

Handheld Computing Predictions: What Went Wrong?

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Abstract. Handheld computers have been criticized as one of the most excessively hyped new IT products of all time. This paper looks at handheld computing predictions made over a 10 year period, investigating what went wrong, and what went right, with handheld computing predictions. Handheld computing predictions can be divided into three phases, depending on the product concept definition widely held at the time: handheld computers as pen-based computers, personal digital assistants, or handheld companions. While longer-term predictions were inflated in the first stage, they were surprisingly accurate in the second stage and excessively conservative in the third stage. The complaints about over enthusiasm and hype have more to do with incorrect product concept assumptions than poor guesses about the size of markets—technology directions are just as difficult to predict, or even more difficult, than technology sales.

1 Introduction

Handheld computers have been criticized as one of the most excessively hyped new IT products of all time (e.g., [3]). The disappointing market performance of the Apple Newton MessagePad was often highlighted as a symbol of computer industry hype spinning out of control, though almost all the major personal computing companies in the early 1990's (including Apple, Microsoft, IBM, Tandy, and AT&T), in addition to some well funded start-up companies (such as Go and Momenta), suffered from high-profile disappointments in this industry. The most famous prediction about handheld computing was attributed to John Sculley, then CEO of Apple Computer, who was said to have claimed the Personal Digital Assistant (PDA) market would grow to \$3.5 trillion. Sculley denies ever making this overly optimistic prediction [5], but the widespread repetition of this claim indicates how disappointed many observers were with the early handheld computer industry.

This paper looks at handheld computing predictions made over a 10 year period, investigating what went wrong, and what went right, with handheld computing predictions. With the benefit of hindsight, what can be said about these predictions? How wrong were they? And did they come close to envisioning the increasingly successful handheld computer industry found today? An important idea used in this study, borrowed from studies of the history and sociology of technology, is that technologies are developed by communities with conceptions of the problem that a new technology is trying to solve, and the key performance criteria that follow from a particular product concept definition [2]. While the 'winning' technology ideas seem

obvious in retrospect, it was not obvious in the early 1990's that handheld computers were better seen as companions to existing PCs than as stand-alone consumer devices, or that handwriting recognition or wireless communications would not be the most crucial technological features for market acceptance. The numerical forecasts of the size of the handheld computing market appear, in retrospect, to be surprisingly accurate, despite the complaints about hype and technology fads. What proved to be inaccurate in the early forecasts were the assumptions about product concept definition—an understanding of what exactly a handheld computer should be.

Why is examining emerging technology predictions important? There are at least two good reasons: one to do with expectations management, and another, more fundamental concern with the impact of events early in a technology's development. The expectations management problem is the issued raised by most industry observers. If a new technology is excessively hyped, disappointment inevitably follows, and development of a new technology may be slowed or abandoned. A more fundamental reason, however, for studying emerging IT predictions is the argument that events early in the life of an emerging technology have a disproportionate effect on its later development [4]. A choice of a particular standard (e.g., the QWERTY keyboard), a business partnership, or a key customer at a critical moment could, according to this argument, may have a substantial impact on what the technology eventually becomes. To the extent that visions or predictions of technology futures affect these early events, predictions are important.

2 Handheld Computing Predictions Data

Data on handheld computing predictions was taken from a search of the ABI/Inform Global article database. 2528 articles on handheld computing, pen computing, palmtops, and personal digital assistants were found in the database between 1987 and 1997. This study extracted published numerical predictions that were made three or more years into the future. This data is summarized in table 1.

Table 1. Handheld computing predictions, three or more years in advance.

Year	Projected Units	Product Definition	Source	Publication
2001	13m	handhelds	IDC	Infoworld, May 18 98
2000	2.4m	PDA, US	Yankee Group	InformationWeek, 22 Jul 96
2000	5m	handhelds	Dataquest	Ziff-Davis UK, 4 Jun 1997
1999	2.7m	handhelds	Dataquest	Guardian (London), 1 Aug 96
1999	1.6m	handhelds	Microsoft	Computer Reseller News, Apr 18 94
1999	4.84m	PDA	Forrester	Computer Reseller News, Sep 26 94
1998	5m	PDA	Link Resources	Upside, June 1994
1998	1.36m	PDA, US	BIS	Computer Reseller News, Sep 26 94
1997	1.4m	PDA	BIS	Computer Reseller News, Apr 18 94
1997	2.6m	PDA	BIS	Computer Reseller News, Feb 21 94
1995	6.1m	pen-based	Dataquest	Sales & Marketing Mgmt Feb 91
1995	2m	pen-based	Infocorp	Computerworld, June 3 91
1995	1m	pen-based	BIS	Advertising Age, Nov 11 91
1995	4m	pen-based	Dataquest	Business Week Mar 30, 92

