Dell Monitor Productivity Study

Measuring The Impact Of Large, High Resolution External Desktop Monitors On Worker Productivity

HOTTECH | VISION AND ANALYSIS

July 2021 | Commissioned By Dell Technologies

Table of Contents

Improving Remote Worker Productivity With Dell Monitors

While work from home and remote employees have been increasing at a steady pace in recent years, current global events have forced a surge in their numbers. Although once considered a stop-gap remedy, remote work is no longer thought of as a temporary solution; multiple surveys claim that many companies will transition a portion of their previously on-site workforce to permanent remote work positions. Case in point, a recent research paper proclaims, *"…a third of the global workforce will be on a hybrid-working arrangement by the end of 2021. This means that although knowledge workers in some countries are starting to return to the office, the home will remain the dominant place for work."*

Remaining productive while working remotely can be a challenge for some users, who may not be accustomed to performing their duties under less than optimal conditions. In fact, the same research paper referenced above also states that, *"…many workers find that their home offices are not well-equipped for productivity. This trend continues in 2021 as one out of two employees face physical distractions when working from home that impedes their productivity (63% in North America, 54% in Europe, and 40% in APAC)."*

It is common for on-site workers to have access to powerful desktop systems, docking stations, and multiple monitors in their corporate workspaces. When working remotely, however, these same users may be relegated to a laptop alone. When users are forced to be productive on relatively small, single laptop displays, with cramped laptop keyboards and touchpads, they often have to make undesirable trade-offs that may hinder productivity. For example, users may have to bounce between open applications and windows, or shrink their application windows to fit alongside each other on a small laptop display, which often necessitates additional task-switching, scrolling and sub-optimal ergonomic conditions. These trade-offs are mitigated when larger or multiple external monitors and input devices (i.e. a full-sized keyboard and mouse) are connected, which enable easier simultaneous viewing and navigation of multiple application windows. Ideal placement and positioning of the monitors can also alleviate potential ergonomic issues and facilitate a more comfortable working environment.

Choosing The Right Tools To Maximize Productivity

To maximize productivity, choosing the right tools for a particular job is paramount. While higher-performance system upgrades are often a preferred solution to boost productivity, for many users a more powerful system may not help much at all. Users that spend most of their workday entrenched in email, Word documents or PowerPoint, don't typically place a heavy enough load on a modern computer system to achieve any meaningful time-savings during every-day use after a typical system upgrade. A user's monitor, keyboard and mouse, which are the devices that a human interfaces with the most to actually interact with a PC, however, can have a significant impact on productivity and comfort.

With these considerations in mind, in early 2020 we set out to measure the potential productivity benefits of attaching an external monitor(s) and a full-sized keyboard and mouse to a laptop, to augment and expand a user's digital workspace. The products included in that initial study consisted of mainstream 24" and 27" FullHD monitors, dual 24" FullHD monitors and a 34" curved WQHD monitor. Dell's Display Manager utility was also used to optimize on-screen application positioning, per each participant's preference.

