
Abstract

In this chapter, the notions of expectations, uncertainty, and trust are combined to formulate a framework that is able to track the changes of and conflicts over the three modes of enactment of responsibility (assumption, ascription, and subjection) we have identified. Before presenting the model, three dedicated sections summarise the considerations presented in the previous chapters on social action, expectations and trust. This analysis is then developed into a heuristic framework to explore the changing configurations of responsibility and to explore the conditions and factors explaining these changes. The functioning of the framework is exemplified by outlining a brief sketch of two broad ideal types of responsibility in science and technology (focused responsibility and diffuse responsibility), which draws on the account of science, technology and society trends described in the preceding chapter.

5.1 Motivations, Responsibility and Social Action: *Reprise*

The chapter “Responsibility and Social Action” emphasised that responsibility has to do with the consequences of actions on somebody or something, be it specified or indeterminate. This orientation to others justified the positioning of responsibility under the umbrella of social action, in Max Weber’s sense of subjectively meaningful actions that are oriented to others’ behaviour. This move allowed us to draw on Weber’s understanding of social action to highlight the fact that not only the prospected consequences, but also the motives of an action are to be considered when a link between actions and their consequences is established. This twofold nature of social action defines the characteristics of human responsibility in the two types of

Weberian ethics. The distinction between instrumentally rational and value-rational action describes two opposite ways to link actions and (the responsibility for) their consequences, generating potential for conflicts. Yet Weber's reflection on political responsibility and religious ethics shows the possibility of their coexistence and pragmatic mastering. We argue that their coexistence is possible because of their common reference to rational human behaviour.

Commenting on the notion of rational action in Weber, Paolo Volonté has observed that, "on the one hand, human behaviour is rational insofar as means are consistent with ends and they are competitive with respect to other alternative means. On the other hand, rationality requires that decisions are based on stringent arguments, and actions justified by valid motivations [...]. Rationalising is assigning a meaning to things, therefore doing things in a sensible manner" (Volonté 2000, 10). The first meaning of rationality ("human behaviour is rational insofar as means are consistent with ends and they are competitive with respect to other alternative means") refers explicitly to instrumentally rational action. One can easily see that instrumentally rational action is typical of economic activity (see also section 3.1). It is not by chance that Weber links the predominance of instrumental rationality in modernity to the increasing autonomy of the economic sphere in society and to the parallel success of the capitalist economic order. This success of the capitalist economy spreads "homogeneous expectations" among individuals based on self-interest. These homogeneous expectations create empirical uniformities on which the "interpretive scheme" of instrumentally rational action is built ("On the other hand, a uniformity of orientation may be said to be 'determined by self-interest,' if and insofar as the actors' conduct is instrumentally (*zweckrational*) oriented toward identical expectations", Weber 1978, 29). More than this, the capitalist economy assigns to this latter type of action a moral value and, indeed, one might say that it is this moralisation that supports its diffusion. The key link in this transition is to be found in the German notion of *Beruf*, which has the meaning of 'profession' but also evokes the notion of *Berufung* (calling, vocation) (see, for instance, Rutigliano 2001, 205). As Weber affirms: "at least one thing was unquestionably new [of the nascent capitalism]: the valuation of the fulfilment of duty in worldly affairs as the highest form which the moral activity of the individual could assume" (Weber 1950, 80). With the telling image of the "iron cage", Weber describes how what was originally intended as a form of individual asceticism became a cage that rigidly shapes human action in modern society.

For when asceticism was carried out of monastic cells into everyday life, and began to dominate worldly morality, it did its part in building the tremendous cosmos of the modern economic order [...] which today determines the lives of all the individuals who are born into this mechanism. [T]he care for external goods should only lie on

the shoulders of the saints like a light cloak, which can be thrown aside at any moment. But fate decreed that the cloak should become an iron cage.” (Weber 1950, 181)

At the same time, according to Weber, the identity of vocation and profession in protestant ethics narrows down the sphere of the morally meaningful action of the individual to the economic sphere. It is in this context that

this peculiar idea [...] of one’s duty in a calling, is what is most characteristic of the social ethic of capitalistic culture and is in a sense the fundamental basis of it. It is an obligation which the individual is supposed to feel and does feel towards the content of his professional activity, no matter in what it consists, in particular no matter whether it appears on the surface as a utilization of his personal powers, or only of his material possessions (as capital). (Weber 1950, 54)

This moral value assigns to rational action a conventional validity. Accordingly, failure to conform will generate spontaneous reactions of disapproval in the social context to which actors belong. This conventional force bolsters the probability-possibility that a certain behaviour occurs in a certain interaction process (see Weber 1978, 29ff and section 3.1 of the present book).

