Business Models for Enactive Interfaces

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Abstract

The definition of a Business Model is one of the fundamental steps in the creation of a new company, being strictly related to the types of product or services in the focus of the company itself. Among various types of technological products, Enactive Interfaces pose challenges in the definition of a good Business Model. The aim of this paper is to address these challenges and to provide an understanding of the peculiarities related to the commercialization of the Enactive Interfaces by analyzing a selection of companies in related fields.

1.   Introduction

The concept of Enactive knowledge has brought new perspectives into the field of human computer interaction and Virtual Reality systems. While research teams are investigating the theory and creation of Enactive Interfaces, it is also interesting to analyze the possible business activities that these interfaces can introduce. The purpose of this study is to identify and assess current and potential business models relating to the creation and accessibility of Enactive Interfaces.

Despite widespread use in the industry, the concept of business models is often poorly defined. Some definitions address aspects related the architecture of the product, service and information flows [16]; others refer to the core logic for creating value in a company [13]; furthermore a series of authors introduce a financial element into their definitions [1], [14]. It is also worth mentioning the ongoing discussion of the difference between strategy and business models [15] even though many people use these terms interchangeably.

In general, the purpose of creating a model is to help understand, describe, or predict how things work in the real world by exploring a simplified representation of a particular entity. Therefore in the case of business models, the model shall be defined as a representation that helps an organization understand, describe and predict the 'activity of buying and selling goods and services'. Why is there interest in business models? Are business models useful? What are their purpose [10]?

The economic environment of today is competitive, complex [6], rapidly changing and characterised by an increasingly uncertainty [3] that makes business decisions complex and difficult. This difficulty increases when the level of the technology involved is even more sophisticated. As demonstrated by many studies [9], the business model concept can fill some of these gaps; it is one of the tools that can help tackle some aspects of the complexity by highlighting issues and pointing out the relationships between different variables, and can eventually gain an important position in managing uncertainty [5]. Business models can improve measuring, observing and comparing the business logic of a company [7]. Another advantage of the business model concept is to help foster innovation and increase readiness for the future through business model portfolios and simulation [2]; it may also be useful in the legal domain related to the patenting [4].

In the general context of Human Computer Interaction (HCI), Enactive Interfaces play a delicate role due to the fact that they interact more with the user's knowledge and sensorimotor system. Moreover, Enactive Interfaces can be analyzed in terms of their technology or application field and knowledge area. Some business models have been identified and applied to specific business fields such as web/digital cultural content, e-Business, and electronic markets [17], [16]. It has been found that some business models are much more common than others, and that some do, indeed, perform better than others.

A business model analysis approach has been selected and applied to a number of relevant companies in the fields of HCI and Virtual Reality (VR) systems, since clearly identifying Enactive related businesses is difficult. This approach allows the classification of companies into fields, and the identification of principal aspects that characterize their business models. After having analyzed the main aspects and challenges of Enactive Systems and the business model characteristics previously identified, a potential set of business models to be adopted for Enactive Systems has been proposed.

As will be described in the following sections, the peculiarities of Enactive Systems affect the resulting business models. They require a strong focus on the user Human Perception Action loop, and—therefore—responsiveness and understanding to the needs of target users.

2. Analysis of Business Models

In addition to specific business model definitions and broad classification of such models, a number of authors provide us with business model ontologies [12], classifying business models with a certain number of common characteristics across a set of different categories. For simplicity, we have focused on an operative and systematic study [11]. Starting from a general definition it is possible to highlight business model components in key areas and their relationships. The entities of this ontology and their relationships are represented in Figure 1.
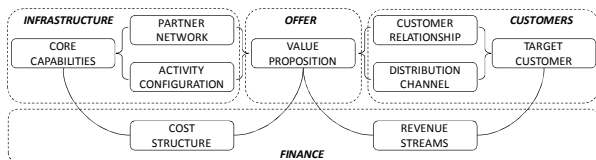

Figure 1. Business Model structure [12]

According to this model, the main aspect of a company is represented by its value proposition, strictly linked with its offer. This value is delivered to groups of customers through distribution channels. It is the strategic crafting of client acquisition channels that establishes lasting and trusting relationships with the customer. In most companies, these activities—and particularly understanding target customers and defining the customer relationship—are performed by marketing staff. Once having defined its core capabilities and infrastructure, the company generates value through the arrangement of resources and activities supported by partner relationships with other entities. Finally, the financial aspects of the company are supported by its cost structure and revenue streams.

3. Business Model Analysis in HCI and VR

The detailed structural analysis of a business model based on its value proposition can be used for the classification of business related to Enactive Interfaces. For this study, the starting point has been businesses focusing on human-computer interaction with an emphasis on Enactive Interface technology and design. Because many different technologies are involved in the creation of multimodal interfaces, companies have been selected to cover areas spanning hardware, software and servicing. The list has been obtained by focusing on companies with a strong position in the market or a well known history of success.

