An Attempt at the Study of

# Decision Making in Gliding

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**Presented at the XIXth OSTIV Congress, Rieti, Italy (1985)**

## Introduction

Gliding in which the first author now has been involved for some forty years has certainly been the origin of the academical work which he has been conducting in the field of sport psychology for twenty-five years (1, 2). He has therefore wished, in the course of the past few years, to center with greater accuracy on his beloved gliding. This paper concerns work conducted in association with the second author on decisional behaviours in gliding, though these two pieces of research work are closely linked together.

The general hypothesis which we adopted can be expressed with accuracy through George Moffat's concise phrase: "Soaring is made up of decisions" (3).

Our purpose was to determine the modalities, the ingredients and the conditions of the pilot's decisional activity, as well as the cognitive activity which it contains, taking into account the temporarity and uncertainty parameters which affect this type of action, totally "embarked" on the fluctuations of the aerial environment.

We shall indicate the method followed in section 1. Then, in section 2, starting from the specific hypotheses put forward from the general hypothesis, we shall introduce some of our results concerning decision making first, then cognition, and lastly people's attitudes when confronted with uncertainty.

## Section 1: Methodological aspects of the study

1.1. We first conducted non-directive exploratory interviews with six high-level pilots and/or instructors, and analysed them thematically.

1.2. Then, taking advantage of all this is conscious and utterable cognition in gliding, we asked pilots from the St.-Auban sur Durance National Gliding Centre to record on tape, as they were gliding, the narrative of what they were doing and why they were doing it as well as what they "would deem interesting to mention on this point". (The pilots were either gliding on their own or in the company of an instructor or an observer.)

Fifty-odd hours of recordings were gathered, coming both from expert and non-expert pilots.

1.3. The following processing operations were conduced:

1.3.1. Integral transcription of the recordings (over 1,000 pages)

1.3.2."Deconstruction" of the transcribed recordings: for each flight the elements of the transcriptions were distributed on charts respecting the sequential order of utterance in four columns ordering them into: a) informational and situational content; b) decisional content; c) previsional content; d) personal involvement content.

1.3.3. Coding: a second, more accurate content analysis was made within each of the four categories mentioned, introducing about fifty coded radicals. The links existing between the deconstruction items thus coded were also identified. The whole was punched on cards.

1.3.4. Computer treatment essentially produced: item listings for each flight (n: 24), with their relations (they were more particularly used to draw the type of diagram which will be mentioned in section 4), and charts showing the frequency of items, on which various computings and numberings were later based.

1.3.5. As a complement, a qualitative processing of the recording transcriptions was also conducted ("reconstructive analysis").

1.4. Other approaches were added to those already mentioned; on the one hand two attempts at experimentation on the field; on the other a clinical study of the subjects of this experimentation. These are outside the scope of this paper.

**Figure 1**

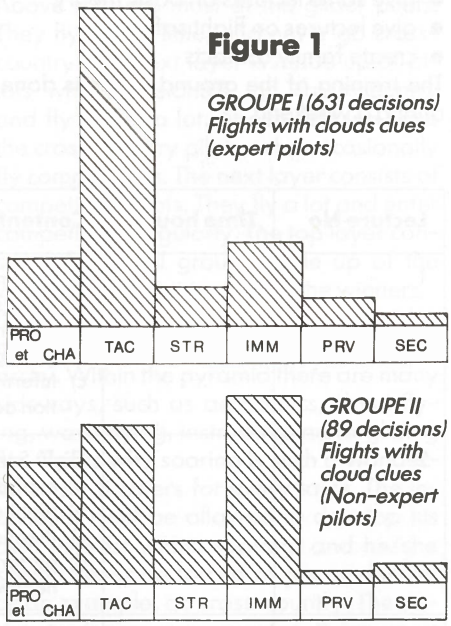


*Figure 1. Percentage of each type of decision against the total number of decisions in two flight groups.*
*Caption: pro and cha: Programme and programme change decisions, TAC: Tactical decisions, STR: Strategic decisions, IMM: Immediate decisions of technical exploitation, PRV: Informative decisions, SEC: Safety decisions.*

## Section 2: Results of the study and disquisition

2.1. Decisional aspects

2.1.1. In accordance with our general hypothesis, the importance of the place and the part of decision making in gliding has been largely confirmed: the content of the recordings made during flights entirely focuses on decisions, what motivates and prepares them, and on their consequences. Decisions proper make up approximately one fourth of the items recorded.

2.1.2. In connection with the importance of decision making we are made the hypothesis that various kinds of decisions are combined in the conduct of the flight. We noted:

(1) Programme decisions (or programme change decisions) fixing in whole or in part the task to be performed. Among non-expert pilots, purposes remain very fragmentary.

