HYBRID
CHECKOUT

An Evolutionary technology

having a Revolutionary impact

Kay Seljeseth
CEO PeoplePos

August 2014

Summary:

The HybridCheckout counter is now a market-ready product. Highly positive results of recent proof of concept tests confirm the design advantages and benefits to retailers and customers described in an earlier series of white papers.

These test results show that customers and cashiers working together at HybridCheckout counters outperform any other checkout solution. Key performance indicators include checkout speed and throughput, customer satisfaction and ease of use.

Throughout the PoC tests, HybridCheckout throughput was measured at 1,700 to 1,900 items registered per hour. These results indicate a 62-to-82-percent improvement of throughput compared to traditional cashier-based scans. Customers working at single self-service checkout stations typically register 150 to 250 items per hour.

Product Development Process to Date

HybridCheckout scanning is a new concept in retail customer service. The HybridCheckout approach uses parallel processing in a checkout counter that looks very much like a standard cashier-operated counter. It differs from traditional designs by providing a second scanning area and scanner, which are directed toward the customer.

This design enables customers to scan items in parallel with the cashier or operate independently in self-service mode. But however the HybridCheckout counter is used, a cashier is present at all times.
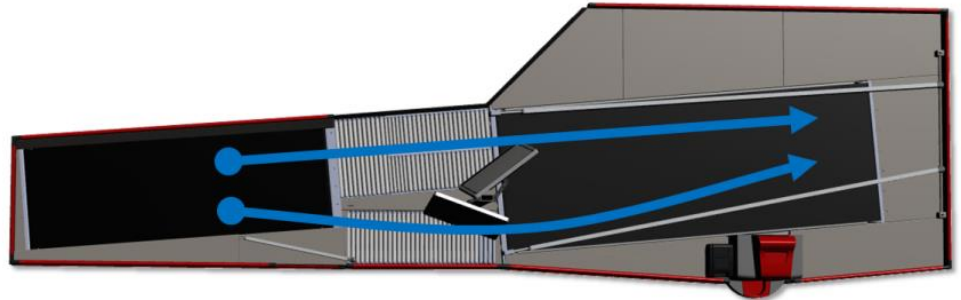
The HybridCheckout commercialization process has been underway for more than two years. Product development so far has included these stages:

- Concept development

- Checkout hardware and software design

- Ergonomic refinements

- Prototype testing

- Collection and analysis of prototype test statistics

- Performance evaluation by retail experts

- Process refinements

- Software development

Proof of concept testing is a crucial development in the commercialization process. The HybridCheckout PoC test process uses:

- A fully functioning HybridCheckout counter

- Fully functioning point of sale software

- An experienced, professional cashier

- Customers, who have no previous knowledge about HybridCheckout equipment or approach.

For more information about HybridCheckout design, operation and capabilities, please visit: www.hybridcheckout.com.

HybridCheckout Test Design

The intent of POC testing was to:

- Validate the metrics gathered and calculated during prototype testing.

- Test the overall design and usability of the HybridCheckout equipment and approach.

- Measure HybridCheckout performance under real-life conditions.

- Verify and validate the planned checkout processes.

- Observe how actual customers relate to a HybridCheckout counter under real-life conditions.

- Capture the opinions and preferences of test participants.

Participant Profile and Post-Test Survey

To ensure valid results, test participants included 7 men and women ages 14 to 70, chosen randomly from a group of supporters of a youth sports team. Five of these participants had no previous knowledge or experience with HybridCheckout equipment or procedures. Two others had seen and tried a HybridCheckout counter briefly before. But, they had no experience using it with multiple customers and a professional cashier. One of the participants was a somewhat experienced cashier.

Test Method

POC testing was performed in a large office area, with sufficient space for the counter and an ambient light level quite similar to that of any retail checkout area. Other aspects of the test included:

- **Setup.** Each test pass used a single line of 7 customers, who were ready to place items onto the loading belt from carts or baskets filled with items. Time measurements started when the first item of the first sale was scanned. They ended when each sale was completed with a successful debit card payment. No delays or pauses other the ones created by the process were added.

- **Cashier.** The cashier was an experienced professional cashier with previous work experience at a major grocery store. However, she had not been working actively as a cashier during the previous few years. She was given a total of three hours of training time to master the point of sale software and the HybridCheckout process.

- **Payment method.** The only payment option supported was a debit card. This option was chosen because each checkout transaction slip gives predictable and comparable time-per-payment and time-per-checkout statistics.