The second meaning of rationalisation (“rationality requires that decisions are based on stringent arguments, and actions justified by valid motivations”) points at the fact that rationalisation does not concern instrumental action only. Rationality is not only about finding the most appropriate means to a set of given ends. Rationalisation concerns, more generally, “the clarification and systematization of value assumptions and conditions” (Ferrara 2005, 15) which is the leitmotif of modernisation. It is the progressive and open-ended effort of “self-conscious formulation” and of “consistently planned orientation of action” (Weber 1978, 25) that characterises all types of rational actions. The “stringent argumentations” are therefore based on self-conscious effort, not only for instrumental actions, but also for value-oriented action, as a condition to cope with “modern life [which] is actually a multiplicity of principles, each of them incorporated in autonomous value spheres that are mutually irreducible” (Ferrara 2005, 32).

For the purposes of the present book, and for our framework, the distinction between instrumentally rational and value-rational action suggests that the assumption of responsibility can have different motives. Captain Smith can go down with his ship because this will allow the rescuing of his passengers or because it is a duty of the captain to go down with his vessel, even if it were completely empty. Or, scientific freedom can be preferred over preventing the diffusion of potentially dangerous information, or different means to prevent this diffusion can be debated. Retrospectively, responsibility assessment can concern causal chains (did his be-

haviour cause this situation?) and motives (was her action in conflict with her own values? and was it with mine? what was her goal?). Referring to such a distinction provides a guide for answering questions about the motivations of responsibility.

5.2 Varieties of Expectations

Expectations are a matter of action orientation. As action is a matter of motives on the one hand, and of causes and consequences on the other, expectations necessarily concern both. The more cogent for the actors, the more broadly shared is the interpretation of a situation and the more congruent are the expected behaviours and the actual course of action. In section 3.1, we noticed that cogent expectations have to do with institutional constraints. Greater institutionalisation stabilises expectations in terms of shared, or at least integrated, representations of the world and societal issues, thus offering “mental shortcuts” for establishing relationships, including causal relationships, between artefacts and actors. As a consequence, institutionalisation increases the conformity to expectations and the likelihood of the congruence between the actual and the expected behaviour (Pellizzoni 2005). The influence of institutions, and of expectations incorporated in institutions, is acknowledged both by the theories considering institutional behaviour a product of interaction (such as symbolic interactionism and phenomenology) and by those who consider institutionalisation as a condition of interaction (like in Parsons’s systems approach). When STS deal with expectations, they show that expectations do not regard only actors and their behaviour, but also artefacts as well. Stable expectations become part of the “agenda building” activities of the actors involved in the development of technological artefacts and the knowledge on which their development is based. Expectations are therefore directed *to* the artefacts and, through them, to other actors, both in terms of their physical structure (Kroes 2009) or technical specifications (van Lente 1993), and of their function (Kroes 2009, van Lente 1993). This latter concerns their “*for-ness*” and teleological orientation. In so doing, STS see technology as a combination of the social *and* the material, emphasising that these intersubjective constructions ‘strike back’ at the actors and constrain their options for action, so that agency and structure are seen as coevolving (a position which van Lente and Rip 1998, 224, consider close to Giddens’s structuration theory). Once these prospected configurations are stabilised, they “serve as a yardstick for the present and as a guide for the future” (van Lente 1993, 171): what is defined a (technological) option can become a technological promise; promises generate requirements to be met, and they may demand actors to work and collaborate in

order to achieve them. Once they are shared, accepted, and thus legitimate, expectations acquire an autonomous force and call for action; they are translated into requirements that must be met in order to fulfill them, tasks are assigned to achieve them, and a variety of activities are undertaken to meet the requirements and the imperatives conveyed by expectations. Referring to the relevant literature, we have noticed that these integrated sets of actors' socio-technical expectations and agendas – about technologies, but also about the social actors and relations associated to them – can constitute (temporarily) irreversible patterns of coordination and division of techno-scientific labour, which is nicely captured by van Lente and Rip's notion of "prospective structures". In this book, we propose the term "structural stasis" to describe their durable stability. However, insofar as they are "historical products" (Disco and van der Meulen 1998, 325), these configurations can be subject to change by way of the local activities of relevant actors producing ad hoc arrangements and agendas. We refer to the (temporary) malleability of prospective structures and their associated agendas and configurations as "structural genesis".²⁸