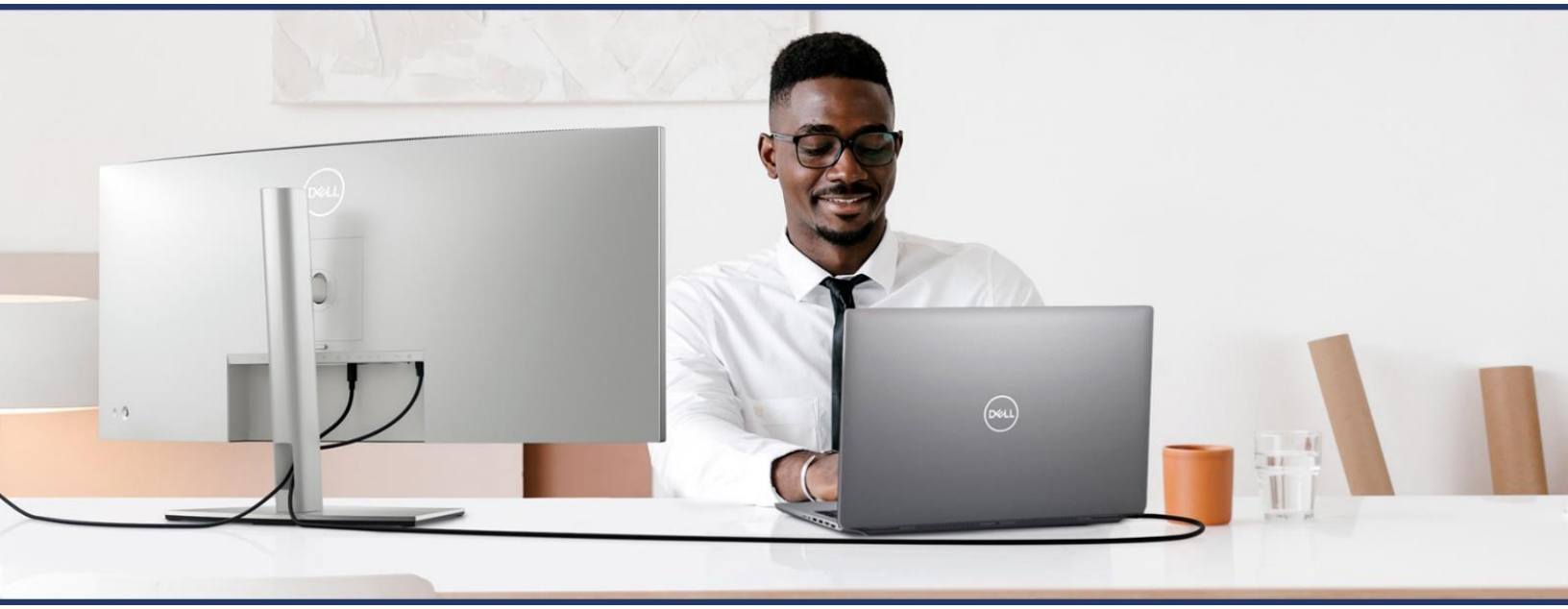
The results from that study were interesting and impactful. By adding an external monitor (or monitors) and full-sized input devices to the laptop, participant productivity increased significantly. For example, participants improved their productivity by approximately 32% using the 24" FullHD monitor setup over the 14" laptop display alone.

A year after the initial study, however, with hybrid work becoming the new norm, we've decided to further explore the potential productivity benefits of external monitors, using a number of larger, higher-resolution models, which leverage both flat and curved panel technologies. FullHD 1080p monitors are relatively common now, but larger, higher-resolution displays are steadily increasing in popularity.

In this study, we replicated the test procedures and workloads of last year's effort, focusing on larger and higher resolution Dell monitors in sizes ranging from 25" to 49", with selected single and dual monitor setups, and ultrawide form factors. The goal of this research effort is to explore the impact of bigger and higher resolution monitors on productivity, regardless of where the work takes place.

There Are No Barriers To Entry: Setting Up External Monitors Is Simple

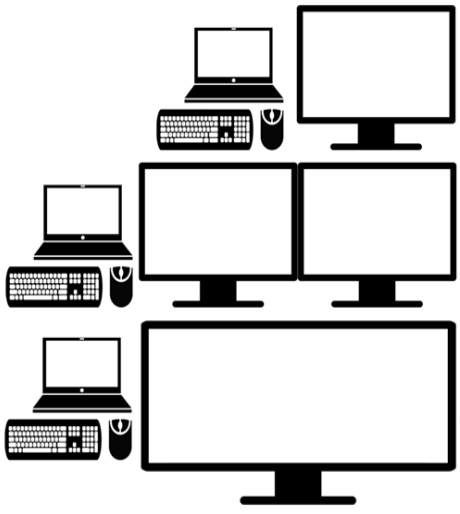
For some users, the thought of installing and configuring multiple monitors is daunting. The actual process is straightforward and easy to understand, however, even for novice users. With the modern Dell Latitude 7400 2-in-1 system and USB-C or DisplayPort enabled monitors featured in this study, anyone capable of opening a box and plugging-in a couple of cables can be up and running in minutes. The installation process is as simple as connecting the monitor to power and attaching one end of the display cable to the monitor and the other end to a PC. Windows will automatically detect the display (or displays) a few moments later and then it's simply a matter of choosing the desired display mode, to either extend or duplicate the desktop. It is that simple.



What We Tested: System, Input, and Monitors

For this study, five participants were tested on multiple different system configurations. The baseline configuration was a lone Dell Latitude 7400 2-in-1 device, featuring a 14" Full-HD (1920x1080 resolution) display, an Intel Core i5-10310U processor, 8GB of RAM, and a 128GB NVMe solid state drive. The system was running Microsoft Windows 10 Professional, the latest Chromium-based Edge web browser, and Microsoft Office 2019 Professional Plus.

