White Paper

The Truth About Interactive Whiteboards, Pens and Fingers

Separating Myths from Facts

SMART Technologies

Introduction

We encounter touch technology virtually every day, whenever we use an interactive kiosk, a PDA, a touch-sensitive gaming device or a bank machine. Touch technology frees us from dependence on keyboards and makes it quick and easy to interact with digital content. All touch systems use technology that tracks contact with a display surface and transmits that information to a computer.

Touch technology for interactive whiteboards can be divided into two broad categories: *pen-and-finger systems* and *pen-only systems.* Pen-and-finger systems register input from virtually anything – the most common devices being a user's finger or a nonproprietary pen tool. Pen-only touch systems require a special device to register contact with the board's surface, usually a proprietary pen.

Each technology offers different advantages, depending on the user's needs, but because interactive whiteboards are a relatively new information and communication technology (ICT), information about various options and features abounds. Evaluating and sorting through volumes of technical information necessitates being able to quickly separate myth from fact.

This white paper is an attempt to dispel some of the myths about the two different kinds of interactive whiteboard systems. It explains the nature of these myths and the facts they mask, and concludes that the most important differences between pen-only and pen-and-finger systems relate to basic versus premium feature sets and personal preference.

The Myths

Myth #1: The need for hand support – a question of usability

One frequently heard myth concerns the need to rest one's hand on the surface of the board while writing. Pen-and-finger systems can detect contact from virtually any object, so they will read a hand resting on the board's surface as an attempted pen or mouse event. With pen-only systems, all communication occurs between the special pen tool and the board's surface, so resting hands do not register contact.

Pen-only advocates suggest that being able to rest one's hand on the board means users can write more naturally. However, writing on a large, vertical surface is not the same as writing on a small, horizontal or angled surface, such as on a PDA or Tablet PC. When writing on small devices, we use fine motor movements in our fingers and wrist. On

interactive whiteboards, as we increase the size of our writing, we hold our fingers and wrist steady while using the larger muscles in our arms and shoulders. In this scenario, resting our hand on the surface of the board typically creates too much drag as we move the pen across much more space.

For a few centuries now, we have been writing on blackboards without resting our hands on them as we write. If we do not want to smudge our work, we must do the same with dry-erase whiteboards. Being able to rest one's hand on an interactive whiteboard while writing does not constitute an advance in usability. That being said, some users simply prefer to rest their hand on the board while writing, and pen-only boards give them this option.

Myth #2: Pen-only boards are more hygienic

Another myth concerns the suggestion that pen-only systems are more hygienic than the communal surface of pen-and-finger boards. Touching the hard surface of an interactive whiteboard is no more or less hygienic than touching a pen – or a keyboard, a door, a desk or any other shared surface. If either the interactive whiteboard or pen requires cleaning, a commercially available cleaner and paper towel should suffice.

Myth #3: Pen-only systems are more durable

This claim is often made in relation to so-called *soft boards* and *hard boards.* These terms, while not technically accurate, are sometimes used to make a superficial distinction between two kinds of available technology: *resistive* and *electromagnetic,* which can also be classified as pen-and-finger and pen-only systems respectively.

Boards incorporating resistive technology are made with a flexible plastic front sheet and a hard backboard*. Boards employing electromagnetic technology are made by sandwiching a sensing grid and core material such as foam between two nonflexible plastic sheets. The front sheet of the resistive technology board is made from a polyester-based plastic†, while the front sheet of some electromagnetic boards is made from a melamine-based plastic. These particular compounds were originally commercialized under such brand names as Mylar® and Formica®, respectively.

* A number of resistive technology boards exist on the market, some using softer sheets than others. In this white paper, the term *resistive technology* will refer to the most widely used board in this category, the front projection SMART Board™ interactive whiteboard.

This myth specifically suggests that electromagnetic boards have a rigid melamine-based front sheet and no moving parts, which is supposed to make them more durable. But claims like these need to be examined closely.

The hard-coated polyester front sheet in resistive technology boards is secured over a backboard made from a robust aluminum honeycomb composite. This material provides high strength and lightweight support behind the front sheet, so when a finger presses the board's surface, it immediately presses the front sheet to the back, thereby closing the tiny air gap. The sensation is similar to pressing a finger onto a small stack of paper.