5.3 Expectations and Types of Trust

The greater the "forceful coherence" of these configurations (van Lente and Rip 1998, 225, note 1), the smaller the need is to gather information and (new) knowledge about the situation of interaction: if one is sure about the (future) behaviour of others or the functioning of devices and systems, there is no need to check. This is why people would probably consider a passenger who asks for the details of the technical safety equipment of an aircraft (abstract trust) to be neurotic, and this is why we avoid checking the phone calls of our children and partners (personal trust). Yet, Simmel allows us to make a more nuanced specification of two types of trust based on the forms it assumes: faith or weak inductive knowledge (see section 3.3). Trust, therefore, is not only different because of the object of the expectations (specific individuals or abstract systems) it refers to, but because of its originating principle. In brief, (1) trust founds the hypothesis that an actor or a system will maintain a certain type of behaviour in the future on the basis of weak inductive knowledge, which is rooted in the previous interactions with other actors or with an

28 The notion of "genesis" and "stasis" are inspired from Margaret Archer's work on social morphogenesis (Archer 1995). In our view, although Archer's notion of structure is much wider, the understanding of the processes of structural elaboration has several contact points with the approach of this book.

abstract system; (2) trust implies the suspension of judgment on the contradictions and uncertainty that such weak knowledge cannot solve (an “act of faith” about the future behaviour of the actors or the future functioning of the systems).

Faith, in the sense that Simmel proposes in the context of trust, is coupled with shared, forceful and unquestioned beliefs. To faith, we can apply what Mary Douglas noticed with regard to another notion which is used to cope with uncertainty and divergence between expectations and events: sin.

The very name of the sin is often a prophecy, a prediction of trouble. So for the people living together first comes the temptation to sin, and then the thought of future retribution, then warnings from friends and relations, attacks from enemies, and possibly a return to the path of righteousness before the damage is done. [...] Before the bad event the sinner on the brink of transgression could be reminded of his responsibilities and checked in time; when the bad event happened, it would be traced back to the known sin. (Douglas 1994, 25-27)

Similarly, faith implies that “one ‘believes’ in something without justifying this faith by proofs of its worthiness, and often even in spite of proofs to the contrary” (Simmel 1950, 318, note 1). The stronger the belief, the easier it is to “suspend contradiction and ignorance as well” (Möllering 2001, 415).

Trust as weak inductive knowledge is, instead, ‘forensic’ in nature: it requires verification from past experience to make inferences about expected future ones. It is no coincidence that it is often considered specular to risk, which is the other side of any investment, even when it is an “investment” in another person as in the case of trust (Coleman 1963). Trust as weak induction asks for confirmation and can end in disillusionment when events defy expectations. It can therefore be associated with situations in which prospective configurations are more malleable and revisable and in which the force of shared expectations can be challenged and perhaps reversed.

5.4 A Heuristic Framework of Responsibility

The analysis of responsibility in the chapter “Responsibility and Social Action” identified the intimately “social” character of responsibility (as it is always directed to a specified or unspecified ‘other’) and identified three ‘modes of enactment’ of responsibility in terms of assumption, ascription and subjection. From this initial connection between responsibility and social action, we derived the following implications: (1) social action is oriented towards others’ behaviour both in terms

of motivations (meanings) and consequences; (2) actions can be instrumentally rational or value-rational; (3) social relationships imply the mutual orientation of actions; (4) expectations about the consequences of one's own behaviour and about others' behaviour, in terms of meanings and motivations, are central in orienting social actions and in establishing social relationships, including those in which responsibility is at stake; and (5) there are varying degrees of certainty about the consequences and motivations of others' behaviour, and trust can complement knowledge to support specific sets of expectations and actions.