To assess any potential productivity improvements, we attached a Dell KM7321W Premium Keyboard and Mouse Combo to the system, along with an array of monitor configurations, which included:



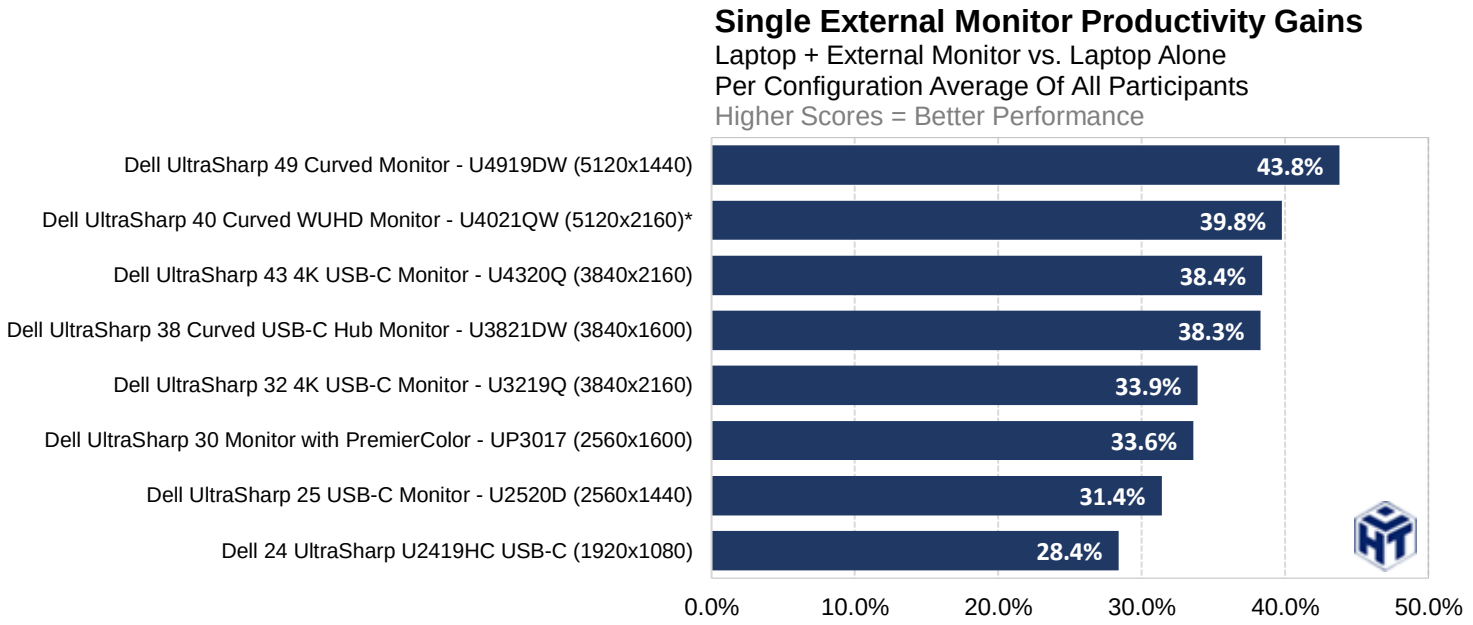
- Dell UltraSharp 25 USB-C Monitor - U2520D (2560x1440) x 2
- Dell UltraSharp 30 Monitor with PremierColor - UP3017 (2560x1600)
- Dell UltraSharp 32 4K USB-C Monitor - U3219Q (3840x2160) x 2
- Dell UltraSharp 38 Curved USB-C Hub Monitor - U3821DW (3840x1600)
- Dell UltraSharp 43 4K USB-C Monitor - U4320Q (3840x2160)
- Dell UltraSharp 40 Curved WUHD Monitor - U4021QW (5120x2160)
- Dell UltraSharp 27 USB-C Monitor - U2721DE + U2719DC (2560x1440 ea.)
- Dell UltraSharp 49 Curved Monitor - U4919DW (5120x1440)

A Dell 24" UltraSharp U2419HC 1080p monitor was also used to establish baseline performance versus the larger, higher-resolutions monitors. Configurations consisted of single and dual flat-screen, large, and curved monitors of various resolutions. With all but the laptop and single 24" monitor configuration, Dell Display Manager was also used to align applications in various layouts across the screens, per each participant's preference. All of the monitors were configured in Extended Desktop mode to maximize available screen real estate, which allowed participants to use the laptop's built-in display in conjunction with the external monitors. Our goal was to ascertain what potential productivity benefits could be achieved by incorporating full-sized input devices, increasing the overall usable screen area and resolution, and providing a multi-desktop user experience.

