A barrier to such strategies is represented by the over-functional nature of computer software design applications, because software has evolved by incremental addition rather than through unified multifunctional tools. Like the Japanese kitchen knife, the skilled professional requires flexible multifunctional tools rather than the fragmented gadgetry that is prevalent in the Western kitchen. Such a shift would result in a continuity of control, compatible with the increased continuity of design data flow; a traditional mark-maker can be used in a variety of ways. Tools should respond to and dictate skills, creating new forms of representation whose controls literally lie at our fingertips. Given the predicted growth of haptic feedback devices, a truly "intelligent" interactive "pencil," together with other similarly transformed design tools, should soon be possible. Such devices are an increasing necessity if designers are to address the processing of continuous data.

At this point in time, design practitioners might look enviously at music where, partly as a result of the digital basis of harmonic systems and annotation, it has long been possible to input data across a wide range of instrumental interfaces. These range from the traditional (using matching and often hard-won skills) to the innovative (requiring new or often no skills). Representational instruments have few parallels: there is little outside the computer that can mimic traditional drawing skills, while simultaneously exploiting new processing options. Perhaps design practitioners and theorists alike are partly to blame for not providing sufficient market-pull to harness appropriate levels of technology-push. This missing interface has meant that a generation of designers has been relatively weak at building directly on their traditional skill-base and has had to adapt to the machine, rather than harness existing hand/eye skills to machine intelligence.

The notion of an intelligent, intellectually "sharp" pencil or "thoughtful marker" might serve as a useful technological metaphor and ambition. Such an instrument would possess an interpretative, processing and information function, in addition to its primary data input role. It would respond to skills without boundaries, allowing the user to perfect hand/eye/brain routines through successive iterations of technological advancement. Such transferable representational skills linked to both personal and corporate knowledge would be relatively future-proofed.

Norman (1998, p. 221) argued convincingly for a more human-centred approach to the design of computers, primarily as a means of making their potential more realizable and accessible to ordinary consumers. As part of this thesis, advanced markets are characterized as immature, their products difficult to learn and operate, and their development driven by technologists. Such products inevitably demand high-level skills, but frequently these might be characterized as *purposeless skills*, i.e., those that essentially attempt to overcome the inadequacies of the system in contrast to *purposeful skills*, which link high-level human abilities to positive outcomes (Figure 8.7). Clearly, these two types of skill are not always easy to separate and the former may occasionally become the catalyst for the latter. Nevertheless, Norman's dictum could be applied to professional augmented reality technologies within the marketplace and not merely to their volume-distributed, consumer progeny. In this way, augmented reality tools may overtake their rather ineffective and deskilled virtual equivalents, although, as Norman argues, this process may require corporate as well as user action, so that the designers and the eventual users of the products interact. In this case, the eventual users are

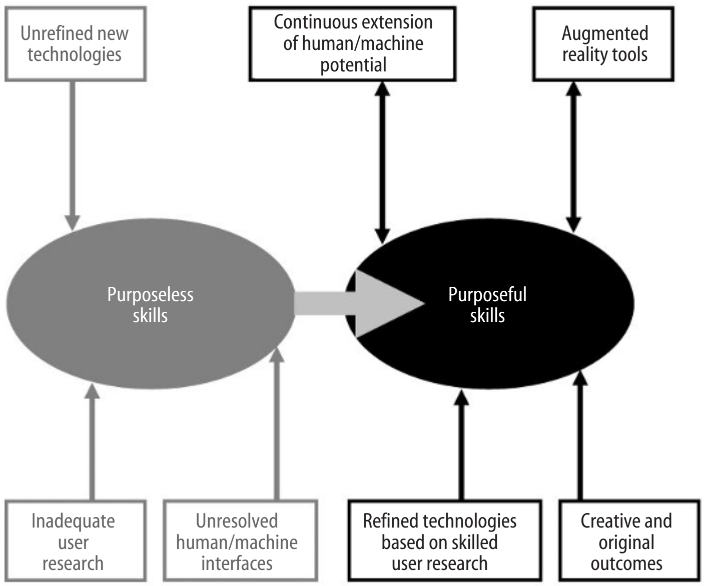

Figure 8.7 The transformation of transient skills into long-term skills.

designers so that cooperation might be assumed to be more, rather than less, fruitful than their designer/consumer equivalents.

In conclusion, several factors point the way forward: first, designers should be equipped with the specification skills required to take more control over new working environments. The design profession – through associations, professional groups, education and research projects – should influence/press the IT industries to develop technologies that adapt to existing high-level skills and new skills, providing software systems with truly integrated, responsive design tools rather than add-on functions.

Second, new models of representation should be developed which address continuous design data processing and practitioners should become more active participants in the development of appropriate design data-processing tools. Finally, as the profession prepares for a period in which real and artificial worlds collide, it should ensure that the positive contribution that each might make to a purposeful reality is not lost in a predetermined and exclusively technology-driven race to acquire totally immersive skills. The starting point of these three seminal activities should be the cultivation of increased knowledge about skills, including their past, present, and future value. Design practitioners should emerge from such deliberations equipped with purposeful skills that have been acquired partly as a result of, rather than a denial of, their supposedly "purposeless" counterparts. Such an approach would represent a true, self-initiated "training for life" (Industrial Centre 2000, p. 1).

References

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