5.4.1 An Illustration of the Framework

In the following, we will try to combine these considerations in a heuristic framework of responsibility. The first step is to refine the description of the three modes of enactment in the light of our observations on expectations and the two types of rational actions described by Weber. The distinction initially presented in section 2.1 can be reformulated as follows:

- (1) The *assumption of responsibility* of Actor 1 towards Actor 2 implies both the anticipation of the consequences of her actions on the other actor and the anticipation of the behaviour of the other actor in relation to Actor 1 actions (that is: the consequences that are expected by Actor 2 and her understanding of the motivations that prompted Actor 1 to act).
- (2) The *ascription of responsibility* by Actor 2 to Actor 1 rests on the possibility of the former making an assessment of the consistency between Actor 1 actions and the expectations Actor 2 had about their consequences (that is: the causal sequences triggered by Actor 1 actions, and the understanding Actor 2 had of the motivations that prompted Actor 1 to act).
- (3) *Subjection* describes a loop concerning the duty to answer of Actor 1 (assuming a responsibility) to Actor 2 and the right for Actor 2 (ascribing a responsibility) to ask Actor 1 for the consequences of her motivated actions.

As we have said, actors' expectations and their mutual orientation are central in defining these three 'modes of enactment' of responsibility. From our point of view, these expectations are a form of anticipatory knowledge about the consequences of actions and about the situation of interaction including the actions that are performed by other actors, their consequences, and their motivations. As we have seen, resorting to shared and stable expectations is a tool for reducing the contingency and uncertainty of social interaction. When considering this

anticipatory knowledge, we propose distinguishing between different forms of expectation according to some of the dimensions we have described above: (1) *relevant object* (whether they concern the consequences or the motivations of actions); (2) *scope* (whether they are focused expectations, concerning a specific and limited set of motivations and narrow domains of consequences, or diffuse expectations regarding actors' broader sets of motivations, related to diffuse and diverse positions and a broader defined set of consequences); (3) *temporal structure* (whether they concern future states or future periods of time including future pasts in ascription and subjection); and (4) *generality* (whether they concern local practices or broader, more general scenarios).

We have referred to the stability of expectations by borrowing the notion of "prospective structures" (van Lente and Rip 1998). To emphasise that different degrees of stability are possible, we distinguished between "structural genesis" and "structural stasis", in order to highlight respectively situations of malleability or irreversibility of structural arrangements.

Finally, as interaction is never free from uncertainty, no matter the cogency of structure, and since this aspect is particularly challenging when techno-scientific knowledge is concerned (see chapter 4), trust can be referred to as a further element of uncertainty reduction, or better: of uncertainty acceptance. In the case of structural stasis, trust is more likely to imply a suspension of judgement on potential contradictions and uncertainty (trust as 'faith'), while genetic phases are likely to entail the scrutinisation of available knowledge about previous interactions with other actors and abstract systems (trust as 'weak inductive knowledge'). Figure 5.1 illustrates the links between these different dimensions.

It must be emphasised (see also section 2.5) that, while we presented the framework by focusing on only two actors, it can be extended to more. There can be more than one actor assuming responsibility for, or imputing responsibility to, the others. While the framework we propose maintains an action-theoretic perspective, there is no reason to confine ourselves to orientation of action concerning only two actors. Moreover, the presence of constraining and enabling (prospective) structural arrangements suggests a view of an agency that is "embedded", thus salvaging the idea of institutional and material dependences that influence action and relations. Eventually, the relevant relations of these actors do not necessarily concern all three modes of enactment we have identified. They can be asymmetrical and can be articulated by different combinations of them. And we mentioned that the link between actors, their actions and consequences can be assessed by another actor who is not concerned by such consequences (or, put differently, to whom action is not directed). This "observer" is, by definition, a "third party" to the interaction,