- **Transaction size.** A mix of shopping carts and baskets was used for the testing. Contents varied from 4 to 44 items per customer.

- **Video documentation.** A professional video team filmed the POC testing process. To view these videos, please visit: http://www.hybridcheckout.com/Article/Evaluate/Proof-of-Concept

Test Hardware and Software

POC tests used commercially available hardware in standardized retail checkout procedures.

Barcode scanner hardware

Barcode scanners used in the test include two **Birch BS-360** scanners. Scanner specifications include:

- Rotating laser scanner (Scantech-ID Mica Scanner)

- 2000 scans per second

- 6 directions pattern

- W * H * D: 85 * 110 * 65 millimeters (3.3 * 4.3 * 2.6 inches)

HybridCheckout Counter

In the HybridCheckout process, customers load items onto the conveyor belt or take them directly from a basket for a self-service operation. The cashier and customer scan items side by side in two separate lanes, using two independent scanners. After items are registered, they are moved automatically to loading areas, where they are packed into bags by the customer. This standard process was also used during PoC testing.

The dimensions of the HybridCheckout model used in the testing are:

- Full length: 558 cm (220 inches)

- Loading area (width * length): 82 cm * 240 cm (32 * 94 inches)

- Packing area (width * length): 150 * 240 cm (59 * 94 inches)

- Cashier registering area (width * length): 39 * 78 cm (15 * 31 inches)

- Customer registering area (width * length): 39 * 78 cm (15 * 31 inches)

- Loading and packing area belts: 180 * 70 cm (71 * 28 inches)

- Floor-to-working-area surface height: 93 cm (37 inches)

The HybridCheckout counter was run in Shared scanning mode for the tests. This mode was used because the process is closer to the standard checkout process. And, Shared mode is the most likely mode used for carts and baskets with varying number of items. (Split mode is more suitable for comparisons of HybridCheckout and self-checkout solutions. This comparison is outside the scope of this report.)

Customer side view
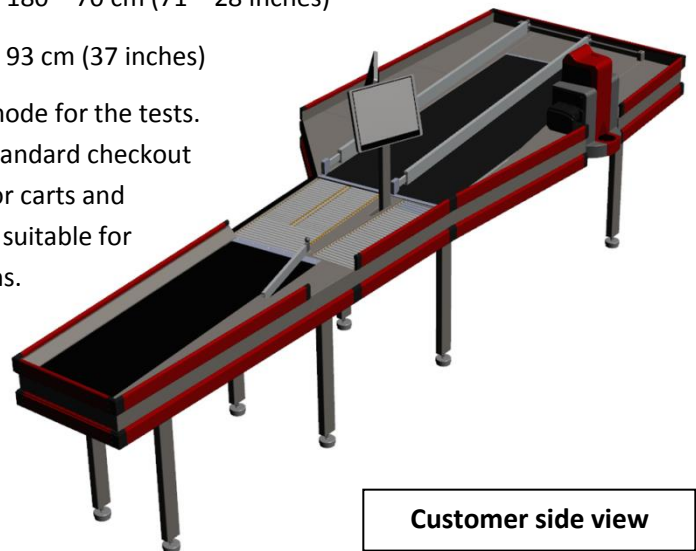
Point of Sale software

The point of sale software used on both sides of the counter was Timekiosk HybridCheckout POS V5.0B. The counter used one instance of the software. The cashier and customer used two screens running the same application. The cashier had access to the shared sale information when the counter ran in Shared mode. But when the application runs in Split mode, the cashier has access to information related to both of the ongoing sales. This approach enables the cashier to add items or correct information in customer-side transactions.

PC Hardware

- Motherboard: ASUS H87M-PRO

- Processor: Intel i5-4670 @ 3.40 GHz

- Memory: 8 GB RAM – Kingston KHX1600C9D3/4GB (2 pcs)

- Hard disk: 60 GB SSD – Intel SSDSC2CT060A3

- O.S.:   Windows 7 Ultimate N SP1 – 64 Bits

Monitors (2 pcs – picture to the right)

- Birch TM-2600

- 15 inch flat touch

- 1024 x 768 pixel resolutions

- eGalax Inc. TouchController

Other hardware

- MicroController (IO ports):   microChamelon with V4 Firmware

- Receipt printer: Birch A8 USB (picture to the right)

- Belt drives: Interroll Cassette System (2 pcs)

- Rollers: Interroll Series 1100

- Card terminal: Point Xenta (integrated)

- USB-2-VGA adapter: MCT Corp

Throughput Data

HybridCheckout Passes

PoC tests measured throughput (number of items registered per unit time, including payment processing) in each of two test passes.

