

## CHAPTER A.3

# EVENT ANALYSIS AND RESPONSIBILITY IN COMPLEX SYSTEMS

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The theme of the present book is reminiscent of the papers and discussions of the first workshop on "New Technology and Human Error" held ten years ago and published in the book of the same title (Rasmussen *et al.*, 1987). In fact, error can be considered as a sub-category of the notion of event. Event analysis leads to the identification and organisation of the other previous events which are supposed to have participated in the production of the event or error being studied.

This chapter continues the discussion of the problems evoked in the first book with reference to the notion of responsibility. Why this option? In the daily press, event analyses concerning traffic, domestic and industrial accidents often speculate about "human error". But to speak of human error is already to impute the error to the individual. This imputation raises the idea of the responsibility of the individual in the error. Curiously enough, reliability, safety and ergonomics specialists often eliminate this problem of responsibility by saying that their purpose is not to establish responsibility, but to analyse the *process* of error production. So, for example, the word responsibility does not appear in the index of Reason's book on human error (Reason, 1990).

Analyses of this process of error production show that error has multiple sources and that only some of these sources lie in the individual characteristics of a specific person. But, if it is not right to impute the error to any single individual; it is also not desirable to eliminate the role of the individual in error production.

Insofar as a certain autonomy is required by the agent (the actor in the activity), this autonomy implies that the agent must account for his actions and accept having his responsibility discussed. We must bring an axiological dimension into the analysis.

A second reason for addressing the problem of responsibility is connected to the complexity of modern technological systems which create a large distance between human action and its results. In simple technical systems, the relationship between action and results is direct even though this relationship is not always easy to analyse. The fitter can observe the effect of his work, such as touching up a piece with a file, either directly or with the aid of a simple instrument, but it is not the same for an operator in a complex system. Between the operator setting up a plant for a continuous process and the observable effect of this set-up, a stream of intermediary phenomena are introduced which are connected to the characteristics of the technical system and the product. It becomes very difficult after a while to distinguish between what is to be attributed to the individual action and what to these intermediary elements. This distance between action and its results is typical of modern technologies and makes the issue of responsibility interesting and difficult.

Two points of view can be adopted for the study of responsibility in relation to event analysis. The first point of view is centred on individual responsibility: to what extent is an individual who has intervened in the process of event production responsible for this event? The second point of view is centred on the event itself: who is responsible for this event? In order to define responsibility, we must try to evaluate the share of responsibility which is to be ascribed to each person who is considered to have intervened more or less in the genesis of this event. Individual intervention is direct when the individual is at the end of the causal chain; it is indirect when the individual intervention occurs before; such as is the case, for example, of the role played by the designer of a technical element that is implicated in the event production. Obviously, these two points of view are not independent: a good knowledge of each individual responsibility contributes to the clarification of the share of responsibilities. Conversely, analysis of the process of event production which brings out the role of the different factors, helps us to appreciate the nature of the responsibility of each individual. This chapter will emphasise the first point of view (individual responsibility), which is the one most studied. The second view (share of responsibility) will only be handled briefly, since a full treatment would require a much more extensive development than is possible here.

First, the chapter will introduce some relevant ideas, particularly: *event*, *cause*, *action*, and *responsibility*, and discuss them in the light of works perhaps little-known in this context. Then, more specifically, it will address the question of responsibility, giving a particular place to a recent model. The concluding section establishes some of the connections between the analysis of responsibility and event analyses.

## 1. ABOUT RELEVANT CONCEPTS

In the framework of event analysis, the study of responsibility can be illustrated by some preliminary comments about the concepts of event, cause, action and responsibility.

### *Event.*

Event analysis raises questions about the nature of events. Historians and philosophers can help us give some elements of a response to these questions. Ricoeur (1983) mentions two basic properties to an event: *non-repeatable singularity* and *practical contingency*. By the first property, he means that events occur only once. As long as an event is described with enough details, it becomes specific and unique. Two events are never strictly identical: they can only be considered the same when a few of their features define a category. This categorisation of events is derived in the first instance from a model which is a reduction of reality: one reduction among several possible others, and one which always has to be justified.