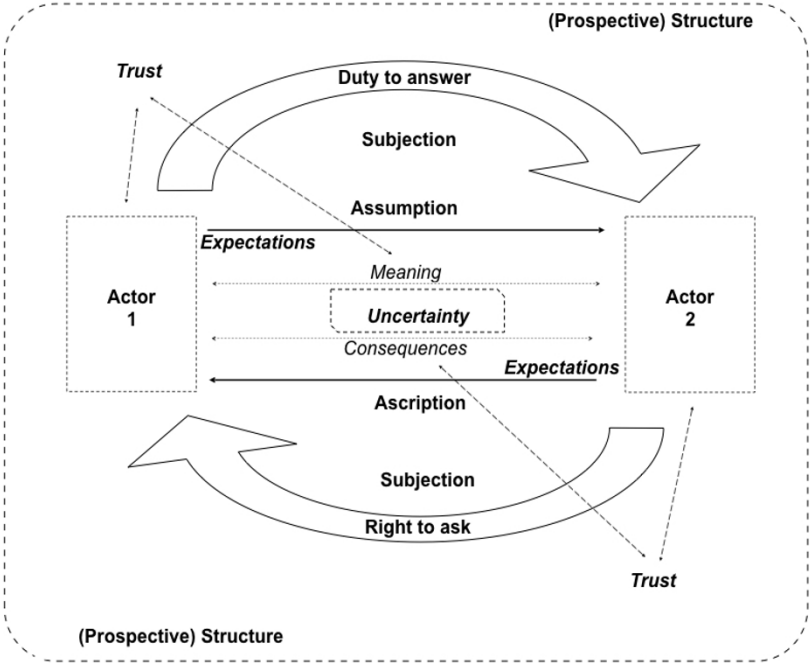


Fig. 5.1 A heuristic framework for responsibility
Source: adapted from Arnaldi and Bianchi (2014)

although, in so far as she assesses the situation, she directs her meaningful action to the other two actors we are considering, and a relation between her and the other actors can be subsequently established. As a general rule, therefore, we can consider the framework, and its elements, to be potentially applicable to a number N of actors, who are socially related (in the technical sense of reciprocally orienting their actions) (Fig. 5.2.).

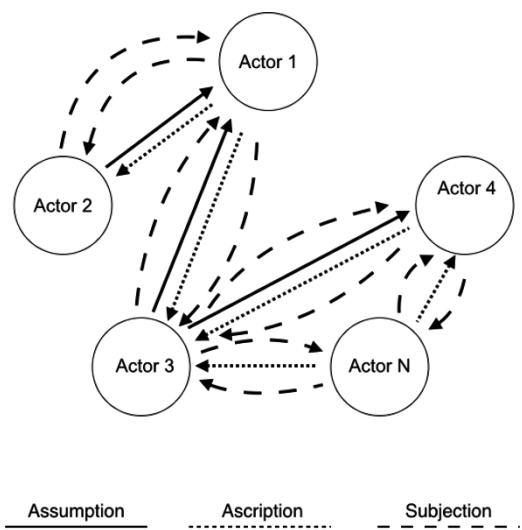


Fig. 5.2 The heuristic framework for responsibility in a plural setting

5.4.2 Generating Ideal Types

Chapter 4 observed the “essential elements of responsibility” we have identified initially in sections 2.1 and 2.2 (the consequences of action, the criteria for their assessment, and the actors that are involved) in the context of science, technology and society. To do so, a selective scoping of the literature was done to examine three corresponding dimensions of science-society relations: (1) the impact of scientific knowledge and technology development on society, (2) the criteria considered legitimate to assess these impacts, and (3) the actors that are considered relevant to assess and steer science, technology and their impacts on society.

The sections in Chapter 4 considered the changing features that the literature associated with each of these three dimensions. These changes followed the same path towards a broadened scope of the impacts, knowledge and actors entitled to assess and orient science- and technology-related activities. Our goal was neither to assess comprehensively the literature nor to propose an empirical reconstruction. The description we proposed, rather, highlighted the core elements of the changing “problematism” of science-society relations, which in turn constitutes the background of responsible S&T governance.

We will further elaborate this by referring to Max Weber's notion of ideal type. As mentioned in the introduction, for Weber ideal types are logical constructs with a heuristic function. He makes clear that "[i]n its conceptual purity, this mental construct cannot be found empirically anywhere in reality. It is a *utopia*" (Weber 1949, 90). The abstractness of ideal types is a consequence of the process producing them. "An ideal type is formed by the one-sided accentuation of one or more points of view and by the synthesis of a great many diffuse, discrete, more or less present and occasionally absent concrete individual phenomena, which are arranged according to those one-sidedly emphasized viewpoints into a unified analytical construct" (Ibidem). This one-sided emphasis is rooted in the interest of the researcher, and ideal types should be considered limiting concepts with which the real situation or action is compared and surveyed for the explication of certain of its significant components (Weber 1949, 93).

In the following, we outline two ideal-typical representations of responsibility and of its three modes of enactment (assumption, ascription and subjection) in science, technology and society. We call these two ideal types "focused responsibility" and "diffuse responsibility".²⁹ This distinction is based on the different ways in which actors in science and technology development, their impacts and our knowledge about them are considered.