The following tables summarize HybridCheckout performance data. The photo at right shows a test pass in progress.

To view a video of this process, visit: http://www.hybridcheckout.com/Article/Evaluate/Proof-of-Concept

Test Pass 1 - HybridCheckout:

Customer	Item Qty.	Time of Sale	Time per Item (sec.)	Items per Minute	Items per Hour	Remarks
Customer 1	44	01:10	1.59	38	2 263	
Customer 2	17	00:33	1.94	31	1 855	
Customer 3	9	00:26	2.89	21	1 246	
Customer 4	33	01:17	2.33	26	1 543	
Customer 5	15	00:37	2.47	24	1 459	
Customer 6	18	00:42	2.33	26	1 543	
Customer 7	4	00:16	4.00	15	900	
Per Sale Average	20	00:43	2.51	24	1 436	
Total / Average	**160**	**05:01**	**1.88**	**32**	**1 914**	

Test Pass 2 - HybridCheckout:

Customer	Item Qty.	Time of Sale	Time per Item (sec.)	Items per Minute	Items per Hour	Remarks
Customer 1	40	01:15	1.88	32	1 920	
Customer 2	10	00:33	3.30	18	1 091	
Customer 3	20	01:12	3.60	17	1 000	Note 1
Customer 4	15	00:16	1.07	56	3 375	Note 1
Customer 5	37	01:12	1.95	31	1 850	
Customer 6	6	00:19	3.17	19	1 137	
Customer 7	26	00:39	1.50	40	2 400	
Per Sale Average	22	00:47	2.35	26	1 532	
Total / Average	154	05:26	2.12	28	1 701	

Note 1: Customer number 3, an elderly man, forgot to enter the PIN when completing his payment. Due to a hearing impairment, he could not hear the message asking him to correct this immediately. As a result, it took extra time before payment was completed. This delay allowed customer number 4 to scan and complete most items before the previous sale was paid.

As a result, there's a peculiar jump and change in the time intervals and performance data for these customers. This kind of situation, which might occur frequently, will lead to delays in any checkout solution. Parallel scanning in the HybridCheckout process shows that the registration process will continue efficiently, even if such incidents happen.

The photo at right shows a test pass in progress.

Cashier-only Pass

PoC testing also included a cashier-only test pass to compare HybridCheckout data with traditional checkout methods. The following table shows the results of the cashier-only test.

Test Pass Cashier-only:

Customer	Item Qty.	Time of Sale	Time per Item (sec.)	Items per Minute	Items per Hour	Remarks
Customer 1	18	01:13	4,06	15	888	
Customer 2	33	01:41	3,06	20	1 176	
Customer 3	14	00:46	3,29	18	1 096	
Customer 4	8	00:28	3,50	17	1 029	
Customer 5	14	00:57	4,07	15	884	
Customer 6	25	01:27	3,48	17	1 034	
Customer 7	31	01:39	3,19	19	1 127	
Per Sale Average	20	01:10	3,52	17	1 022	
Total / Average	**143**	**08:11**	**3,43**	**17**	**1 048**	

Using the Cashier-only test pass as a reference, the HybridCheckout process performed as follows:

Checkout Mode	Items per Hour	Throughput
Cashier-only	1048	100.00%
HybridCheckout Pass 1	1914	182.63%
HybridCheckout Pass 2	1701	162.31%

The comparison indicates a 62-to-82-percent performance advantage for the HybridCheckout process. Because the parallel HybridCheckout process is less sensitive to cashier interruptions and customer-related delays, the actual performance advantage is probably even better than the comparison data shows.

The cashier-only pass was performed with no interruptions. There were no substantial delays. Also, the lack of cash transactions reduced transaction times. Cashier-only checkout times are more sensitive to cash transactions. Typically, throughput in a cashier-only transaction is about 600 to 900 items per hour. These results are lower

than the PoC testing statistics because in real-life sales, cashiers spend more time processing cash and coupons and performing other customer service tasks.[1][2]

Higher throughput values can be achieved by professional cashiers working very efficiently with well-known items that are quickly registered at counters with large, highly efficient scanners. The advantages of using of high-performance technologies and very efficient staff members benefit both HybridCheckout and cashier-only solutions. As a result, these advantages likely not affect the overall difference in performance.