In the area of hardware we have selected producers and distributors of haptic interfaces, interactive interfaces and more traditional HCI devices. The companies representative of the software aspects are those related to software tools for managing advanced interfaces, or supporting human interaction based on awareness and knowledge. Finally, we have selected companies in the area of simulation and training, including servicing for such systems (Figure 2).
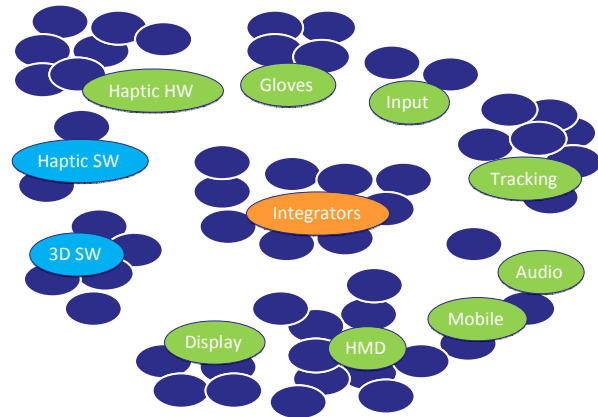

Figure 2. A display of the selected companies (blue circles) grouped by product area

The above empirical selection of 55 companies can be analyzed to understand possible business models according to two dimensions: involved assets and rights being sold. The first dimension distinguishes among four important assets: physical, financial, intangible and human. The second dimension classifies a business as creator, distributor, landlord or broker.

By combining these two dimensions it is possible to classify businesses according to sixteen different business models. Among these sixteen only few of them characterise the HCI-VR businesses; Figure 3 shows the distribution of the selected companies.
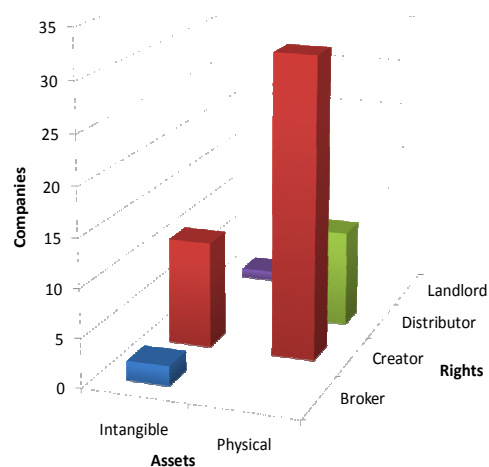

Figure 3. Distribution of Business Model types

The most recurrent role is represented by physical creator including companies that produce devices; this

kind of business is strictly linked with physical distributors. From a general overview it is possible to note that the absence of some business models in this representation may indicate an opportunity to be taken into account, for example the areas of human training and exchange that have not yet received much coverage.

Since this analysis allows the classification of any type of business, the analysis has been focused to deal with key features and their relationship. In particular we adopt the business ontology description presented above [12]. The detailed analysis starts by comparing specific companies in different areas of HCI-VR.

In the field of haptic interface production three major actors are *Sensable*, *ForceDimension* and *Novint*. There is an important difference in the way *Novint* poses itself because its target is gamers. It is also worth mentioning that *ForceDimension* is performing a form of outsourcing providing the core technology for *Novint* devices. Figure 4 shows the analysis outlined in Figure 1 applied to Novint.
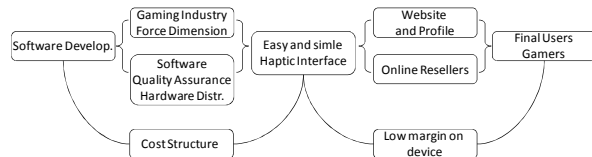

Figure 4. Structure of the Business Model of Novint

Once the ontology is applied to all of the companies in the sample, it is possible to construct an aggregate business model diagram showing all of the approaches and their different aspects. In the majority of cases the value proposition is a specific device or software, although there is a wide group of companies that provide consulting and complete VR systems. As expected, the target customers are mostly represented by industries and research centers, although a few companies are consumer oriented. Such customers are reached mostly by resellers, or with subsidiaries that sometimes provide demonstration centers. The value configuration is mostly based on support service for existing hardware, integration services for a better use of the devices, and some focus on device design. The core capability of a company is generally related to a specific technology. Finally, the partner network of such companies is characterized: for producers by companies that provide complementary technologies, or for integrators by the providers of core technology.