For Ricoeur, the second property, practical contingency, means that an event is something which could be done otherwise; it must be distinguished from something which is the result of a logical necessity. This property seems connected to a correlative property which is that an event marks a *break* in a process taking place over time. The popular expression, "it is not an event" rightly stresses these characteristics: it means that what is observed was not special, but expected, normal, and so the opposite of an event. To speak of a break implies that things could have occurred differently. The event constitutes a *change*, which explains the important role played by this notion in accident studies (Kjellén, 1987). This *variation* or *deviation* is considered as the destabilising element in the system, with the underlying idea that, if the system were to function as usual, there would not be an incident or accident. As Johnson (1980) notes, changes constitute crucial points in the study of accidents.

### *The notion of cause.*

Event analysis is closely related to the notion of cause (Rasmussen, 1990; Leplat, 1995). As Rasmussen (1990) wrote, after an accident (or even after any event in general) "a committee will carefully analyse the available evidence in order to backtrack and explain the course of events in terms of a causal chain." (p. 368)

The notion of cause has been abundantly discussed by philosophers and psychologists. Aristotle devoted a chapter of one of his books to the matter, which is still of interest. In general, the following type of definition is accepted: to say that event X is the cause of event Y is to say that the occurrence of X is a necessary condition to the production of Y, in the circumstances considered. "In the circumstances considered" means that it is essential to define the field within which the event is to be explained.

If the circumstances were to change, it could be that X no longer would be a necessary condition for the production of Y. The identification of the chain, or rather of the network, relative to a given event is a first essential step in the study of events. The "causal tree" method of accident analysis gives a typical example of this (Leplat, 1985).

The causes of an event are theoretically infinite: any analysis considers only a subset of them. The choice of this subset is one of the main questions in *causal reasoning*, particularly well studied by Mackie (cited by Einhorn and Hogarth, 1986) who noted that "judgements of causal relevance are generally related to the degree to which a variable is a difference-in-a-background. This means that factors that are parts of some presumed background or "causal field" (in Mackie's terminology) are judged to be of little or no causal relevance." (p. 5). This notion of *causal field* reminds us of the importance given to all that is exceptional in the causal explanation of an event. "Thus, because differences-in-a-background involve events that are unusual, abnormal, or unlikely, an important test of Mackie's notion of the causal field is that this kind of event should characterise the arousal of causal interest." (Einhorn and Hogarth, 1986, p. 5)

In event analysis, *backtracking* the course of events raises the problem of determining when to stop and to how establish stop rules. Rasmussen (1990) discussed this problem and gave some rules (for example: that information is missing; that a cure is available). Reason (1990) characterises the causal events by their distance from the terminal event: he speaks of *tokens* for the events directly related to the individual involved in the terminal event, and of *types* for the events related to the managerial or organisational factors which lie behind them. The relation of the tokens to terminal events is more direct, but more specific, while that of types to these same events is more indirect, but more general in that they are present in a much more extensive class of terminal events. In terms of prevention, action directed at tokens of *symptomatic* nature is more immediately effective, but limited in its effective scope, while action directed at types has a more *curative* effect; it is less direct and immediate, but it has a larger range of effect.

Responsibility for the terminal event is shared by all the individuals who play a part in the events that constitute this causal chain. Therefore, *causal analysis* is an important element in the study of responsibility: it shows us already that *individual responsibility* cannot be isolated from the chain of events in which individual action is included.

#### *Event and action.*

It is possible to distinguish two main types of events: one linked to human actions and one to physical phenomena. The former are the result of an intention, the latter only of physical properties. The presence of (human) actions in the causal chain raises numerous questions which are at the core of action theories.

The most classical question is illustrated by the debates over causes vs. reasons and over explaining vs. understanding. In his theory of action, Ricoeur (1986) defends the thesis that human action must be related to a *double register* and "at the same time belongs to the system of causality and to the system of motivation, both to explanation and comprehension." (p. 172) He argues against semantic and epistemological dualism by noting that action "means above all producing a change in the world" (id.) "To act is always to do something in order for another thing to happen in the world." (p. 174) As a result, "the course of things and human action are interwoven with the notion of intervention in the course of things" and this intervention "implies that we follow chains within natural systems." (p. 174). Because an action aims to produce something, directly or indirectly, it brings into play properties of its environment whilst its result is an expression of both these properties and the actor's intentions. The action defines a certain field in the world within which it is organised: action analysis must also involve an identification of this field. Finally, human action and physical causality are intimately interwoven: it is the analysis of their articulation which is at the core of event and responsibility analysis.