1995	70m	PDA	Technologic	Computerworld, Aug 31 92
1994	3.2m	hand-held	Dataquest	Sales & Marketing Mgmt Feb 91

The handheld computing predictions can be divided into three distinct periods, based on the most common definition of what the product category was assumed to be. Though these products were always assumed to be highly portable, and were computing devices, the names given to them varied over time. Predictions before 1992 tended to focus on handheld computers being pen-based. Predictions made around 1994 tended to define handhelds as Personal Digital Assistants (PDAs), while predictions afterwards used the label handheld computer or handheld companion.

While longer-term predictions about the handheld computer market were inflated in the first stage (the pen-based stage), they were surprisingly accurate in the second stage (the PDA stage), and even became excessively conservative in the third stage (the handheld stage). Figure 1 plots these numerical predictions against the actual size of the world handheld computing market, as reported by Dataquest.

Handheld Computer Sales Forecasts (Units)

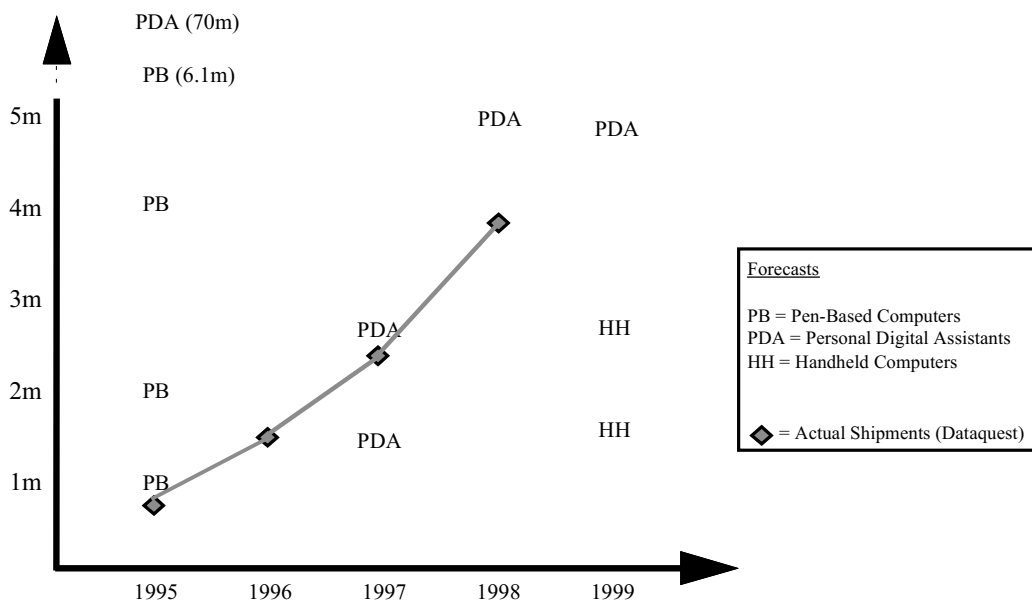


Fig. 1. Handheld computer sales forecasts appear to be almost random, unless the forecasts are classified by product concept definition. The first definition (pen-based) results in overestimates, the second definition (personal digital assistants) is not as inaccurate as often suggested, and the third definition (handhelds) is conservative

During the period when handheld computers were assumed to be primarily pen-based computers, the predictions of future market size can be fairly criticized for being both highly variable and too inflated. One prediction of 70 million PDAs by the year 1995 falls into the category of pure fantasy. Yet, by 1994, when the industry began to talk about the importance of PDAs more generally, the widely published long

term predictions for the handheld computing industry were impressively accurate. By the time that industry analysts began to concentrate on the idea of handheld computers, or handheld companions, the predictions were, if anything, too conservative.

