freedom, just like humans are supposed to have. Rather, the example shows that (1) intentionality is hardly ever a purely human affair, but most often a matter of human-technology associations; and (2) freedom should not be understood as the absence of 'external' influences on agents, but as a practice of *dealing* with such influences or mediations.

3 Designing Material Moralities

This analysis of the moral agency of technological artifacts has important implications for the ethics of technology and technology design. First, the mediation approach to technology makes clear that moral issues regarding technology development comprise more than weighing technological risks and preventing disasters, however important these activities are. What is also at stake when technologies are introduced in society are the ways in which these technologies will mediate human actions and experiences, thus helping to form our moral decisions and our quality of life. The ethics of technology design, therefore, should also occupy itself with taking responsibility for the future mediating roles of technologies-in-design.

Moreover, our analysis of technological mediation shows that, even without explicit moral reflection, technology design is inherently a moral activity. Designers, by designing artifacts that will inevitably play a mediating role in people's actions and experience, are thus helping to shape (moral) decisions and practices. Designers 'materialize morality'; they are 'doing ethics by other means' (cf. Verbeek, 2006). This conclusion makes it even more urgent to expand the scope of the ethics of technology to include the moral dimensions of the artifacts themselves, and to try and give shape to these dimensions in a responsible way.

3.1 Designing as Combining Agencies

In practice, however, taking this responsibility runs into a number of serious problems. One, to 'build in' particular mediations, or to eliminate undesirable ones, it is necessary to predict what mediating roles technologies-in-design will play in their future use contexts, while there is no univocal relationship between the activities of designers and the eventual mediating role of the products they design. Technological mediations are no intrinsic qualities of technologies, but are brought about in complex interactions between designers, users, and the technologies. As became clear above, technologies can be used in unforeseen ways, and therefore are able to play unforeseen mediating roles. The energy-saving light bulb is another example of this, having actually resulted in increased energy consumption since such bulbs often appear to be used in places previously left unlit, such as in the garden or on the façade of a house, thereby canceling out their economizing effect (Steg, 1999; Weegink, 1996). Moreover, unintentional and unexpected forms of mediation can arise when technologies

are used in the way their designers intended. A good example is the revolving door which keeps out both cold air and wheelchair users. In short, designers play a seminal role in realizing particular forms of mediation, but not the only role. Users with their interpretations and forms of appropriation also have a part to play; and so do technologies, which give rise to unintended and unanticipated forms of mediation. These complicated relations between technologies, designers, and users in the mediation of actions and interpretations are illustrated in figure 1.

The figure makes clear that in all human actions, and all interpretations informing moral decisions, three forms of agency are at work: (1) the agency of the human being performing the action or making the moral decision, in interaction with the technology, and also appropriating the technological artifact in a specific way; (2) the agency of the designer who, either implicitly or in explicit delegations, gives a specific shape to the artifact used, and thus helps to shape the eventual mediating role of the artifact; and (3) the agency of the artifact mediating human actions and decisions, sometimes in unforeseen ways. Taking responsibility for technological mediation, therefore, comes down to entering into an interaction with the agency of future users and the artifact-in-design, rather than acting as a 'prime mover' (cf. Smith, 2003).

The fundamental unpredictability of the mediating role of technology that follows from this does not imply that designers are by definition unequipped to deal with it. In order to cope with the unpredictability and complexity of technological mediation, it is important to seek links between the design context and the future use context. Design specifications should be derived from the product's intended function and from an informed prediction of the product's mediating roles and a moral assessment of these roles. A key tool to bring about this coupling of design context and use context, however trivial it may sound, is the designer's moral imagination. A designer can include the product's mediating role in his or her moral assessment during the design phase by trying to imagine the ways the technology-in-design could be used and by shaping user operations and interpretations from that perspective. Performing a mediation analysis (cf. Verbeek, 2006) can form a good basis for doing this. It cannot be guaranteed that designers will be able to anticipate all relevant mediations in this way, but it is the maximum designers can do to take responsibility for the mediating roles of their products.

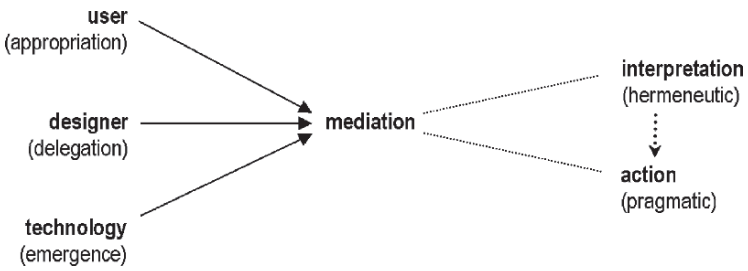

Fig. 1 Origins of technological mediation