### Responsibility.

The notion of responsibility appears in many domains which serve to give it various dimensions: moral, civil, penal, individual, collective, etc.. In each of these domains it has different meanings, varying according to the time, social environment and state of knowledge about humans and society.

*Objective responsibility* relates to (or is defined from) the similarity (or difference) between the subject's action and what is prescribed, that is an action in accordance with an external rule (whether defined organisationally or legally). This type of responsibility does not take into account the intention of the subject, but considers only the actual nature of the action in relation to an externally defined norm.

In *subjective responsibility*, intention plays an essential role. The concept of subjective responsibility has been expressed in many ways, e.g.:

- to be able to answer for oneself,
- the "common meaning of the consciousness (of) being the unarguable perpetrator of an event or object" (Sartre, 1953, p. 639),
- "... the choice made by the subject of the authority which he sees as legitimate and to which he will hold himself responsible" .... "if the subject denies that authority the right to ask him the reason behind his acts, no coercion will lead him to base his responsibility in the ethical order of things. He is only responsible if he wishes to be." (Encyclopaedia Universalis in the article on *responsibility*)

Foucault (1981) reflects on the changes occurring in the legal notion of responsibility: "The penal system cannot function with only a law, an infringement and a perpetrator of the deed. It needs something else, additional material; magistrates and jurors, even the lawyers and the public prosecutor's office can only play their part to the full if they are given another type of testimony, the accused's own testimony about himself, or the testimony which others give on the basis of his confessions, memories, secrets, etc." (p. 404)

Objective and subjective viewpoints can also be found in the definitions of human errors (Leplat, 1985; Reason, 1990). The qualifier "human" here raises the idea of ascribing the error to a specific individual. To what extent is an individual involved in the production of what is considered to be an error, to what extent could he prevent this error, and did he recognise the error as such? Fishbein and Ajzen (1973) discuss the ambiguity of the concept of responsibility in accidents, stating that it underlies many different types of questions:

- Was the actor associated with the accident?
- Was he instrumental in producing the accident i.e., did he cause it?
- Is he responsible in the sense that he could have foreseen the accident?
- Did he intend to cause the accident?
- To what extent was his behaviour justified?

To end this examination of the connotations of responsibility, we will mention some of Schlenker *et al.*'s comments (1994) on psychological and philosophical texts. They distinguish two main concepts: imputation and answerability. Imputation focuses on *causality*, and they give three uses of responsibility there:

- direct causality: for example, attribution models focus on responsibility as an internal representation of causality.
- the mental state in which the actor exercises free will, the actor chooses to bring about an intended outcome.
- the mental capacity for acting in a reasoned and deliberated way. This is what is usually meant when people say that someone is "responsible for their own actions."

The second facet, *answerability*, is focused on the "liability to appropriate sanctions" after the event. Three uses are distinguished:

- responsibility in the general sense of being accountable to others.
- responsibility as resulting from "obligations created by moral or legal codes".
- responsibility as referring to "the duties arising from social roles."

## 2. MODELS FOR RESPONSIBILITY

The definitions and discussion above provide useful elements for research into individual responsibility, but it is useful to try to organise them into a more systematic model. Leplat (1993) proposed such a model based on the notions of error, task and intention. This model considers three types of tasks:

- *prescribed task* or task defined by the organisation,
- *redefined task* or task the actor gives to himself and which corresponds to his intentions,
- *realised task* which corresponds to the actual activity or action carried out.

Analysis of the differences between these tasks is an interesting way to study errors and also gives clues to the approach to the problems of responsibility. The original article developed this analysis in connection with the notion of intention. Here, we will give only the main categories developed there to classify situations related to:

1. Actor's intention vs. the prescribed task:
  - a) The actor knows the prescribed task but deviates consciously from it.
  - b) The actor knows the task imperfectly.
2. Actions not in line with the intentions, for reasons:
  - a) mainly imputable to the actor
  - b) mainly imputable to uncontrolled modification of the task.
3. Scope of the intention
4. Deviating from the intention through some (unexpected) effects of the action.

For each of these categories the origins were examined both of the inappropriateness of the intention, and of the lack of agreement between actions and intentions. These were then linked to the study of responsibility. We will use these analyses by integrating them into another model, the *Triangle Model*, very directly centred on responsibility, which will be presented in detail.

Rather than paraphrase this model, we will let the authors (Schlenker *et al.*, 1994) introduce it. Their general thesis is that "responsibility is a necessary component in the process of holding people accountable for their conduct.

