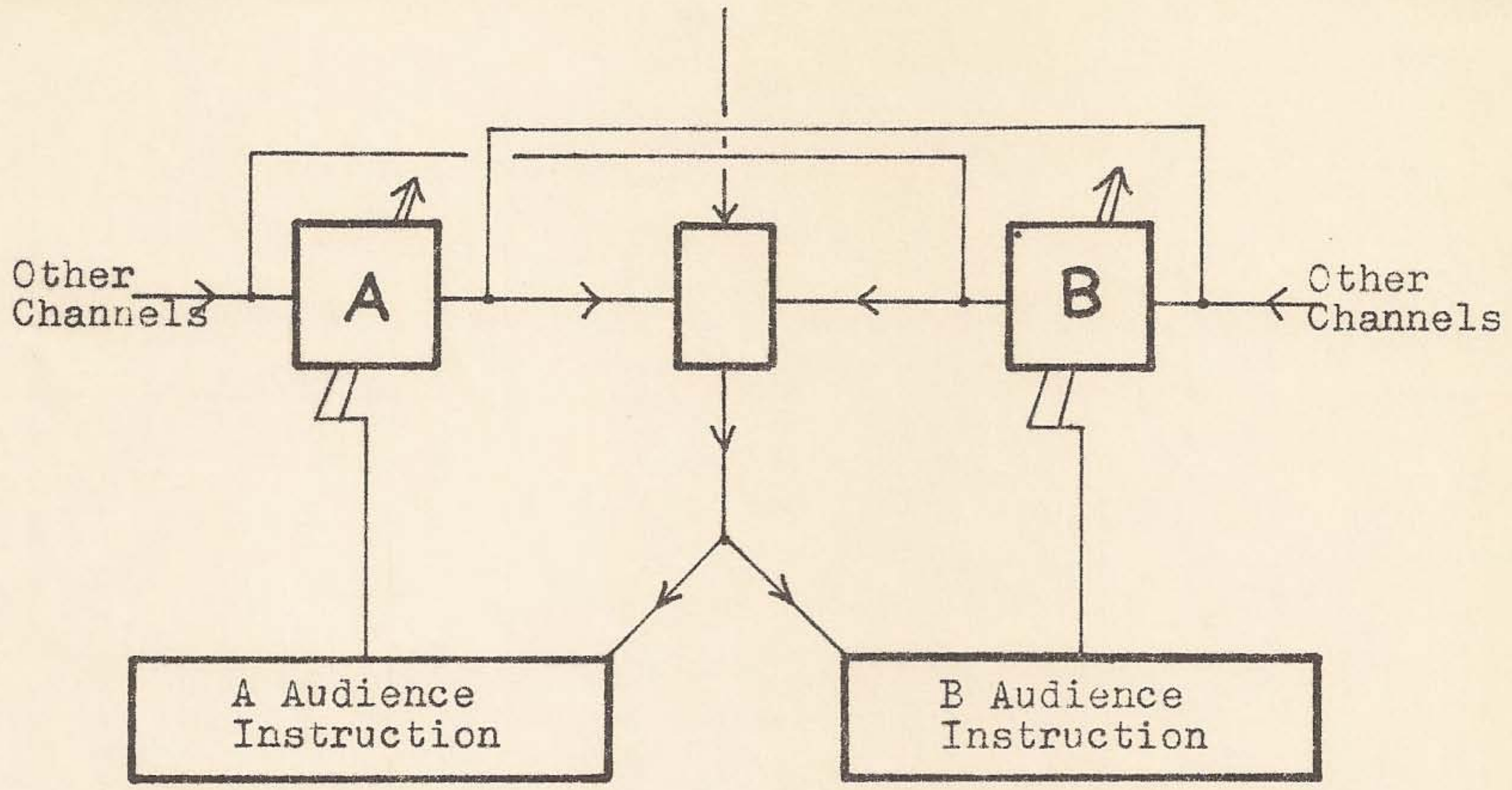


DIAGRAM 9.(I)