Single External Display Productivity Improvements

Participants in this study were timed while performing an array of tasks utilizing a web browser, image editor, and several Microsoft Office applications, including Word, PowerPoint, and Excel on 11 different external monitor configurations (***see Appendix A for details***). The test conditions were devised to mimic common use cases and necessitate repeated application-switching, scrolling, and multiple Cut, Copy, and Paste operations.

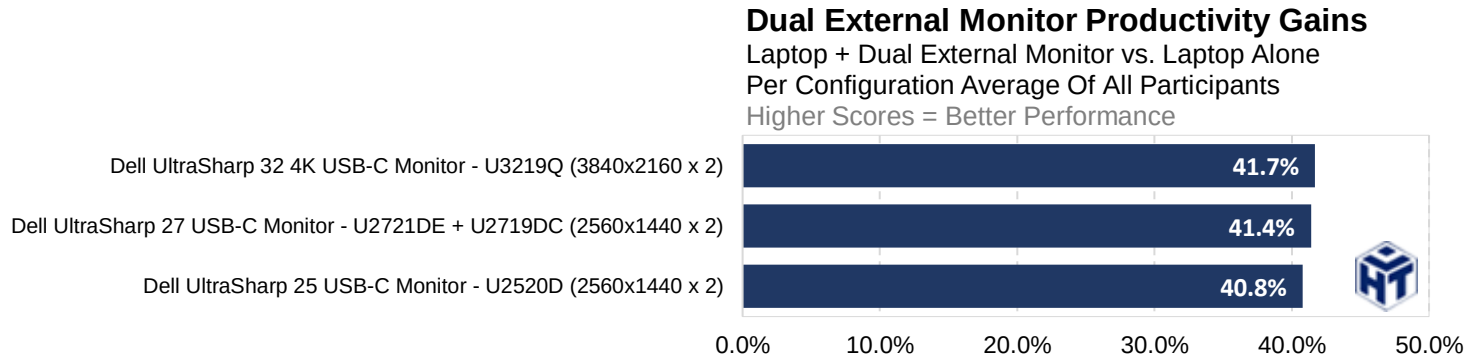
Before we dive into the results, we should provide some additional context in light of last year's similar study. Our latest baseline data shows a slight decrease in productivity (approximately 3.6%), when using a single 24" FHD external monitor. This difference is likely the result of multiple factors. The studies used two different groups of participants, with differing skill levels. Participants in this study were asked to completed workloads on 12 different configurations, versus 6 in last year's study. The monitors and laptops used were different and external monitors have increased in prevalence over the last year.



That said, the results are no less impressive. All of the single external monitor configurations showed massive times savings. The average productivity increase for single external monitor configurations 32" or below was nearly 34%. Shifting focus to the larger monitors (larger than 32"), shows an average productivity improvement of more than 40%, with the high-resolution, Dell UltraSharp 49 Curved Monitor - U4919DW exhibiting the largest improvement of 43.8%.

Dual External Display Productivity Improvements

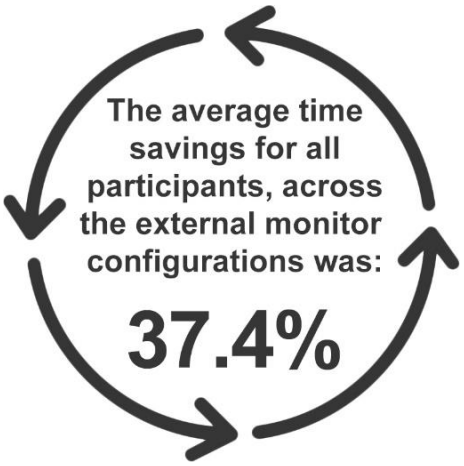
In addition to the array of singe monitor configurations, we also tested participants with an assortment of popular dual-monitor configurations, with monitors ranging from 25" up to 32".



When the participants were tested on the dual-monitor configurations significant time savings were also achieved. The average productivity improvement for the three dual-monitor configurations was 41.3%, with the largest dual Dell UltraSharp 32 4K USB-C Monitor - U3219Q configuration showing the greatest improvement of 41.7%.