Accountability refers to being answerable to others for performing to certain prescribed standards, thereby fulfilling obligations, duties, expectations and other charges." (p. 634) This accountability implies the presence of principles for, and means of evaluation. The model requires that "the evaluator has information about three key elements and the linkages or connections between them. (...)

These elements are:

- (a) the *prescriptions* that should be guiding the actor's conduct on the occasion,
- (b) the *event* that occurred (or is anticipated) that is relevant to the prescriptions, and
- (c) a set of *identity images* that are relevant to the event and prescriptions and that describe the actor's roles, qualities, convictions, and aspirations." (p. 634)

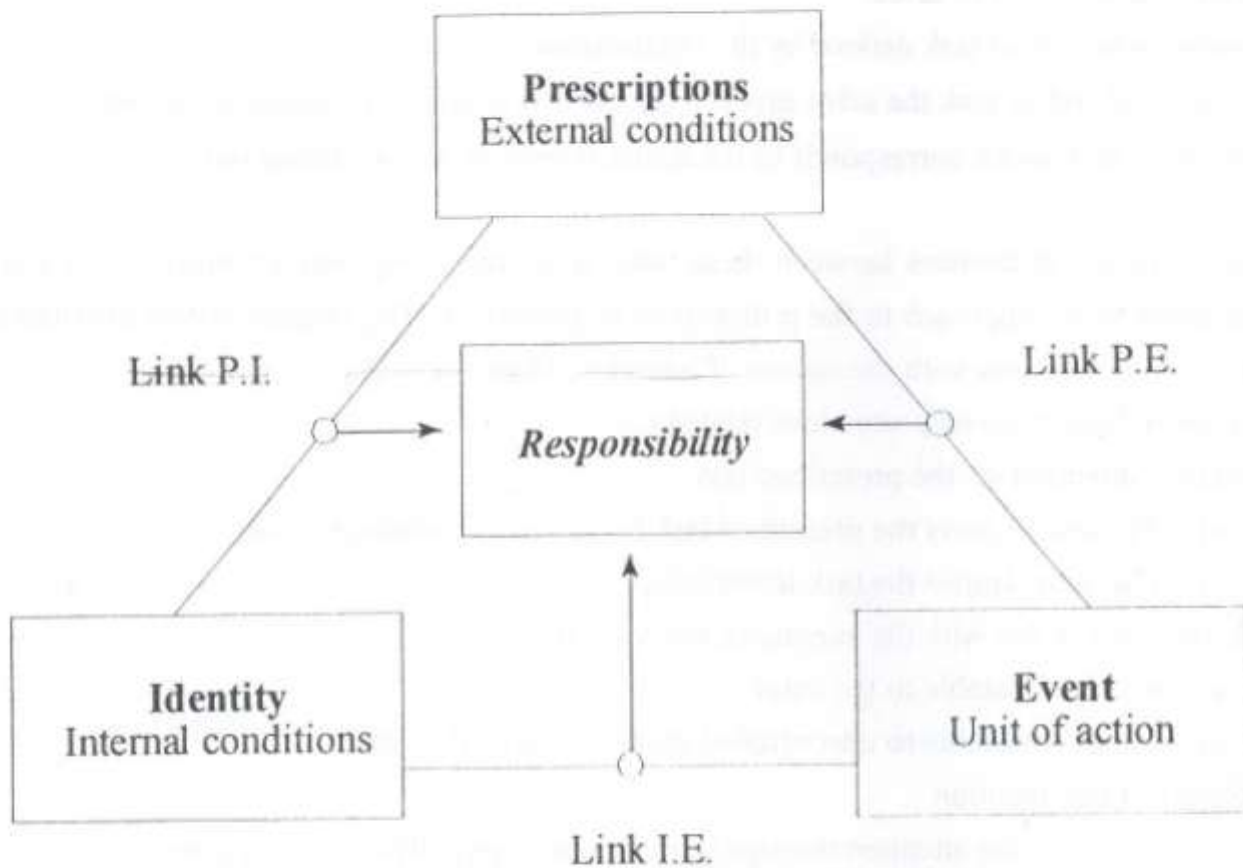


Figure A.3.1 The responsibility triangle (adapted from Schlenker *et al.*, 1994)

Based on the triangle model of responsibility, "people are held responsible in a given situation to the extent that:

- (a) a clear, well-defined set of prescriptions is applicable to the event (prescription-event link),
- (b) the actor is perceived to be bound by the prescription by virtue of his or her identity (prescription-identity link), and
- (c) the actor seems to be connected to the event, especially by seeming to have (or to have had) personal control over the event, such as intentionally producing the consequences (identity-event link).