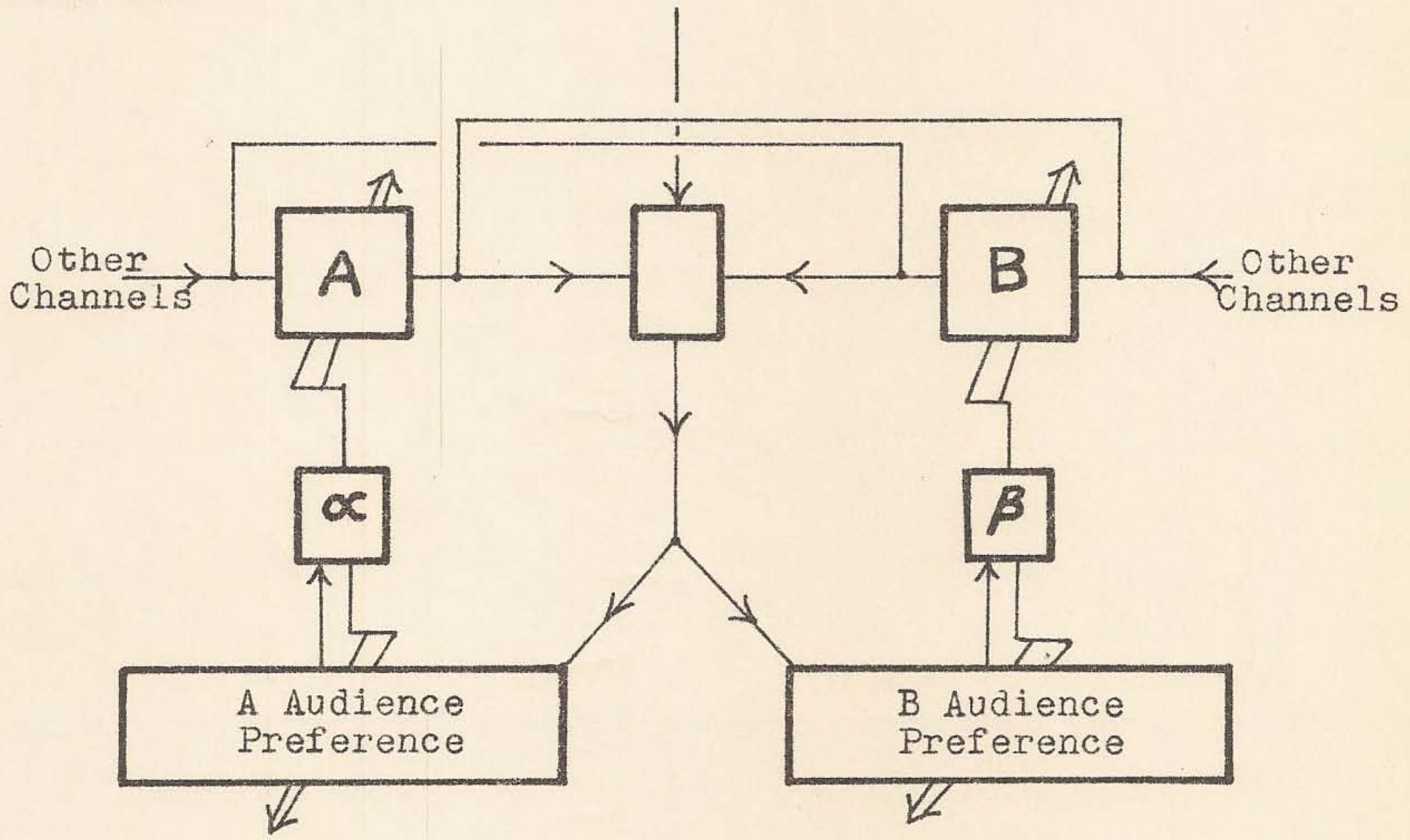


DIAGRAM 9.(II)

influence their preference choices exert (in principle this may be true for an indefinitely long dramatic presentation but except in very odd conditions the inferences required are impracticable). Even if this is possible it is difficult to see how the audience could exert control over their agents unless they were provided with the possibility of conveying much more specific messages (the metainformation, amongst other things, indicates what alternatives of anticipated action are available to be preferred). If there is no metainformation the audience would have to transmit specific instructions rather than preference choices. Consequently a much larger capacity of channel would be required and, apart from the impracticality of providing it, there would be a virtually unsolvable problem associated with the interpretation of the probably discordent instructions received from different members of the identified audience. The fact is that provision of metainformation leads to a degree of coherence because it specifies the choice alternatives and the audience members are not allowed the liberty of delivering any instruction they would like to deliver. Expressing the point in Cybernetic terms we show the instruction system in DIAGRAM 9 (I) where the thick arrows are the conventional image of an operation that changes the characteristics of a subsystem through which the thick arrow passes. We can avoid actually sending instructions (which would be impractical) by the expedient depicted in DIAGRAM 9 (II) which reveals that the metainformation (whatever properties it may have in addition) conveys data about the state of the agent who is the relevant operator. It is also obvious that separate metainformation channels are needed between A and the A audience and B and the B audience, to avoid ambiguity.