(2) Strategic decisions determining the leading principle and the overall organization of the actions to be performed to realize the programme. They are comparatively few.

(3) Tactical decisions which deal with the situational occurrences of the flight. They account for more than half the total number of decisions made by expert pilots and a quarter for non-expert pilots.

(4) Immediate decisions of technical exploitation. They take a great importance in the recordings made by non-experts; but under certain flight conditions ("blue thermals" or example) this is also the case for experts.

(5) Test decisions or informative decisions whose aim is to inform through the feedback of action, especially when clues are not available in the environment.

(6) Safety decisions in connection with safety margins and escape possibilities which often double others without standing apart (see Figure 1).

2.1.3. Given the polysemy of decisions we produced two hypotheses in correlation with the previous one. They concerned the tactical dominant of gliding. Indeed we

observed the high proportion of decisions coded as "tactical".
The second was that the low-level tactical–and even more so strategic–ability of non-expert pilots caused among them a "leap-and-bound" behaviour, while the expert pilot "glides ahead of his flight". Now, in this regard, our data largely confirmed our point of view. First, the previsional content is practically empty among non-experts as opposed to experts, and the links between informations and decisions are generally only immediate and fragmentary in their case. Secondly one finds a limited proportion of anticipation items at the same time as a high proportion of immediate decisions among non-experts. Lastly, the average value of the proportion between the number of decisions and the number of anticipations differs greatly between non-experts and experts (nearly 7 instead of about 2.5).

2.2. Cognitive aspects

2.2.1. Concerning cognitive aspects linked to decisional activity, the frequency charts obtained naturally enough first confirm what ordinary observation is used to observing: as to the three main sources of information taking,–which are the observation of the environment, the instruments and the information transmitted (mainly through radio)–the non-expert pilot prefers the second (this is well known: he flies "with his nose in the cockpit" and he relies very much on the third to give himself confidence; besides, concerning the information contents, the finer categories of information, such as those on the strength and nature of the wind, the nature and structure of the upward currents, or the aero-meteorological situation confirm the difference between the cognitive competences of the pilots observed. One remarkable feature which we observed among expert pilots is the selection which they effect of test information from which a whole range of data on their environment is confirmed in their eye.

2.2.2. Let us now deal with what may be called prospective cognition. We made the hypothesis that in an activity where action can never be stopped and where the transformation of the environment is continuous, it is most important to plan and to anticipate, and that this conditions the operation of decision making. Indeed prospective cognition proved to be vastly different between expert and non-expert pilots. The latter make few previsions and these are of limited temporal bearing. Conversely, it was observed that among expert pilots the rate of anticipation and prevision items was nearly as high as that of information items.
The item charts for each flight show that there are prevision contents which appear more frequently (for example expected upward currents, anticipated maximum flying height). As to anticipations (whose characteristic it is to integrate the pilot's very interferences to the representation he has of the future) we had to distinguish between anticipations concerning action proper and anticipations on the consequences of actions, as well as anticipations concerning safety; but we can go so far as to say that any anticipation is a safety factor.

2.2.3. Informative decision and cognitive prospection: We were led to assume that in an activity where uncertainty remains important, resorting to action in order to obtain an informative feedback is all but necessary. Decision then works as a quest for information. According to Lemoigne's views one decides to inform oneself as much as to inform one's decision (4). After all the decision system may not be a system which receives information. Nevertheless in gliding it is often necessary to "go and see" in order to find out.

2.3. Uncertainty and risk taking.

In gliding it is necessary to know how to act in uncertainty. Uncertainty affects information, forecasts, anticipation on the consequences of action. This is linked to the very unfixed characteristics of the aerial environment.

2.3.1. Pilots with little experience try to reach a feeling of safety through the information which they get through the radio or from experienced pilots, and through the confidence which they have in the instruments on which their eyes are often riveted. The most competent pilots appear to "grade" their uncertainty, to balance their doubts, to moderate and index even their certainties. They integrate uncertainty whereas the non-expert pilot keeps oscillating between ill-founded certainty and the deepest anxiety.

2.3.2. On the tactical level in particular, the plurality of options does not always offer the possibility of choosing without hesitation. Here again the "grading" of uncertainty but not its suppression characterizes the expert pilot. Resorting to previous experience cannot, as a rule, supply mechanically applicable criteria. Such a theorization as F. Restle's then seems of little pertinence to us (5).