From this view, responsibility is the adhesive that connects an actor to an event and to relevant prescriptions that should govern his/her conduct; thus, responsibility provides a basis for judgement and sanctioning." (p. 635)



Prescriptions correspond to the prescribed task; events are the units of action and their consequences; identity images correspond to individual characteristics. Schlenker *et al.* represent these three categories of elements on the vertices of a triangle, called the *responsibility triangle*. This has the advantage of making the linkages among elements clear (Figure A.3.1). This model can be considered from the actor's point of view in order to analyse his feeling of responsibility, but also from the expert's point of view as a way to evaluate responsibility from outside. This model helps to analyse the possible sources of differences between evaluations of responsibility.

We will now look at some types of problems which can be introduced in these linkages in work situations.

#### a) Prescription-event linkage.

This can be characterised by the question: *is the task clearly specified and can it be realised?* This linkage will be considered weaker if the task (goal, rules, conditions) are obscure, ambiguous or conflicting. *Weakness in this linkage* is often cited in studies of errors. It can be ascribed to several causes. First, the *task definition* may not be relevant because it does not fit the actor's competence: e.g. it is not defined explicitly enough and the actor cannot fill that gap. A bad definition of a prescribed task can also be the result of the designer or work organiser's having poor knowledge of the task, its goals or its conditions of execution. Finally, criteria for the evaluation of the results can be too vaguely specified which can generate *conflicts of criteria*. Some conflicts of this type are classic and well-known: speed/precision, quality/quantity, production/safety, etc..

Complex systems often entail weak links between prescriptions and events because of the *presence of conditions that are difficult or impossible to control*. "We have produced a design so complicated that we cannot anticipate all the possible interactions of the inevitable failures." (Perrow, 1984, p. 11) This is the case in certain *complex dynamic systems whose control exceeds human possibilities*, such as the loosely coupled, but complex systems described by Perrow. The reaction of the system depends not only on the operator but also on the rules of the system themselves and on the material processed. It is also the case for a process with slow reaction dynamics, when there is a long time between the actor's action and its effect (Hoc, 1989).

*Collective activities*, where the actor's task *depends on the results of other actors over whom he has no control*, also constitute an example of the weakening of the prescription-event linkage. This weakening is magnified in large organisations or social institutions with complex hierarchies. Between a decision made at the top of an administrative hierarchy and its effect at the bottom a lot of phenomena take place which escape the control of the decision maker.

This problem is crucial when administrative or political responsibility must be discussed: this is sometimes called the inertial effect of the technostructure.

*Parasitical effects* are found in the case of interventions which may have reached their foreseen goal, but have had only marginal effects in relation to their total intention. For example, a noise level may be lowered but, if at the same time auditory clues useful for action have been eliminated, the resulting change in risk may be small. These effects are frequent with complex systems on which interventions can have unexpected and undesired consequences.

#### b) Prescription-identity linkage.

This type of linkage can be translated into the questions: "does the actor know what to do?" and "does what he has to do correspond to what he wants to do?" This linkage represents the adjustment or coupling between the actor's characteristics and the prescribed task.

Ergonomics has identified many sources of defects in this linkage, only a few of which can be mentioned here. Insufficient skills for the task are very direct sources of errors (Bainbridge *et al.*, 1989). For example, a bad understanding of instructions can make the actors not observe them. (Herry, 1986) Moreover, skill must be extended beyond that which is strictly necessary for carrying out the task in normal conditions, in order for the actor to cope with unforeseen conditions.

Certain linkages are favoured, as shown by research about compatibility and affordance (e.g. between control actions and intended effects). When new socio-technical systems do not comply with these expected linkages, errors and incidents can happen. These favoured sensorimotor or cognitive linkages are difficult to eliminate and to replace with others.

The prescription-identity linkage will also reflect the linkage between the worker's (social actor's) views and those held by the work organisation. When this linkage is weak, actors may refuse to follow the prescriptions governing their activities as group members: this occurs in the case of alienation (Schlenker *et al.*, 1994).