"Focused responsibility" defines the impacts of techno-scientific advances in narrow terms, mostly internal to the technological-scientific domain and its economic implications. Uncertainty about the impacts of techno-scientific knowledge and innovation is seen as controllable, insofar as science itself provides the means to predict consequences, and technology the instruments to control them. This ideal type of responsibility reflects the separation critically analysed by means of the "double delegation" model (Callon, Lescoumes and Barthe 2001). The separation between nature and socio-political collectives, and the corresponding distinction between the social actors that are entitled to deal with them, are reinforced and legitimated by a self-referential and self-justifying view of technological and scientific

29 An ideal type is not a "hypothesis", "in the sense that it is a proposition about concrete reality which is concretely verifiable", nor "a description of reality if by this is meant a concretely existing thing or process to which it corresponds", it is not an average, nor a formulation of the concrete traits common to a class of concrete things (Parsons 1949, 603-604). As Weber wrote, "it must be accepted as certain that numerous, indeed a very great many, Utopias [ideal types] of this sort can be worked out, of which none is like another, and none of which can be observed in empirical reality as an actually existing [...] system, but each of which however claims that it is a representation of the 'idea' of it (Weber 1949, 91).

progress. In this configuration of responsibility, experts and decision-makers act as the relevant actors and relegate the general public to a passive role.

“Diffuse responsibility” is characterised by the overcoming of the division between science and society postulated by double delegation. It expands the forms of knowledge that are considered relevant to decisions on science and technology and broadens the criteria for assessing the social implications of science and technology. The inclusion of more actors in science and technology decision making, is a consequence of the first two points. The public ceases to be merely a passive recipient of technology (policy) impacts and diverse social actors enter the processes shaping the direction of techno-scientific development and its governance.

If we look at these two ideal types the terms of the heuristic framework we proposed, focused and diffuse responsibility can be seen as defined primarily by the mutually oriented expectations of the actors who are part of responsibility relations.

Responsibility is thus focused when expectations are focused. Focused expectations refer here: (1) to motivations, as far as the latter are centred on specific and discrete sets of behaviours of the actors (for example, the professional role of the scientist); and (2) to consequences, as far as the scope of consequences of science and technology is circumscribed to a narrow set of domains, primarily in techno-scientific developments and economic impacts.

Simmetrically, responsibility is diffuse when expectations are diffuse. Diffuse expectations refer: (1) to motivations, as they include actor's diffuse and diverse role-sets and, accordingly, to duties and obligations that are less defined and broader (such as the case of the scientist who has not only the professional duty to advance science, but to do this with a view to its usefulness concerning societal problems); and (2) to a broader range of consequences of technological change (such as impacts on distributive justice, dignity, privacy, etc.).

In focused responsibility, (prospective) structures can be stable and ‘static’. As a result, actors’ roles and tasks are unambiguous and unchallenged (for example, in the elaboration of policy as defined by the double delegation model). In diffuse responsibility, the structural relationships between science, technology and society, and consequently the roles they define, are instead considered to be in a changing, ‘genetic’ phase, as the result of the new knowledge and assessment criteria, as well as of the emergent forms of social interaction that are developed in the techno-scientific domain (for example, hybrid and participatory forms of policy-making).

As for trust, a situation of “structural stasis” implies the sharing of beliefs, or at least the integration of different beliefs about society, its components and their relations. As a result, these structural constraints operate towards a greater institutionalisation of social relations, both in terms of behavioural patterns (thus increasing conformity to expectations and the likelihood of congruence between

the actual and the expected behaviour) and in terms of shared, or at least integrated, representations of the world and societal issues (thus offering ‘mental shortcuts’ for establishing relationships, including causal relationships, between events, objects and actors). In both cases, institutionalisation reduces the need to gather information and assumes the suspension of judgment on expectations and beliefs. For instance, focused responsibility turns ‘faith in science’ into ‘trust in scientists’ whose specific research activities are considered from the point of view of a more general belief in scientific and technological progress. In diffuse responsibility, with its changing structures, the faith-based element of trust, “suspension”, leaves room for the greater importance of inductive knowledge, albeit weak. The (assumed) stability over time of these relationships with people or systems is inductively determined through direct experience, or through mediated communication. While ‘faith in science’ does not disappear, but scientific activities and their impact are increasingly subject to public scrutiny.