2.3.3. Besides the "choice in uncertainty" aspect, decisions in gliding often include a risk-confrontation aspect when a genuine danger element affects some situations in which failure would lead to actual material or bodily damage. We have widely observed that pilots–at all levels–are aware of this possibility, and in this regard they usually take the necessary

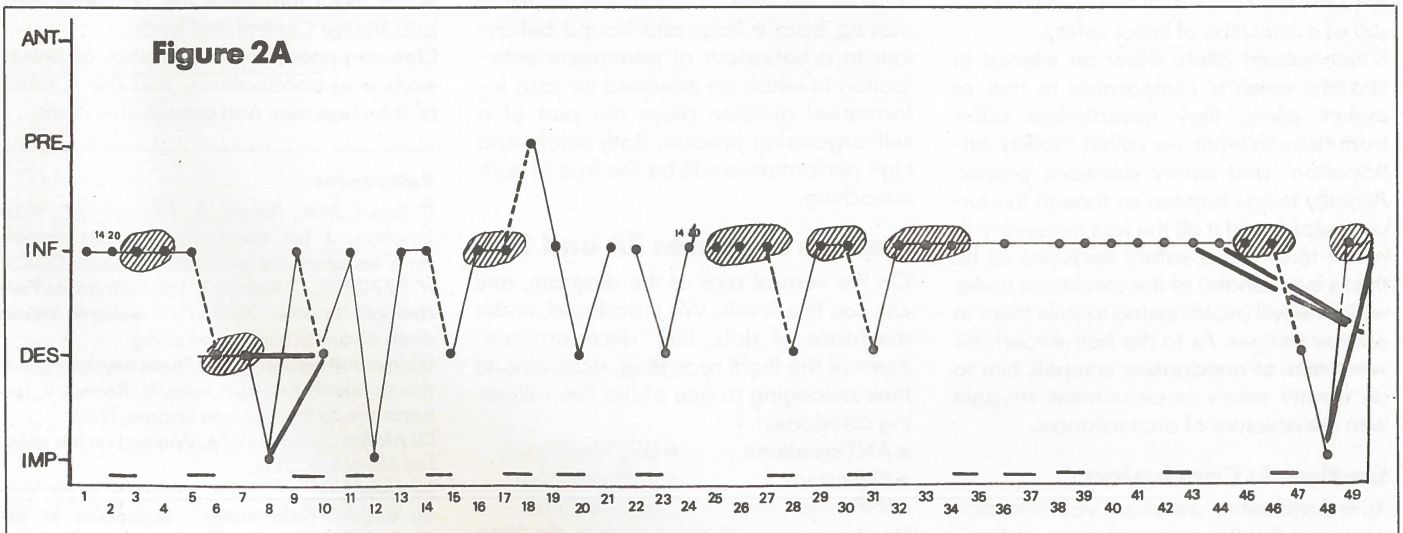


*Figure 2A. Fragment of a diagram showing the cognitive-decisional flux (non-expert pilot's flight)*