An argument often mentioned in order to escape responsibility is to try to weaken the prescription-identity link. "People accused of wrongdoing or failure can claim that prescriptions that might otherwise apply do not apply to them because of their special identities (e.g., "I have diplomatic immunity" ...) or can claim that their identity is not covered by the particular prescriptions that are being invoked (e.g., "it was not my job" ...)" (Schlenker *et al.*, 1994, p. 639)

*c) Identity-event linkage.*

This can be translated into the question: "has the actor done what he wants to do?" It represents the personal control of the action and plays a particularly important role in the attribution of responsibility. It is common to consider a person all the more responsible for an action when he takes over its control. An action is considered to be controlled by an actor insofar as the execution and result of this action corresponds to his intention.

Between intention and action, two main categories of links are presented, which we need to distinguish with different terms. Searle (1985) proposes the terms "preliminary intention and intention-in-action". Preliminary intention is formed before the corresponding action (I go to catch the bus to go to a meeting); intention in action is very directly connected to the on-going action e.g. I punch the bus ticket in the ticket machine). To punch my ticket, I do not have to form a preliminary intention: this operation is encapsulated in the more general action of taking the train. It is also intentional, but on another level. Similarly Heckhausen and Beckmann (1990) distinguish the "goal intention" and the "instrumental intention", the latter concerning the means of realising the action. The previous distinctions are reminiscent of Leontiev's distinction (1975) between *action* (defined by its conscious goal) and *operation* (means of realising the action). Acquisition of experience is characterised by the greater role played by the second type of relation between intention and action: the automation of parts of actions is a very clear example of this category.

Deviations between intention and action indicate a loss of control of the action. These deviations have been the object of numerous studies of errors (Norman, 1981; Reason, 1990). They correspond to the category of error called "slips", of which various classifications have been proposed. Errors in this category are especially frequent among experts.

*Cognitive biases* can also be connected to this type of deviation. Tversky and Kahneman (1974) noted rightly that they stem from heuristic procedures resulting from the agents' experience which aim to reduce the difficulties of complex tasks involving evaluation of probability and prediction. These practical procedures are valuable in common and frequent conditions, but are not valid in exceptional conditions (a loss of the intention - action link).

A difficult problem is to evaluate to what extent an agent is responsible for actions resulting from intention in action or automatism, acquisition of which is necessary for carrying out these actions in prescribed conditions. There is no simple answer to this question: it will always be necessary to appreciate the conditions in which these automatism were acquired. For example, for a repetitive task with severe temporal constraints, if an operator is obliged to automate his activity, the responsibility for actions resulting from this automation cannot be entirely attributed to him (Leplat, 1993). This is also true of the errors resulting from designing contrary to stereotypes or due to affordances which are not respected.

The link between intention and action can also be disturbed by *non-intentional effects* which are outside the actor's control. For example, to avoid a hole in the roadway, the driver swerves and hits a car. Of course, this effect was not desired. Searle (1985) discussed the status of these non-intentional actions that come from the fact that the action space was only partially taken into account. This *restriction of action space* is often related to a relative lack of spatial or temporal autonomy for the agent in relation to the scope of the intention. This effect was fully discussed by Schützenberger (1954) with his distinction between *tactics* and *strategy*. The undesired effects are often to be ascribed to a reduced scope for decision through lack of autonomy or competence.

The identity-event linkage is very directly connected to the problem of the *imputation of causes* which is addressed in theories of attribution. These theories have recently been revised in the framework of counterfactual reasoning (Lipe, 1991). These aspects cannot be developed fully here, but we will mention the role that *counterfactual reasoning* can play in relation to the notion of control of action (Giroto *et al.*, 1991). "The counterfactual assessment of events, i.e. the mental construction of alternatives to factual events, is a pervasive mental process that is quite natural for people." (p. 111) This reasoning is found in expressions such as "if X had occurred, the accident would not have happened", for example, "if the driver had not drunk alcohol, his reactions would have been faster". Such reasoning supposes the possibility of generating alternative scenarios in the situation considered.