Given these statistics and considerations, the PoC performance results correspond well with the numbers calculated in simulations used in the white papers. These results are shown in the following table.

Checkout Mode	Items per Hour	Throughput
Cashier-only	777	100.00%
HybridCheckout	1620	208.00%

This data helps confirm that, in a test environment HybridCheckout throughput is at least 62 percent better than that of a cashier-only checkout process.

In a real-world scenario, a HybridCheckout performance improvement of 80 to 110 percent is more likely. This advantage is confirmed by the 82-percent PoC testing metric in Pass 1.

The below graph is from the HybridCheckout White Paper series – Part III (Page 5):

---
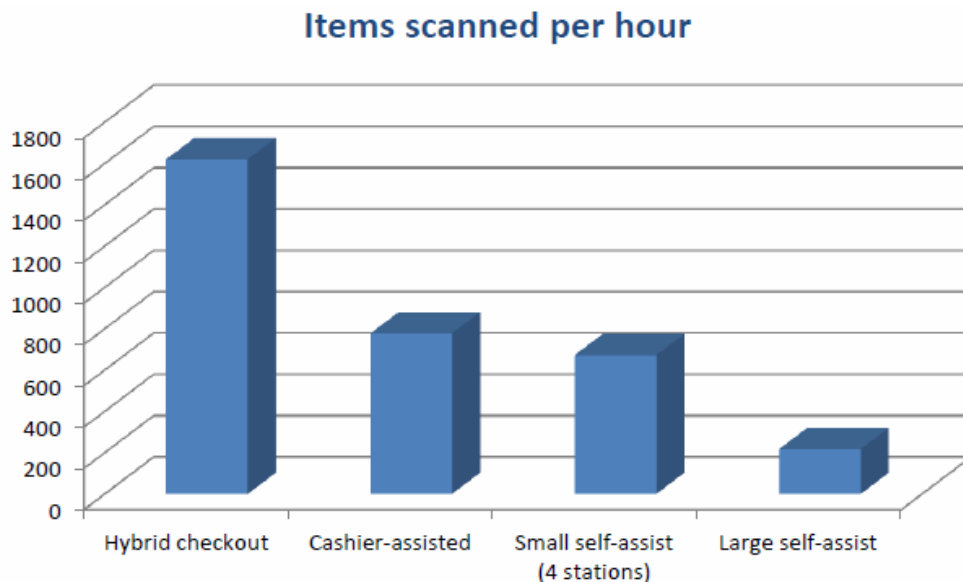
[1] 666 items per hour: Kassörers interaktion med kassa och kunder inom dagligvaruhandeln, Annika Kihlstedt and Göran M Hägg (Sweden 2005).
[2] IPM (Items per Minute) to «Total»: 14-20 items per minute (840 – 1200 items per hour): Multiple proprietary sources available on the Internet. The figures mentioned do not include payment time and service time required after "Total" is pressed. As a result the actual performance is substantially lower.

Other Performance Test Results

PoC test results confirm that the HybridCheckout counter is a market-ready product that will provide grocery, supermarket and other retail operations with major cost savings, reduced floor space requirements and more flexible staffing options.

Technical or process-related problems. Testing revealed no technical or process-related obstacles that might jeopardize use of HybridCheckout in retail grocery facilities. Grocery customers and staff members also expect an improved checkout environment with use of HybridCheckout counters. These improvements are linked to better ergonomic design for staff members, a very fast checkout process and easy-to-use customer self-service support.

Customer survey results confirm PoC test results. Survey respondents ages 14 to 70 confirmed advantages to customers and have verified that the checkout process is very customer-friendly. Testers indicated a solid preference to use HybridCheckout over cashier-operated and self-service checkout options.

First-time customers. This test involved sending a customer to the HybridCheckout counter with only a simple message of advice: "You will be able to check out your items in a new type of scanning counter. We just want to observe how the process proceeds."

As soon as the cashier mentioned "You may help by scanning barcodes on your scanner," all customers participating in this test immediately started scanning items in Shared mode with the cashier. The message from the cashier was sometimes combined with a small hand gesture pointing out the customer-side scanner. Other aspects of the checkout process were performed without any problems because HybridCheckout counters use the same general process as that found in any conventional checkout process.