The melamine-based plastic is harder, but not necessarily more durable. Its surface is as thick as the Arborite® or Formica used to cover countertops and is not additionally supported by a strong backboard.

Resistive technology boards have been stabbed by knife-wielding students, stapled by primary school children, frozen in storage, rained on and used for more than a dozen years – and they have continued to function because small tears or marks on the surface, while extremely uncommon, do not interfere with the operation of the board. In fact, many argue that the hard-coated polyester sheet is more durable because, like all polyester-based plastics, it has the ability to relax back into its original shape if strained by scratches, bumps, hits or temperature extremes – much more common occurrences than students wielding sharp objects. This characteristic is more technically referred to as *elastic recovery*.

In the end, one of the best and most objective measures of interactive whiteboard durability is a manufacturer's RMA (Return Merchandise Authorization) rate, which indicates how many boards have been returned to a manufacturer due to field failure. To obtain an objective measure of durability, one should ideally compare different manufacturers' RMA rates.

Myth #4: Higher touch resolution equates to greater accuracy and precision

Another common myth about interactive whiteboards is that those with higher touch resolution are more accurate and precise. This myth is, however, based on an assumption that fundamentally confuses touch resolution with projector resolution.

The first thing to understand about touch resolution is that it does not refer to whether you touch the surface of the board with a finger or pen

or any other object. Both pen-and-finger and pen-only systems characterize touch resolution as the number of touch points, or location points, on the board's surface. Claims about greater accuracy and precision derive from the belief that more touch points (i.e., location points) will more exactly register where one touches the board.

What such claims do not explain, however, is the effect of projector resolution on touch resolution. Projector resolution is measured in pixels, or "picture elements" – the phrase from which the word *pixels* derives. Digital information is projected on-screen in pixels, which are the smallest units of selectable data. That means that if one wants to select information on screen or write in digital ink, one can only be as accurate and precise as a pixel.

Accuracy and precision only become a problem if there are fewer touch points than pixels, that is, if the smallest unit of selectable data cannot be accurately located because there aren't enough touch points for each pixel.

The number of touch points in today's interactive whiteboards far exceeds the number of pixels in today's projectors in order to accommodate a variety of projector resolutions (e.g., SVGA, XGA, SXGA and UXGA) and to anticipate advances in projector resolution. Beyond that, accuracy and precision depend on the fineness of one's selection tool, the exactness of one's vision and the accurate alignment of the projected image with the board.

When people talk about wanting an interactive whiteboard that provides accurate and precise touch, they invariably mean that when they interact with projected information, such as pressing a menu button or selecting a portion of an image, the expected result will occur. Having as many touch points as pixels will ensure the highest achievable degree of accuracy and precision. Having more touch points simply accommodates the variety of projector resolutions currently and potentially available.

The Facts

Pen-and-finger systems

Those who prefer pen-and-finger systems want, or need, the option of using a finger or a pen to operate and write on the board. For example, for many users, mouse-related functions, such as pressing buttons and dragging and dropping objects, are more easily accomplished with a finger, while writing in digital ink is more easily performed with a pen. For others, such as preschool children or special needs students, using a fine-tipped pen tool may prove more challenging, so having a choice

between input devices can be crucial. Children without fine motor control in their fingers, for example, have been known to operate pen-and-finger systems very well with a tennis ball. When an interactive whiteboard is shared by people with widely divergent needs, having the choice that pen-and-finger systems provide makes sense.

Pen-only systems

Pen-only systems offer a more basic feature set. Not everyone needs the option of using a finger or pen, and some simply prefer a pen. Others like or need the option of resting their hand on the board while they write or interact with content, an option that is easily supported because all communication occurs between the pen and board's surface alone. In the end, people typically choose pen-only systems because it is their personal preference or because they are happy enough with a more primary set of features.

Conclusion

Interactive whiteboards are a relatively new information and communication technology. As new manufacturers bring out models embedding different technologies and feature sets, and users learn more about the category itself, there is much new information to review and digest. Under such circumstances, it is critical to separate myth from fact in order to understand the real benefits of the system being promoted.

With regard to pen-and-finger and pen-only systems, if the product comes from a reliable manufacturer operating under the certification of an agency like the International Standards Organization (ISO), then the significant differences between these systems will relate to basic versus premium feature sets and to personal preference – not typically to matters of hand support, hygiene, durability and resolution.