Focused responsibility considers uncertainty about the impacts of technology as residual and manageable by means of resorting to shared and durable expectations about roles (such as professional roles) and facts (for example through institutionalised procedures such as risk calculation) that are consistent with stable (static) structures. Diffuse responsibility considers a more pervasive uncertainty, as a consequence of the areas of ignorance and indeterminacy that characterise our knowledge of technology’s impacts, but also as a result of the ambiguity of roles and the limited cogency of institutional models that characterise a “genetic” phase of structural transformation.

Focused expectations, static structures, and suspension of judgment as the prevalent dimension of trust, describe modes of responsibility in which assumption, ascription and subjection are relatively uncontested and limited in scope to aspects related to the techno-scientific domain. For example, if we apply this to the responsibility of scientists and policy makers, the professional role of the scientist can be seen as predominantly characterising the assumption of responsibility: the scientist must, first and foremost, be a good scientist. In terms of ascription, she may be imputed of having fallen short in advancing science and technology and, as far as risks are concerned, of having made mistakes and pitfalls in her expert assessment. Moreover, scientists have a duty to answer, and other social actors have the symmetrical right to ask them about aspects of their scientific activity. The moral of “speaking truth to power” follows this logic. Similarly, policy makers are expected to assume responsibility for supporting the efforts of scientists and technologists to advance techno-scientific progress, in order to let its benefits flow to society. When risk is concerned, they must take up experts’ assessment and recommendations.

If they fail to uphold scientific knowledge and activities, in these various forms, policy makers can be called to answer for such failure.

Diffuse expectations, genesis of structures, radical uncertainty, and weak inductive knowledge as a main dimension of trust, describe relationships in which responsibility assumption, ascription and subjection concern a wider range of social issues and needs and result in broader criteria for assessing the impacts of technological innovation on society. For example, the assumption of responsibility of scientists and policy makers is broadened to include the ethical, legal and social implications of technology and innovation too. It does not only concern aspects that can be relegated to the phase of risk management, or to post hoc impacts of a technology. Techno-scientific progress is no longer considered as self-sufficient, and its very direction is scrutinised. Along with the actors related to them, these societal aspects form instead an indistinguishable whole together with those related to research and technological development. Eventually, scientists may also be ascribed, at least from the moral point of view, these broader and indirect effects of their work, in a context in which a radical uncertainty characterises technology and its consequences. Scientists can be held responsible for these consequences, if not legally (liability), at least morally (blameworthiness). Symmetrically, policy makers see their responsibility defined in broader terms too. The assumption of responsibility no longer concerns the commitment to effectively support self-referential progress, but the mandate to align science, technology and innovation to societal goals and demands (no matter how defined and ranging from “competitiveness” to “sustainability”), through the inclusion of other societal actors in innovation and decision-making processes too. Policy makers can be ascribed the responsibility for failure in steering this alignment, for instance by not effectively including the concerned social actors in the definition either of research priorities (for example through the activation of appropriate consultation or participation mechanisms) or the relevant impacts of technology to be considered in assessment processes. Eventually, it is this alignment of science and society that constitutes the standards they have to meet and for which they are answerable.

From such a perspective, controversies on responsibility in science and technology can also be analysed as conflicts over expectations. Different actors may have differing expectations with respect to the consequences (causality) or motivations (meaning) of action, or both. This diversity reflects focused or diffuse expectations and their unequal distribution among the concerned actors, due also to ignorance and ambiguity of facts and motives. Eventually, trust can be granted provisionally and can be subject to scrutiny, but its two-fold nature, as weak inductive knowledge and suspension of judgment, implies an inner tension, and the “suspension of judgment” can suggest the existence of irreducible, a-rational “acts of faith” by

different social actors. As a result, there may be a mismatch between responsibilities assumed and ascribed, as well as between the two directions of subjections.

If we consider the dimensions we used to examine responsibility in the two different configurations of science, technology and society relationships as variables and the alternative states for each of them as their values, we have a framework that has the advantage of a certain degree of conceptual parsimony (based on the centrality of expectation) and is sufficiently flexible to explore both the transformation of responsibility arrangements in science, technology and innovation and the conflicts and clashes between these arrangements that occur in the arenas where research, technology and innovation are debated and shaped.