Another way of arriving at the same conclusion is to argue that the basic component of an organisation is a control subsystem and that Axiom (12) is only satisfied if a pair of control subsystems "A coupled to A audience" and "B coupled to the B audience" form part of the complete system. It can be shown that subsystems of control are the minimal components in any stable and organised system and it can also be shown that the least elaborate form of a subsystem of control entails one operation that changes the state or characteristics of an operator and one feedback path whereby the state of the operator (in this case the agent) is indicated to whatever is responsible for the state changing operation (in this case the audience identified with this agent).

The trouble is, of course, that a system like this is only realisable if the set of alternatives contemplated by the A audience do correspond to the states and actions of A and similarly if the set of alternatives contemplated by the B audience do correspond to the states and actions of B. If the agent states were well defined at the outset and if the states contemplated by any member of the A audience were invarient and the states contemplated

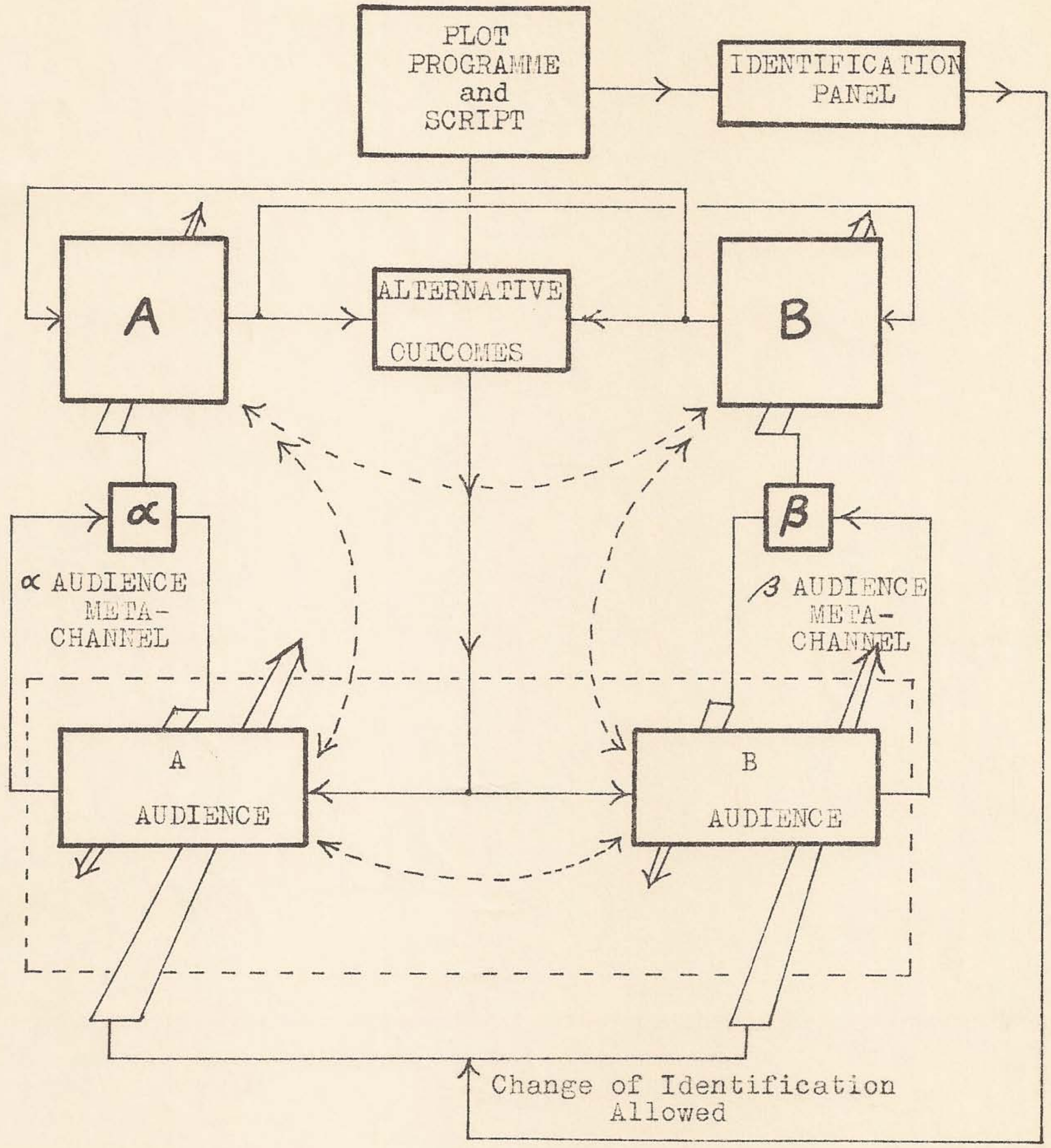

PLOT
PROGRAMME
and
SCRIPT
IDENTIFICATION
PANEL
A
ALTERNATIVE
OUTCOMES
B
α
β
α AUDIENCE
META-
CHANNEL
β AUDIENCE
META-
CHANNEL
A
AUDIENCE
B
AUDIENCE
Change of Identification
Allowed

