The Man-Machine Interface: Advantages of Voice

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Introduction

On the surface it may seem that voice systems are close equivalents to solutions that use RF handhelds. Vendors of voice systems tout that voice is faster and more accurate than RF. While voice is increasingly recognized as the technology of choice for warehouse operations, can the benefit actually be quantified? Is this claim supported by objective data?

Mountain Leverage has conducted empirically valid video analyses of workers picking the same orders, one using RF and the second using voice. In these tests, voice has shown a considerable speed advantage and the analysis identifies why. Not all of the advantages of voice are intuitive. The analysis shows that while voice selection enjoyed a 35% advantage in productivity over RF, only 10% came from the technology itself. The majority of the productivity improvement was the result of more natural interaction between the device and the user. Voice systems are simply easier to use and because they allow the operator to safely complete simultaneous tasks, they do not impact the work flow the way RF units do.

The Research

In the comparison provided here, the picking steps were identical, but the voice user had an additional small step when they travelled to a new aisle for the first time. For the sake of accuracy, this step is included in the analysis.
The process that the selectors followed is broken down in the following analysis. Each selector visited eight locations. The basic steps were:

**Figure 1**

![Diagram of the process steps](Image)

**The Findings**

**Selection Using RF**

This first graph (Figure 1) shows the task breakdown when selecting with an RF scanner. Each color represents a different pick.

**Figure 2**

![Graph of Selection Using RF](Image)
When we look at selection using RF, we see that the steps are sequential. This is due to the nature of the human-device interface; the operator must stop what they are doing to read the screen or to key or scan. If we look at the actual task times, voice and RF are not that different. However, the screenkeyboard interface forces everything to be done sequentially and this is what makes it so much slower than voice.

Visiting the eight locations and completing the tasks took 140 seconds using RF, with an average of about 17 seconds per location. The tasks that took the most time were travel and picking.

**Selection Using Voice**

The following graph (Figure 2) shows the same items picked in the same sequence as above, but using voice technology.

**Figure 3**
The first thing we see is that all the locations were visited and tasks completed in only 91 seconds, or just over 11 seconds per location. Overall this represents a 35% improvement in productivity. Travel time was essentially equal for both at 26.73 seconds for voice and 26.16 seconds for RF. But voice allowed the items to be picked more quickly, requiring only 46 seconds compared to 61 seconds for RF. Some of this can be attributed to holding the RF unit in one hand and picking with the other. It not only takes longer to pick multiple items one-handed, but it is less safe for the operator if items are bulky or heavy.

What is also significant is that when we sum up the duration of each task using RF we get 140 seconds (Figure 3), because each task is performed serially. With voice, there is a productivity gain of about 10% with the sum of the tasks at 126 seconds. Much of the improvement here is due to the natural interaction of voice, but there is, surprisingly, a secondary component to the more efficient selection employing voice. It turns out that it is actually much faster to speak confirmations than it is to scan them, which seems counter-intuitive. Picking up the RF device, aiming the beam, and scanning the bar code takes twice as long as speaking the verification, on average.
The third point to be made is that with voice the sum of the durations of all the tasks is 126 seconds, which yields a 10% improvement in productivity. This shows that picking by voice is inherently faster than picking with RF. However, the whole process of travel and selection was completed in only 91 seconds (a 35% improvement) because many of the tasks were performed concurrently. This is the real productivity advantage of voice over RF; operators using voice-enabled solutions interact while they are working, whereas RF scanning requires the user to stop working and interact with the device, forcing tasks to be completed sequentially. For instance, forklift operators can be moving while they are interacting with the voice-directed device, something strongly discouraged when using an RF scanning system for safety reasons.
Voice implementations generally avoid bar code scanning because the operator is no longer hands-free. Hands-free operation can be restored using a ring or wrist-mounted scanner, but these can introduce their own set of problems including reliability, battery life, and Bluetooth pairing issues. Instead of scanning a location bar code, operators read and speak a ‘check digit’ printed on the location label. A ‘check digit’ is a 2-5 digit random number a user speaks to confirm arrival at the correct location. When inventory is dynamically slotted, check digits are difficult to memorize because the association between the item and the location constantly changes. When items are statically slotted, operators often memorize the check digit of high-volume items which creates opportunities for errors. Voice systems address this by using multiple check digits per slot and choosing them at random, usually by pick assignment. This unique voice solution benefit prevents the repetition and therefore the memorization, so selectors must be at the slot to confirm the check digit rather than speaking it while traveling to the slot. This technique insures that accuracy is maintained.

**The Findings**

Voice has better performance during the time the operator is actually picking and interacting with the device. However, if the process involves extended travel from one pick location to the next, then the productivity advantages of voice are diminished by the travel time. The voice system will still be faster, but not by the wide margins we see when travel times are short. The variation in the length of travel time is a primary determinant of productivity differences between voice and RF. With long travel times, RF may be the proper choice simply based on cost.
Our research has shown that the productivity and efficiency advantages of voice technology are rooted in the nature of the human-machine interface. This interface provides productivity and efficiency benefits that just cannot be matched with screen-based devices.

About Mountain Leverage

Mountain Leverage spent the last decade helping companies maximize the value they get from voice enabling mission critical processes in supply chain and manufacturing. Our teams have years of practical experience delivering solutions, building a reputation for solving complex problems and delivering voice-enabled systems that provide value year after year.

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