The Business Model ontology analysis applied to the selected companies allows the major structures of these companies to be identified, but is unable to capture dynamic aspects of the evolution from an idea to a product. We have therefore identified two main categories for capturing this evolution. The first indicates the status of an idea's maturity; in particular we have selected four main stages: idea, prototype, product and mass market. While this classification is

common for general products that become mainstream, for HCI and VR it is more difficult to advance from one stage to the next. The second dimension captures the place in which such transformation takes place. Four principal areas have been identified: the University where many VR products originate; companies managing engineering or production of products; System Integrators, companies that assemble VR systems; and external producers that provide outsourcing or licensing companies.
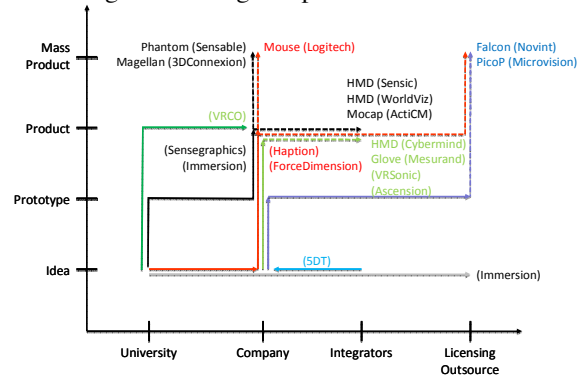

Figure 5. Description of evolution from idea to products along Product Paths

Given these two categories we have identified some *product paths* that show the relationship between an original idea and the places in which it becomes stronger. Figure 5 shows these main steps and examples of identified products and companies that proceeded along these paths. Different colours correspond to different steps, while the dashed lines correspond to possible directions for a path. In the case of Haptic Interfaces, some companies begun by developing prototypes in Universities, such as *Sensable*, or preliminary ideas. In the case of software it is common for complete products to be developed in a University that are later sold to a company for distribution. The grey line from idea to licensing represents the case of patent licensing.

4. Toward Enactive Systems

The creation of a business around Enactive Systems presents challenges similar to those of HCI, with some more specific aspects introduced by the characteristics of such systems.

The multimodal component of an Enactive Interface makes the interface more complex to manage, yet at the same time the goal of Enactive Systems is to create interfaces that are simple to use and intuitive.

Intuitiveness and usability are two challenging aspects that have been extensively addressed by HCI systems because of the large target market. In the case of VR devices, however, the usability aspect is only one of the dominant parameters for device quality because the target customers for such emerging technologies are often highly specialized and are

willing to invest in learning new technologies despite the costs involved. As the target market for such devices grows, the importance of usability, brand identity and human-centered design activities becomes an increasingly important element of a product's success. In the field of VR, many companies have pursued a strategy of device production or technology development focus, provided that they have a partner network allowing them to tackle difficult integration problems and software aspects. In some cases this type of company has adopted a more vertical approach, producing the relevant software and providing customers with a complete solution. This requires the company to be prepared to offer the support needed to service and respond to evolving user needs.

In contrast to complicated VR installations, many Enactive Systems tend to be more simple and easier to use, being in many ways more similar to a traditional HCI device. For this reason, it is more probable to adopt a Business Model in which the complete system, including hardware and software, is managed and provided to the final user. A central aspect of an Enactive System is the strong relationship with human perception and understanding. This relationship is not limited to specific sensorial fields, as in HCI or VR systems, but involves multiple senses. The integration of such aspects for a wide market product requires a strong effort for the validation of the product and its final design. For companies with a heavy engineering focus, business and human factors experts should be involved early in the design process to develop viable products that respond to real-world need. Design research strategies can be useful in this process [8].

A viable solution to the complexity of Enactive Systems is licensing, a means that has been applied in many hardware and software cases. A company decides to license its technology when it is not able to produce it by itself, or when integration activities are beyond its core expertise. Such was the case during the initial phase of *Immersion*, when force feedback joystick technology was licensed to a third party for production. In its current stage, *Immersion* produces high-end devices for research and high-tech companies while licensing its force feedback technology to console companies like *Sony* and *Microsoft*. A similar approach has been followed by *DDD*, a company specialized in glass-free stereographic displays, who initially licensed its technology to *Shape3D* and later followed with the direct production of advanced displays.

In the Business Model ontology, the value proposition is not the only core aspect to be analyzed. The partner network allows problems concerning technology integration to be managed while at the same time exploiting the technology in different application fields. In the area of HCI, the success of peripherals depends on support from the videogame industry - in particular if such devices provide new gaming possibilities.

5. Main Conclusions

The identification of future business models and their effectiveness has some limitations, but the results of this analysis can provide direction and understanding to the development of more effective businesses concerning Enactive Interface technology. Hopefully, the application of this knowledge will lead to the greater dissemination and use of Enactive Interfaces in the marketplace.

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