So, while handheld computing predictions could be accused of hype during the earliest years of the decade, the strictly numerical estimates appear to be reasonable in retrospect, particularly during the second and third phases. Why, then, are there so many complaints about the handheld industry making poor predictions about the future? To help answer this question, we need to look at not just the size estimates of an emerging market, but predictions about what problem the technology should be solving, and what the key performance criteria of a handheld computer should be.

3 Product Concept Definitions and IT Predictions

The complaints about over enthusiasm and hype may have more to do with incorrect product concept assumptions than poor guesses about the size of future markets. The early industry did a better job than is often supposed of predicting the size and importance of its future market. The industry did a relatively poor job with the difficult task of predicting what the key performance criteria would be for market acceptance.

If we accept the suggestion of technology historians and sociologists to look at the assumptions about the problem a new technology is trying to solve [2], we can see that the most commonly discussed assumptions about handheld computers tended to cluster around particular ideas, but were also liable to change rapidly. Table 2 summarizes the major product concept definitions found in the early handheld computing industry, taken from a more detailed analysis of the ABI/Inform database information [1].

Table 2. Product concept definitions in the early handheld computer industry.

Definition	Problem	Key Performance Criteria	Examples
Palmtop Computers	<i>Very small computers</i>	<ul style="list-style-type: none"> • Size • Computing power • Computer applications 	Atari Portfolio (1989) HP 95LX (1991) Poqet PC (1989) Psion Series 3 (1991)
Pen-Based Computers	<i>Information for mobile workers and technophobes</i>	<ul style="list-style-type: none"> • Pen input (handwriting recognition) • Intelligent assistance (mass consumer) 	Apple Newton MessagePad (1993) Casio/Tandy Zoomer (1993) GRiD Convertible (1992) Sharp ExpertPad (1993)
Communicators	<i>Portable wireless connectivity</i>	<ul style="list-style-type: none"> • Wireless link • Telephony applications • Pen input 	EO Personal Communicator (1993) Motorola Envoy (1995) Motorola Marco (1995) Sony MagicLink (1994)

Handheld Companions	<i>Small devices that complement personal computers</i>	<ul style="list-style-type: none"> • Synchronization • Organizer applications • Computer applications 	Franklin REX (1997) HP 320LX (1997) PalmPilot (1996) Sharp SE-500 (1997)
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This analysis of the early handheld computing industry identifies four commonly held sets of assumptions about the problem that handhelds were trying to solve. The first commonly held definition, palmtop computers, assumed that handheld computers were supposed to be miniature versions of personal computers. The key performance criteria were size, of course, but also traditional personal computing criteria such as processor speed, RAM, and standard operating systems. The product lines that were launched during this period, mostly from the year 1991 and earlier, all share the appearance of being a very small notebook computer, with a tiny screen and a tiny keyboard.

The handheld computing predictions examined in this paper begin with the second definition of handhelds as pen-based computers. The assumptions about key performance criteria changed during this period. Pen-based input was widely seen as the defining feature of handheld computing, and both handwriting recognition and intelligent assistance were seen as critical to market acceptance. Pen-based computers were intended for mobile workers, but also for technophobes who were intimidated by computers and keyboards.

As the first generation of pen-based computers for the mass market ran into sales difficulties, the more generic idea of a Personal Digital Assistant became more widespread. Along with the PDA concept came a widely held view that the key to handheld computing would be portable wireless connectivity. While pen input remained important, communications ability became the most critical performance criteria during this period.

It was only by 1996, with the introduction of handheld computers such as the PalmPilot, that the dominant assumptions about handheld computing changed yet again in the industry. The newer definition, which was referred to as handhelds, or handheld companions, saw handheld devices as complements to personal computers, rather than replacements. Seamless synchronization and personal organizer applications became seen as the key performance criteria. Ideas about form factor and input method became more varied.

In retrospect, it appears that the difficult aspect of predicting the future of handheld computing was not estimating the overall size of the market, but predicting what the accepted product concept definition would be, and therefore what the key performance criteria would become. Early product concept definitions around pen-based input and wireless communications led many industry players to pursue the development of those technologies, at the expense of others. The PalmPilot of 1996, for example, featured only the most rudimentary handwriting recognition, little in the way of computing power, a non-standard operating system, no wireless connectivity, and assumed the user of a handheld already had a personal computer. This is what the industry found so difficult to predict.

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