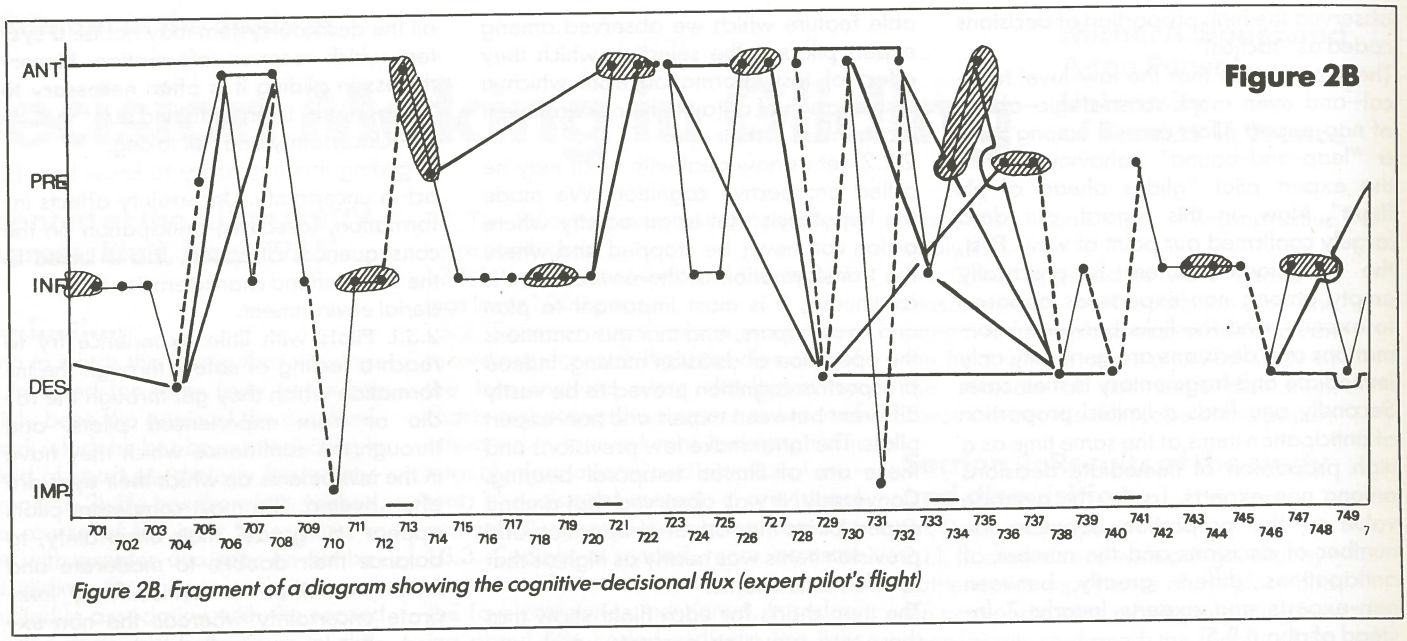


**Figure 2B**

*Figure 2B. Fragment of a diagram showing the cognitive-decisional flux (expert pilot's flight)*

precautions: their basic care then rather seems to ensure the safety of their flights.

## Section 3: General Remarks

Our study reveals that decision taking cannot be identified with risk taking as though gliding just had peril as a stake. The valorization of risk is not what appears from our data.

In this kind of one-day adventure which any flight in a glider amounts to the pilot looks for maximum guarantees to be safer in the pursuit of an aim whose success is doubtful. This is the reason why I think that safety conditions performance much more than it limits it.

It is more right to speak of "safety taking" than of risk taking.

The relation between risk taking and safety must not be understood in a sense in which safety would be a secondary step aiming at limiting risk; but contrarywise in a sense in which risk is only the result of a reduction of initial safety.

If non-expert pilots show an interest in security which is comparable to that of expert pilots, they nevertheless differ from them in what we called "safety anticipation" and safety decisions proper. Actually things happen as though the expert pilot found it all the less necessary to resort to effective safety decisions as he thinks beforehand of the conditions under which he will avoid having to take them to escape danger. As to the non-expert, his weakness of anticipation compels him to an erratic safety in permanent struggle with the pressure of circumstances.

## Section 4: Conclusion

As a conclusion, we show you two diagrams of the "cognitive-decisional flux", hoping that they will at least supply an illustration of some of the results which we tried to communicate in this exposé. These diagrams were hand-drawn from the item listings and their links, obtained after coding and punching the content of the flight recordings. But it is possible to obtain a computer-drawn curve and to modify the parameters shown—one could imagine, for example, a diagram only concerning the flux of informations concerning the atmosphere. Had these recordings been made in real time, a superposition with the barogram of the flight would have been an apt complement to this type of chart.

Even from a quick examination of the two flight sequences shown, one can see all the difference in the structure of the cognitive-decisional flux between the expert and the non-expert pilots (see figures 2A und 2B).

It is the duty of gliding instructors not only to teach the technique of the handling of a glider but also to teach how to use it, moving from a leap-and-bound behaviour to a behaviour of permanent anticipation in which an informed (or also informative) decision plays the part of a self-organizing process. Both safety and high performance will be the fruit of such a teaching.

## Caption of figures 2A and 2B

On the vertical axis of the diagram, one can see five levels. We introduced, under the forms of dots, the "deconstruction" items of the flight recording, according to their belonging to one of the five following categories:

- ANTicipations,
- PREvisions,
- INFormations,
- DES (decisions),
- IMP (personal implications).

On the horizontal axis which is the time direction axis, the item number is shown under the dot by which it is represented on its category level. The short segments parallel to the horizontal axis indicate the virtual simultaneity of two items.

When several items make up a "multiple item", they are placed inside a grey oval.

- So much for items.
- Now, as to the links between items: the dotted lines stand for a relation existing between two close items.

Bold lines stand for items placed further apart.

Fine lines do not have any significance concerning links. Their only use is to guide the eye in the reading of the diagram.

The fragment (2A) of a non-expert pilot's flight approximatively corresponds to the first hour of his flight. One notices: 1°) the absence of prevision and anticipation; 2°) the low number and the weak bearing of the links.

The fragment (2B) corresponds to half an hour of an expert pilot's flight, during a wave flight (between the Southern Alps and Massif Central and back).

One can notice the importance of previsions and anticipations, and the number of links between non consecutive items.


**References**

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