DIAGRAM 10.

by any member of the B audience were different and invariant, then it would be possible to use the metainformation to secure this condition as indicated by DIAGRAM 9 (II). However, as we have argued, these conditions do not pertain and this is one of several reasons why it is necessary to allow for reidentification on the part of any member of this audience. The resulting system is shown in DIAGRAM 10. This organisational image is minimally realised by the physical communication system in DIAGRAM 1 and since our axiom (12) is (according to the present argument) minimally satisfied by the organisation depicted by DIAGRAM 10 we argue that DIAGRAM 1 represents a minimal physical system for achieving this objective (the weak interactions suggested in Axiom (12) are indicated by dotted lines. Thus a dotted line may represent rapport between the actors or chattering amongst the individual members of the audience).

2. 3. QUANTITATIVE PROPERTIES

So far, we have considered the qualitative properties of the organisation in DIAGRAM 10 and its physical mechanism in DIAGRAM 1. The stability of this organisation, hence the reality of DIAGRAM 10 and the usefulness of DIAGRAM 1 depend upon quantitative as well as qualitative properties. The various pathways must be capable of conveying sufficient information bearing messages to maintain the attention of most members of the audience, these messages must be relevant if they are actually informative, and the dynamic characteristics of the organisation must, in some reasonable sense, lead this process of communication to converge rather than diverge.

The statistical information measures used in connection with mechanical communication systems are not immediately applicable. To satisfy our first requirement we need to ensure that some rather arbitrary index, such as the number of relevant decisions per unit interval, exceeds some value that is known to maintain attention in comparable conditions (and is less than a further value that characterises overload). A reasonable criterion appears to be that, assuming relevance, the rate of preference choices exceeds the rate of preference choices in a conversation between a pair of participants wherein relevance of the discourse is evident. Very roughly, people seem to be satisfied if they can express preference once every $2\frac{1}{2}$ mins. (this figure is rough and comes from a content analysis of an unduly small sample of recorded discourse. However, the figure itself is not so important as the fact that some minimum value exists, below which people fail to maintain their interest or attention, and that there is a maximum value, above which their decision capabilities are overloaded. There is plenty of evidence in favour of the existence of these limits).

Brief experimental examination of a laboratory analogue for this subsystem reveals that a complete act of reception of the metainformation preference choice and interpretation and action can occur within an interval of 2 mins. allowing for the variation in response latencies (on the part of the audience members) obtained from an admittedly small group of 5 subjects. We emphasise that our estimate of 2 mins. per act is based upon the behaviour of laboratory subjects in a somewhat unrealistic situation but believe that the number cited is conservative (partly because people will tend to respond faster when they do not feel that their response has to be "accurate" and partly because an interpretation can be given on the basis of initially received, low latency, evidence by an interpreter who, unlike the initation interpreter in the experiment, has been well trained. The feeling that an "accurate" response is needed is a bias that it is very difficult to avoid in experimental conditions). Hence, as in 1.7., we argue that the system is feasible.

This argument depends, of course, upon our assumption of relevance. As in 1.7. the idea is that relevance can be maintained providing that the audience can re-identify their agents sufficiently often. This view stems from the psychology of reinforcement and we are tacitly assuming that correlation of an action with a preference choice acts upon an individual in much the same way as the "reinforcing" knowledge of results delivered when a student, learning a skill, makes a successful response. This ~~man~~ model will suffice as a first approximation to what actually will occur providing we admit the possibility of other motivation.

Having accepted this view (as a tentative hypothesis) we still need the other assumptions of 1.7. in order to gain any insight into the likely behaviour of the system. So far, a couple of models have been briefly considered, namely

(1) A model in which any member of the audience aims to maintain his reinforcement above 80% assuming that one or other of A or B will provide this possibility, (the limit of 80% is derived from the psychology of teaching systems).