Non-barcoded items posed no problem. Even first-time customers showed items to the cashier, who then received the items, weighed them and registered them for the customer. Far from causing any confusion, this process resulted in ordinary communications between the cashier and customers.

The test did not detect any problems or lack of understanding of the process by first-time customers.

Customer assistance. Other tests included adding fruits randomly in each basket or shopping cart. All customers simply asked the cashier what to do or showed the cashier the fruit with a "What do I do now?" gesture. The cashier responded according to the planned process, took the fruit and weighed it as in a conventional, cashier-assisted checkout process.

The process avoided the anxiety and annoyance of customers having to register fruits and other weight-based articles, a typical problem in self-service checkout. Instead, the problem resolved itself and involved simple, friendly gestures and small-talk exchanged between the customer and cashier. In the beginning of the test process, a few customers asked simple questions about where to pay and "Am I done?" But, after the first two passes, the process ran smoothly all the time.

Any assistance request was resolved with ease by the cashier, and the process did not suffer from these small interruptions.

Approaching the counter. From the beginning of the test process, customers immediately placed purchased articles onto the loading belt. They showed no doubt of what to do.

Customers understood (correctly) that the HybridCheckout process was the same as any other manned checkout.

Scanning articles. Before testing began, we were concerned that customers would have problems scanning the articles because customers were not used to operating the new type of scanner. During Pass 1, hard-to-read barcodes caused delays of a few seconds. Twice, the cashier had to stop work, straighten the barcode on crumbled plastic bags and scan the item for the customer. About 4 percent of scanned items posed some delay during the first pass.

Despite these minor delays, the overall process was not affected noticeably as the performance times during and between test Passes 1 and 2 showed little variation.

The testing also revealed that customers observed the cashier and neighboring test participants to learn very quickly where to look for the barcodes.

After the first pass, customers learned some scanning tricks and were able to improve their performance and scan more items without the initial delays from the hard-to-read barcodes. And, their awareness of the scanner position and operation also improved. Less than 2 percent of all articles scanned involved difficulties that resulted in small delays.

Repeated Processes. HybridCheckout scanning speed as measured by throughput was about 1,700 to 1,900 items scanned per hour. These rates were stable throughout the testing process. Some peak performance periods occurred, in which throughput exceeded 2,000 items scanned per hour.

Comparable cashier-only scanning passes using the same testers and items gave a performance of about 1,050 items scanned per hour.

Throughput test results show that HybridCheckout scans with two operators provide 62 to 82 percent more throughput than a cashier-only scanning pass.
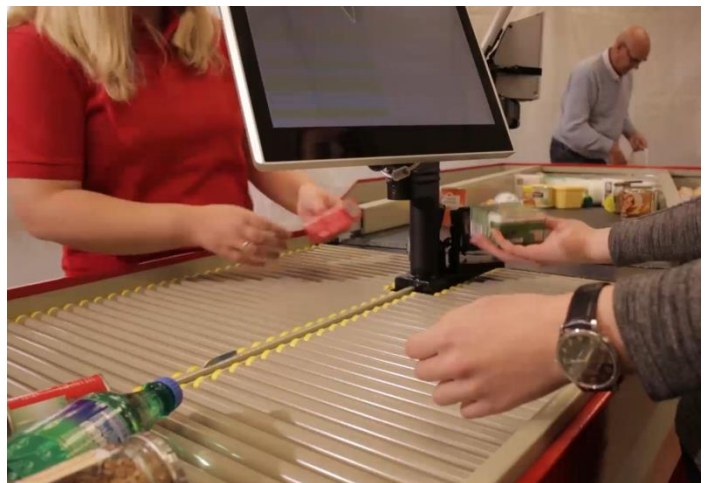
In some environments, the HybridCheckout approach is likely to provide even more than 82 percent additional throughput than standard cashier-only scans.

Cashier-customer co-operation. Throughput test results show that the cashier could pay attention to the test customers' needs and scan items at a close-to-standard rate. Only a few percent of the items scanned by the testers required cashier attention. And, it appeared to be easy for the cashier to shift attention to the tester when it was needed.

Testers did not cause any noticeable "attention collisions" when they tried to address the cashier. However, under real-life conditions, such occurrences might happen a few times during a busy day.

Cashier performance. During training, the cashier reported a certain level of stress related to the new process and requirements of operating the HybridCheckout counter. After the PoC testing, the cashier reported substantially less stress.

