people committing infractions on a regular basis. Therefore, contrary to the intent, this may lead to increased risk (Reason, 1997, 50).

Assuming that the above argument holds true, the next issue that we must consider is whether or not the individuals involved exercised "due care." However, questions on what due care implies are certain to arise immediately. In the case of the Challenger accident, we can identify a problem regarding the burden of proof. NASA engineers were conservative as a rule, what was usually done, and continued to demand a proof of safety with respect to Morton Thiokol; this emphasized the practicality of the design. In contrast, the tables were turned when Boisjoly and the others raised concerns immediately before the launch, and NASA demanded that they prove the existence of danger. Therefore, what kind of suspicion is reasonable with regard to such a "risk" that has yet to have an effect, what proof should be demanded in that case, and what decision should be taken in accordance with the given rules are the questions that fall under the concept of due care. Thus, this situation is accompanied by demands for normativity that transcend specific circumstances.

Here, we will avoid dwelling on individual measures to achieve improvement. However, when due care is generally required, besides the concerns regarding what comprises due care, determining who makes the decision is critical. For example, with regard to product reliability, the problem is whether it is appropriate that engineers with specialized knowledge determine a design with strict application methods such that they are not responsible for the outcome and the consumers bear those costs (Velasquez, 2005, 110). If done so, this is merely a kind of paternalism. Thus, keeping the design setting in mind, we will expand the scope of our discussion to "technology in culture" and examine the public nature of technology within it.

5 Historical Nature of Design

In general, design can be considered to be a process of stipulating target functions and proposing structures to implement those functions. This goal-orientatedness is considered to be a characteristic of technical knowledge. However, at the same time, it expresses the fact that technology is incorporated within a wider social context, for example, through markets or individual customers, etc. In this case, the relationship between society and design could still be perceived as that between social needs and optimal solutions. This view should not be understood from narrow perspectives. When examined from viewpoints such as due care with respect to safety and environment, the nature of social and cultural regulation extends to the design process as a whole, i.e., it is not merely restricted to direct functions but incorporates secondary functions, etc.

Here, let us consider the Ford Pinto case as an example. Despite the usual depiction in textbooks on engineering ethics, this case shows that the assessment of the uncertainty and incompleteness of technology includes a valuation beyond

technology in the narrow sense. This case is usually explained as follows. In the late 1970s, the Pinto, a compact car designed by Ford, was developed in a short period of time to compete with competitors' compact models. Since style was prioritized, the car had a potential flaw in terms of design, in case of a collision, the gas tank could rupture if it were struck from behind. Regardless of the fact that Ford could have made improvements at the cost of just $11 per car, the company was attacked for continuing to manufacture the car based on its cost-benefit analysis until 1978, when new regulations became mandatory.

In most of the textbook descriptions, Ford is blamed for its "profits come first" approach that was grounded in its cost-benefit analysis. However, as some writers point out, despite the fact that Ford's analysis was malformulated, it is not evident whether this analysis was really the decisive ground of its (mis)conduct (Birsch, 1994).[2] Although this particular problem is beyond the scope of this chapter, I would like to use this case to highlight the issue concerning the definition of "safety." Obviously, an automobile cannot by nature guarantee complete safety; moreover, one cannot expect the same level of safety from a compact car as from a conventional large-sized car. In addition, the Ford Pinto is not said to have failed the safety regulations at the time (although there are some people who hold the view that this was a gray area). However, as Richard De George also noted, the reason Ford was attacked was not because of such facts but because, despite the existence of technological solutions, the company was negligent with respect to a risk that should have generally been avoided, i.e., explosion of the gas tank (De Georg,e 1994). Moreover, writers have also highlighted a background in which, amidst the consumer movements of the 1960s and the establishment of the National Highway Traffic Safety Administration (NHTSA) in response to these movements, people's awareness with respect to automobile accidents was shifting from the driver's responsibility for the accident to the manufacturer's responsibility for providing adequate safety (Saito, 2005). Given these views, a part of the reason for Ford's response was assumed to be that the company did not believe that people would be willing to pay for eliminating such a risk and that it could not have predicted that ignoring this willingness would invite a backlash in the future (Harris et al., 1995). I elaborate on this point in the discussion on the research of the history of technology.

If the above debate is an appropriate depiction of this case, determining what "safety" implies would not be primarily dictated by technology but by various other factors such as cost and human trust and desires. Such a social decision is embedded in design. Therefore, if we define the automobile as a form of mass transportation, the assessment of what is valued technologically or what items are risks is conducted on the basis of such a definition. In the words of De George, the decision to accept risk is "not only an engineering decision" but "also a managerial decision, and probably, even more appropriately, a social decision" (1994, 186).

[2]The validity and scope of risk assessment needs a deliberate analysis. This is an exhaustive task and will not be undertaken here.