(2) A model in which any member of the audience aims to maintain his reinforcement above 80%, given the same assumption about the characters A and B, providing, however, that this objective is compatible with obtaining more than a certain amount of variation in the identified character.

As mentioned in 1.7. more realistic models, allowing for the changes that are likely to occur in practice, require computor simulation which would only be worthwhile after the empirical data is available from the experimental system cited in 1.8. Finally, there is the issue of a convergent rather than divergent behaviour. This depends chiefly upon the plot of the dramatic presentation and the acting capabilities of the cast. We noticed a few technical points (about programming and script construction) in 1.5., 1.6., 1.7., and 1.8. (and others are developed below) but it would be premature to say very much about the far more important aesthetic considerations that are involved.

2. 4. SCRIPTING TECHNIQUES

An optimal technique for scripting plays has not been developed. All the same a few comments are possible and a few principles can be tentatively advanced. These proposals should not be taken too seriously, of course, because entirely different methods could be adopted and might prove to be of much greater value.

One could start off with a list of structural events (including the enunciation of the characters) like

(1) A family in Surbiton in 1927, consisting of A = Son, B = Daughter, C = Father, D = Mother

(this family is living in reduced circumstances due to a misboggoten business deal, on the part of C between his firm and character E).

(2) Property Company wishes to buy up C's house in Surbiton.

(3) Introduce Girl F who is defined as mistress of E.

(4) The slump.

(5) Party at local club. A,B,E,F, on stage.

(6) Daughter B is asked to audition for radio.

(7) Car crash involving C.

(8) The Riviera - B, D, and C on stage.

which stipulate, at least tentatively, the number and ordering of scenes, the degree of branching that is desired at a given point, and the location of identification points in the programme sequence. With this much constraint we might, ideally, ask the actors to act

the lines of the specified characters in rehearsal conditions and with regard for the dramatic constraints and the programming restrictions.

The degree of additional initial constraint upon their lives is a matter of optimally balancing predetermination of a plot against production effort expanded in rehearsal. In practice, it seems likely that a great deal of the dialogue could be written with advantage for scenes that do not involve choice, but that the greatest possible liberty should be allowed in connection with the choice situations. Hence, the dialogue must be written in rehearsal, to comprehend the choices that are made.

Finally, there is the issue of metainformation dialogue. At first sight, the author can do little or nothing more than edit the thoughts that are produced by the actors A and B. It should be possible to elicit these thoughts in discussion between A and α and between B and β whilst a rehearsal is in progress, to tape record it, and to edit the tape recorded discussion and to return the condensed version for approval or for alteration. This list does, to some degree, restrict the possible plot structures. Thus certain of the structural events determine the presence of characters. Consequently any programme is restricted at points (1), (5), (7), (8), though the restriction does not limit us to a single outcome. The stipulation that characters B, D, and C appear on the Riviera in (8) implies that no previous outcome can involve their decease and consequently that event (7) was not a fata event for C. On the other hand (8) may involve any state of the characters and

(I) "B married to F and C married to E"

(II) "B a batchelor and C married to E"

(III) "E murderously assulting C, B married to G who is conducting an affaire with E".

(IV) "The same marital status as in (1)".

are all outcomes that are compatible with this list of structural events.

Suppose that we chose one outcome at (8), or possibly a pair, say (I) or (II). One method for developing a plot is to work backwards from the statement

"(I) at (8) or (II) at (8)".

by specifying the choice which selects between (I) and (II) and which leads to (8). Obviously, this choice must, fairly soon,

involve (7). Further, it must comprehend the dramatic constraints entailed by the previous action so that the process of working backwards serves to restrict the actions that would be admissible if we were coming from the start to the finish.

The most important constraint, perhaps, is the character of the leading characters who are able to act like agents and whose behaviour must also satisfy the previously mentioned requirements (like being on stage sufficiently often and having an opportunity to express their thinking). Suppose that A and B are chosen as the leading characters in this play. Their characterisation could be accomplished in the normal fashion by assertions like

"A is a foppish young man but he is intelligent and inclined to Socialist ideals"

"B is an attractive woman with an obsession about motor cars and with pretensions to being a singer"

or by typical forms of A and B dialogue in the various dramatic situations or, and in this case with some novelty, merely by a choice of the actors for A and B parts.

The remaining characters need not be completely determined at this stage.

If we add a few dramatic constraints like

"The play starts at Dinner"

"At some point B makes a deal with E"

"C tries to murder E before the slump"

"D becomes hysterical when at the party in (5)"

and some restrictions upon the form of the programme, this may provide enough form or pattern to initiate the play making process.