Interestingly the cashier observed that it was substantially less stressful to operate HybridCheckout equipment. This was due to two previously unknown factors:

- The cashier does not have to wait while the customer makes the bank card payment. As soon as the scan is complete, the cashier can start to scan the next customer's articles or assist other customers. This removes stress related to the inactive waiting period for the cashier.

- Also, because customers are not at standing around with impatient expressions, the cashier experiences less stress. According to the cashier, the negative effect of customer stress from process delays almost never occur in HybridCheckout. As a result, the HybridCheckout process is less stressful for the cashier, even if the process involves substantially more basic tasks.

In general, cashiers found it easy to operate the counter and provide any guidance. And, they quickly learned to understand and engage the customers to support the checkout process.

Lift analysis. Test data show that customers will register and lift about 45-50 percent of the items through the scanning region. As a result, the HybridCheckout two-operator approach reduces the number of items that the staff must lift by 45-50 percent. This represents a major reduction of load and strain on the cashiers. This reduction will most likely mean that they will experience fewer work-related muscle and joint injuries.

With improved efficiency and lower lifting requirements, store managers can make more flexible work assignments in the store. And, staff members can spend more time throughout the store doing customer service-related tasks.

Cashier side view
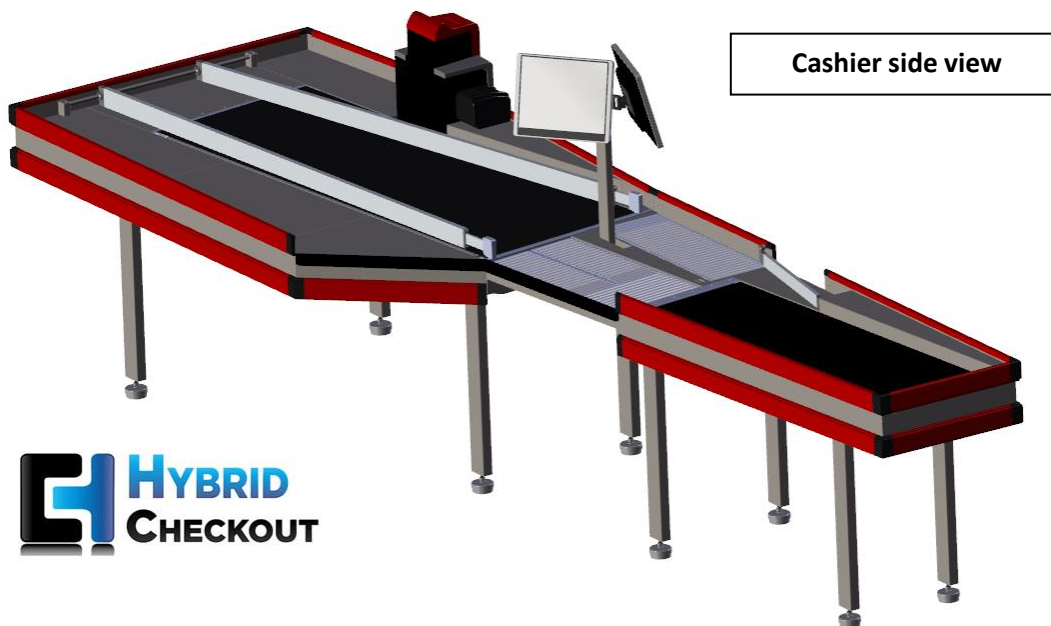
Results of After-Test Questionnaire

After the testing passes, PoC participants responded to a questionnaire. The questionnaire and responses are written in Norwegian (the customers' native language). The following information summarizes their responses. Responses are linked to specific question numbers in the survey.

Idea behind the HybridCheckout approach

When asked about their understanding and support of the HybridCheckout concept, 94 percent responded favorably. Customers immediately found the HybridCheckout process easy to understand. All they had to do was observe another customer or use the counter a few times.

Behavior during the testing indicated that few customers experienced any substantial doubts or confusion about the checkout process or what they were supposed to do.

HybridCheckout counter ease of use

Several questions asked about the use and process of the HybridCheckout counter.

Responses strongly show that the customers found HybridCheckout very easy to use and given the choice would like to use it again.