Giroto *et al.* (1991) speak of "mutable factors" as names for the factors whose change the subjects think would have prevented the accident. To be considered as causes factors need to have this character of mutability. Through experiments done on events scenarios, the authors confirm the hypothesis that, if the events which were in the agent's control were seen as the most mutable, then they were the ones most exploited for the construction of the counterfactual alternatives. "Given the relationship between mutability of an event and perceived causality (...), human action is likely to become the "figure" on the "ground" of the other events when it comes to establishing how a given output was produced. Subjective controllability can be relevant for the assessment of blame and causal roles in accidents and the consequent feeling of regret and guilt of operators." (p. 129-30). As the same authors noted, counterfactual reasoning is essential for elaborating a tree of causes of an error or accident. The concept of "difference from normal" used in the construction of such a tree is connected to this counterfactual reasoning: looking for the "normal" situation amounts to looking for an alternative scenario which serves to emphasise the changes or deviations.

If we accept this model, we can postulate that "people are held responsible to the extent that a clear, well-defined set of prescriptions is applicable to the event (...), the actor is perceived to be bound to the prescriptions by virtue of his or her identity (...); and the actor seems to have (or to have had) personal control over the event (...)". (Schlenker *et al.*, 1994, p. 649).

#### *Collective and organisational responsibility.*

Schlenker *et al.*'s model shows that the study of individual responsibility embraces the totality of conditions that determine action which all of which must be present in a careful event analysis. There are two ways of approaching collective aspects of responsibility with this model.

1. *Analysis of individual responsibility*, as already mentioned, can bring to light the role of other individuals than the one who is the object of evaluation. For example, prescriptions can be defined within a work-group, with the individual being analysed playing a more or less significant role in this definition. The event or unit of action may be a matter for individual action, but may also be a more or less indissociable part of a collective action (for example, a set-up made after agreement among operators). Finally, the operators' identity in relation to their work depends, in part, on their relations with the other team or hierarchy members. So, generally, evaluation of individual responsibility cannot avoid including the collective dimension.
2. *Analysis of collective responsibility* can also be approached with Schlenker *et al.*'s model by considering a group of operators or a team as a collective unit. Responsibility is then examined using the three criteria of the model at that level. For example, prescriptions can be defined for or by the group, action can be considered as collective, resulting from the coordination of individual actions. It is also possible to characterise the group's identity, in particular its functioning characteristics. This can provide the basis for the evaluation of collective responsibility. Articulation of these two types of analyses -individual and collective- will at the same time highlight the problem of responsibility and that of the functioning of the group considered.

*Evaluation of organisational responsibility* can also be approached with the Schlenker *et al.*'s model. The prescriptions then become those to which the organisation is submitted for the action considered; the identity images are the characteristics of the organisation such as those described by organisational psychology and sociology. Finally, it is possible to characterise units of action in relation to the functions of the organisation.

But if we can speak of organisational responsibility, this responsibility is not independent of the people who constitute and manage the organisation: this responsibility and its analysis necessarily lead us to consider individual responsibility as well. Collective and organisational responsibility are tightly connected to the responsibility of the individuals who are elements of the collective units.

Articulation of these responsibilities is a complex problem which merits systematic research. They are difficult to the extent that they involve axiological, even political dimensions. The triangle model can be an aid for this goal, but it is not sufficient. It can, however, help in finding a better definition of the problem.

### 3. CONCLUSION

In theory, event analysis is multidimensional and cannot ever be exhaustive. It must select aspects which will change according to the context, the objectives and the analyst's competences and interests. Responsibility can be considered as a point of view adopted for analysis, which gives greater emphasis to the agents' actions. These actions happen within a flow of events which contributes to their production and which they contribute to produce.

Understanding of human actions requires that the links between these events be known at the same time as the representations the actor has of them. The triangle model described here shows that evaluation of responsibility must reflect this complexity of actions. This model rightly emphasises the close interaction between the three main categories it takes into account. It proposes only a general framework within which different types of theories and models can be developed. In particular, it poses the question as to the content or the interpretation to be given to "identity images". Event analysis has mainly focused on interpretations in the form of individual cognitive characteristics such as competencies, experience, intentions, etc.. Affective or psycho-dynamic aspects connected to personality characteristics or personal history have not really been taken into account. What Schlenker *et al.* (1994) call "convictions and aspirations", which can be designated as the general expression of a system of values, have been considered even less in event analysis. However, they determine both the triggering and the evaluation of actions and, thus, are at the core of objective and subjective evaluation of responsibility. It is not the role of psychology to judge these systems of values but it has to know them. This axiological point of view cannot be neglected for those who want to acquire a better comprehension of human actions.

