KODAK PERFECT TOUCH Technology "Everywhere": Expansion of Kodak Image Enhancement Algorithms Across All Product Platforms

John T. Keech, Brian Mittelstaedt, and Tom Murray; Eastman Kodak Company; Rochester, NY/USA

Abstract

KODAK PERFECT TOUCH Technology has enabled landmark automatic image quality optimization in Kodak retail products since 2002. The technologies employed include exposure compensation, noise reduction, tonal mapping, sharpening, and color management algorithms. Business research has verified strong consumer preference for fulfillment products utilizing KODAK PERFECT TOUCH Technology. As the scope of product opportunities explodes within the digital imaging ecosystem, Kodak is expanding the application of KODAK PERFECT TOUCH Technology into all product platforms. This includes digital capture, software applications and personal printers platforms. Each of these platforms present unique implementation challenges, such as porting KODAK PERFECT TOUCH Technology into embedded environments. Kodak is committed to putting the best imaging capability seamlessly into all future consumer products.

Introduction

As the world leader in imaging, the Eastman Kodak Company develops, manufactures and markets digital and traditional imaging products, services and solutions for consumer and professional photographers. In 2002, we introduced KODAK PERFECT TOUCH Processing to improve the overall image quality and consistency of consumer's images captured on film. Since then, we have introduced KODAK PERFECT TOUCH Technology in many of our digital products to improve the image quality and consistency of digital images.

Our vision is that a consumer using a Kodak system incorporating KODAK PERFECT TOUCH Technology will receive consistent, high-quality images that have been enhanced to a degree consistent with consumers' desires and the system's capability. In the extended imaging "ecosystem" available to the consumers today, they can store, share or print their digital images. If any one node in the "ecosystem" is enabled with KODAK PERFECT TOUCH Technology, then the consumer will receive consistent, high-quality images also.

Background

KODAK PERFECT TOUCH Technology is an integrated and highly robustified set of image processing algorithms. There are two primary modules within the architecture of KODAK PERFECT TOUCH Technology. In the "Image Analysis Manager" an image is analyzed against an array of image enhancement options. These analyses pass instructions to the "Image Rendering Manager", the main processing engine, which builds a custom imaging chain for each image and then carries out the desired transformations.

These transformations include image sensor corrections, image exposure corrections, camera capture corrections, scene specific corrections and output printer corrections. Even when using high quality capture devices, we find that scene composition and lighting problems can be greatly improved via application of KODAK PERFECT TOUCH Technology. In our studies, the distribution of image quality is dramatically raised by application of KODAK PERFECT TOUCH Technology (Figure 1).
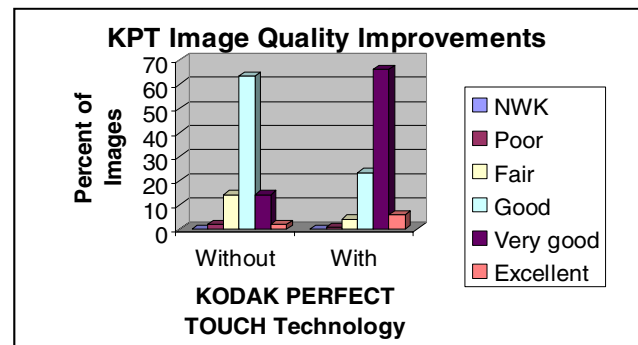

Figure 1. Image quality distribution change afforded by applying KODAK PERFECT TOUCH Technology. Based upon 26 30-frame scanned film orders. Categories are image quality bins that are readily differentiable by consumers. NWK == not worth keeping.

Consumer Response

KODAK PERFECT TOUCH Technology is designed to deliver improvements to key consumer requirements: fewer dark shadows, more vibrant colors and richer detail. Our business research has shown that consumers desire improvements to these attributes regardless if their images originate from scanned film or digital capture.

Consumers consistently demand good image quality in their imaging devices. For instance, in recent surveys of mobile phone users, improved image quality had high 'importance' ratings, but also 'low' satisfaction rating. Clearly, image quality improvements are needed on this class of digital products.

Kodak has conducted extensive business research to determine if there is a significant difference in picture quality satisfaction and preference across multiple digital processing systems. Our results show that KODAK PERFECT TOUCH Technology is in the top tier for print image quality and is preferred to non-Kodak systems. Respondents preferred KODAK

PERFECT TOUCH Technology because of color, picture clarity and improved lighting.

Implementation Across Product Platforms

Today there is an extensive imaging "ecosystem" available to consumers. Kodak has worked hard to interlink the Kodak nodes of this "ecosystem" to enable greater flexibility, quality and innovation to the consumer. These nodes include KODAK Consumer Film together with KODAK PERFECT TOUCH Processing, KODAK EASYSHARE Digital Cameras, KODAK EASYSHARE Software, KODAK EASYSHARE Gallery, and KODAK EASYSHARE Photo Printers. Our goal is to enable KODAK PERFECT TOUCH Technology throughout the Kodak nodes of the imaging "ecosystem".

As previously mentioned, KODAK PERFECT TOUCH Processing was first introduced in 2002 as a wholesale fulfillment service. Today we have put KODAK PERFCT TOUCH Technology into KODAK EASYSHARE Digital Cameras, KODAK EASYSHARE Software, KODAK EASYSHARE Gallery, and KODAK EASYSHARE Photo Printers. It is engineered so that passage of an image through multiple Kodak nodes enabled with KODAK PERFECT TOUCH Technology will not overenhance the image, unless the consumer desires this effect.

In the future, you will see increased applications of KODAK PERFECT TOUCH Technology in more KODAK EASYSHARE Photo Printer models, additional KODAK EASYSHARE Digital Camera models and increased numbers of retail and online services. We recently announced our partnership with Texas Instruments to embed KODAK PERFECT TOUCH Technology into TI's OMAP^{TM} Wireless processors. We plan to improve the image quality and image usability of the wireless devices, as we have already done with our KODAK EASYSHARE Digital Cameras. By building this capability into a Mobile Imaging Reference Platform, which will be made available to handset manufacturers, we hope to reduce the time to market for these imaging-enabled devices.

Future Features

Today, KODAK PERFECT TOUCH Technology runs on PC Window server and desktop systems, as well as many different embedded environments. As we embed KODAK PERFECT TOUCH Technology into more systems, the numbers of environments will increase dramatically. As image pixel sizes continue to increase and CPU and memory are constrained to provide better power utilization, more efficient algorithms will be required. Advanced logic will be required, so that we run only those algorithms that are needed by each image. Image quality capability must continue to increase, requiring more innovation. Upgrades will be required across Kodak systems to keep them competitive with new systems becoming available.

Author Biography

John Keech received his BS in Chemistry and BS in Physics from the University of California, Irvine in 1982, and a Ph.D. in Inorganic Chemistry from the California Institute of Technology in 1986. In 1986, Dr. Keech joined the Color Negative Technology Division of Eastman Kodak Company, where he worked on new technology and product development for Eastman Motion Picture products. In 1996-1998 he managed image science research and inkjet media commercialization. Since 1999, he has served as a Research Associate, managing system engineering and image science deployment for consumer product development programs.