Weighing fruit and other items

When asked about who should do the weighing tasks, customer response was split. About half of the customers surveyed thought it acceptable to do this task themselves. The other half wanted the cashier to process these items. It's likely that delegating tasks that carry a risk of problems or suspicion of theft to the cashier would ensure a positive checkout experience.

Freedom of choice and cashier presence

About 80 per cent of customers surveyed expected that other customers would scan their items in a HybridCheckout counter. All customers strongly agreed that the cashier presence is very important for any assistance during the checkout.

About 70 per cent of the customers surveyed indicate that it's important for them to be able to choose to scan items.
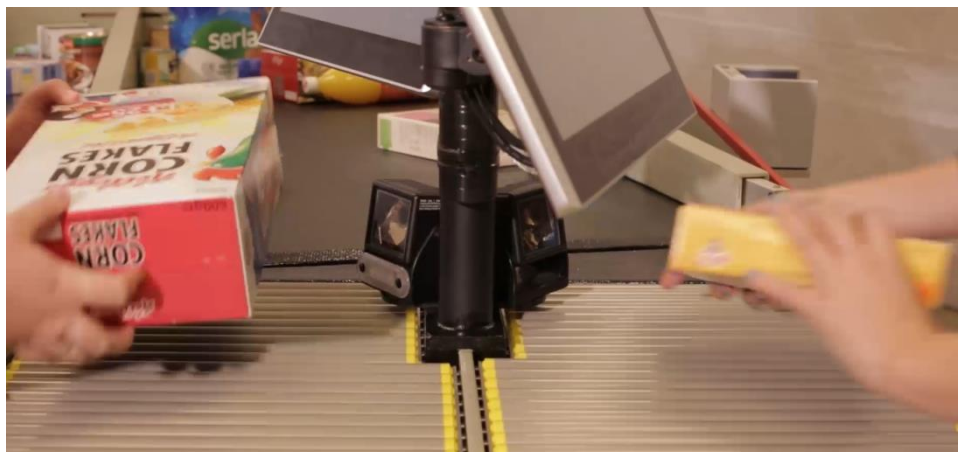
Most important HybridCheckout advantages

Customers were asked to give the three most important advantages of using a HybridCheckout counter in priority order:

1. Faster checkout

2. Lower prices

3. Choice to engage in self-service scanning

These responses confirm evidence from other sources, in which checkout speed is most often the item of utmost importance to customers. There's also an expectation amongst customer that prices would be lowered because of their participation in the checkout process.

Interestingly, only a few customers mentioned ease of use. This might be because the customers expect the checkout to be easy to use and any "checkout problems" are seen as poor service, which affects the customer experience.

Most important HybridCheckout disadvantages

Customers were asked to give the three most important disadvantages of using a HybridCheckout counter in priority order:

1. Customer would be suspected of theft

2. Do not want cashiers to lose their job
   To stressful a process
   Too many tasks (same scores)

Not all respondents provided three answers to this question. Some provided only one. This is likely because they saw few drawbacks to using HybridCheckout.

Preferences regarding choice of checkout method

Customers were asked to list their preferred checkout method given two different checkout scenarios:

Scenario #1: Few items in a basket:

1. HybridCheckout

2. Self-service checkout

3. Cashier operated checkout

Scenario #2: Full trolley with many items:

1. HybridCheckout

2. Cashier operated checkout

3. Self-service checkout

HybridCheckout scanning was the preferred method in both small- and large-volume purchases.

Conclusions and Recommendations

Retailers searching for ways to improve the efficiency of their operations should consider these study conclusions and recommendations:

- **Substantially higher throughput.** HybridCheckout equipment and process can improve grocery throughput by up to 82 percent compared to standard, cashier-only methods.

- **Easy to use and understand.** POC test results and a post-test survey questionnaire confirmed that cashiers and customers found that HybridCheckout equipment and process were easy to understand and use.

- **Preferred checkout method.** Post-test questionnaire responses clearly confirm that HybridCheckout would be the checkout method of choice of most PoC testers.

- **No show-stoppers.** Customers did not reveal any repeated problem areas or doubts regarding HybridCheckout.

- **Additional research.** Although PoC test results are clear, additional research in a production or pilot installation environment is recommended.

Further information may be found from the following resources:

- http://www.hybridcheckout.com/Article/Evaluate/Proof-of-Concept

- http://www.hybridcheckout.com/Article/Evaluate/White-Papers

- http://www.hybridcheckout.com

- http://blog.hybridcheckout.com