The triangle model of responsibility gives a grid of analysis for the actions which are the basic elements of event analysis. The three poles of the model are sources of questions as shown by the examples given. A merit of this model is that it proves that to wonder about responsibility is not only to be interested in individuals and their characteristics, but also to analyse how they interact with the external conditions in which the action is placed. Responsibility is a phenomenon emerging from these interactions in which the different elements involved co-determine themselves in a more or less complex way.

Event analysis which aims to unravel the complexity of the elements participating in the production of the events cannot eliminate responsibility any more than it can the other determinants of human actions from which it emerges.

Allocating responsibility for actions which have their effect through the mediation of a complex system, the functioning of which is outside the actor's control to a greater or lesser extent, raises critical problems for analysts and evaluators. These problems show that more and more, responsibility cannot be considered strictly on the individual level, but has to be considered in terms of *co-responsibility*.

It is necessary to know how a given action is determined by the individual who executes it and by those who determine the conditions. The way to carry out this allocation raises very difficult psychological and social problems, as later chapters of this book show.

At the very least, the previous discussions show that responsibility, the result of a complex combination of conditions, cannot be evaluated on a black and white scale. Responsibility is rarely all or nothing, but must be assessed on a continuum between these two extremes. One is more or less responsible, rather than not at all or completely. We can consider that the questions in which Fishbein & Ajzen (1973) saw an ambiguity in the notion of responsibility (see section 2 above) represent degrees of responsibility. The triangle model can help to highlight the evaluation of these degrees.

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*Some of the lessons which we need to learn from this chapter for the subject of event analysis are the following:*

1. *The concepts of **cause** and **event** are very closely linked to the notion of the unusual or unexpected, not according to plan. We can interpret this in the case of organisational factors with the difference between what the organisation was supposed to do for the control of risks and what it did. This difference is clear if there were indeed plans, or some standard says there should have been plans. If the event which occurred was totally unexpected, then the issue is much more complex and the attribution of responsibility will be controversial.*
2. *Having responsibility can be seen as equivalent to having the possibility to act otherwise. If that is not present then we cannot reasonably regard the person as responsible.*
3. *The issue of intentions is much more difficult to establish either after the event, because people may have reason to try and conceal their real intentions (sometimes even from themselves) or before, if the actions being undertaken have become routine or unquestioning; at that point people may not be aware of what their intentions are, except in very general terms.*
4. *The length or complexity of causal chains leading to an accident or incident provide ample opportunity for people higher in the organisation to hide their role, or excuse it in terms of the impossibility of predicting the outcomes of such long chains, or of taking account of so many possible outcomes in advance. The chapter gives us an indication of the excuses which we may expect to meet in tracing these causal chains during an investigation. Forewarned is hopefully forearmed in this case and gives us the opportunity to prepare counter-arguments to convince the managers that they have to learn.*

*The previous chapter tackled the issue of cause and responsibility from a theoretical and analytical perspective, based on principles which link clearly to the philosophical tradition. The approach was strongly influenced by the casuistic approach to cause.*

*There is another way to approach the whole issue of cause, which draws from another very old tradition of health and safety, namely that of epidemiology. Bernardo Rammazini, the father of occupational medicine, was also one of the founding fathers of epidemiology, the science of the causes of epidemics, which traces down factors associated with the presence of disease by contrasting situations where disease is present with those where it is absent. Epidemiology has been extraordinarily successful in untangling the causal factors in occupational disease at the level of chemical and biological agents, living conditions and individual behaviour and habits. In the study of accidents it has been rather less used, partly because of the complexity of the causal networks involved. It has, however, had quite a lot of success at the level of physical and individual factors (see Hale and Hale, 1971; Saari, 1986, for reviews). Upto now there have been remarkably few attempts to use its principles and methods to try to study the organisational factors linked to high or low accident frequencies. The next chapter assesses the potential of this approach (at least in the USA), in helping to learn which characteristics of organisations are associated with better or worse control of risk.*

*Hale, A. R. & M. Hale (1971). A review of the industrial accident research literature. Research Paper 2. HMSO, Robens Committee on Safety & Health at Work, London.*

*Saari, J. (1986). Accident Epidemiology. In: Epidemiology of occupational health (M. Karvonen and M. I. Mikheev, eds.), p. 300. World Health Organisation's Regional Publications, European Series No. 20, Copenhagen.*