The Many Benefits Of A Single, Large Monitor

Although all of the external monitor configurations resulted in improved productivity with all of the participants in this study, there are some important distinctions to make between the single and dual-monitor setups. Though the total screen area and number of pixels available in a dual-monitor configuration may be similar to a single, larger monitor, a single external monitor configuration offers a myriad of advantages. For example, the installation of a single monitor requires fewer cables and the mounting of only a single stand. Positioning a single monitor is also easier, without the need to align bezels or contend with differing heights or tilts. A single monitor and stand will also consume less desktop space. Perhaps most important, there is nothing to obstruct a user's field of view with a single monitor and there are no issues with differing color output or brightness. With dual monitors, adjacent bezels bisect the usable screen area and any differences in the monitors' color calibration, uniformity or brightness will make images appear differently when moved from screen to screen.



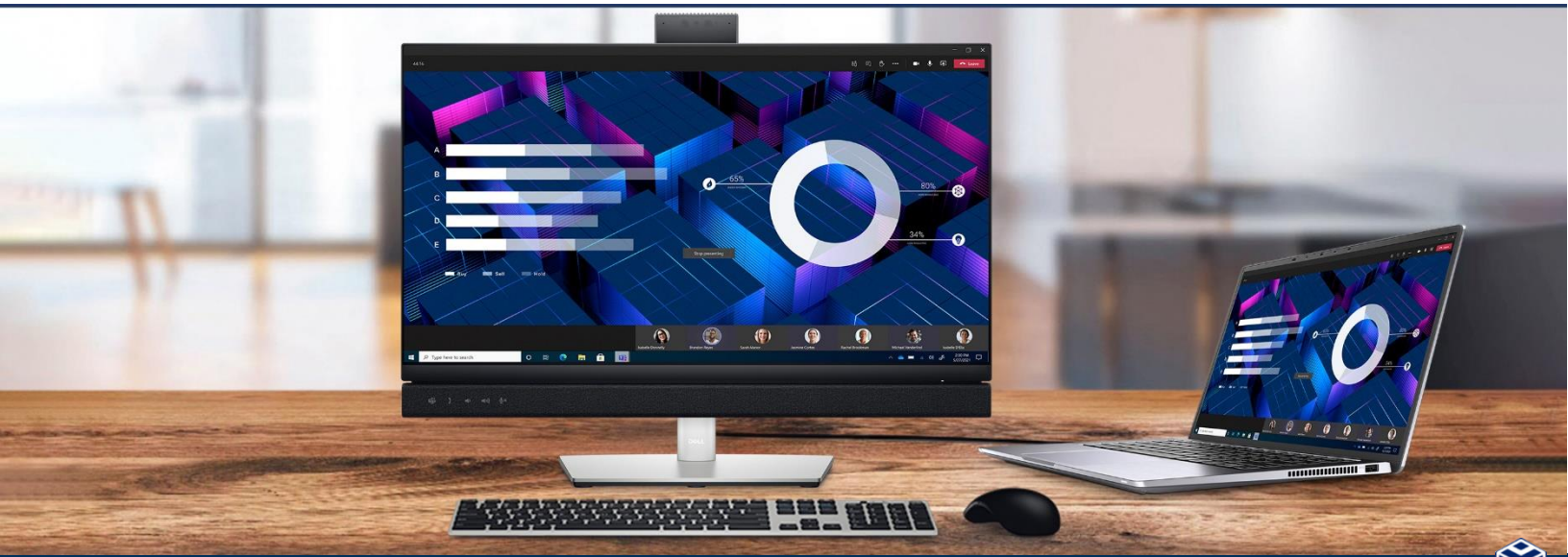
Dual and multi-monitor configurations are an excellent way to enhance a user's experience and boost productivity with multiple desktop instances, but when possible, opting for a single, large monitor may be optimal depending on end user requirements and use cases.

Additional Productivity And Ergonomic Benefits Of External Monitors

In addition to the measurable time savings afforded by incorporating an external monitor (or monitors) into a user's workflow, adding external monitors and proper input devices to a laptop offers numerous ancillary benefits. The larger, properly spaced keys, in conjunction with the ability to position the input devices and monitors in optimal locations, has obvious comfort and ergonomic benefits. Fine-tuning the monitor's height and tilt further enhance comfort and improve usability. In their totality, all of the ergonomic benefits may result in less fatigue, an enhanced user experience, and increased overall comfort, which would likely boost worker productivity and morale in the long term as well. Connecting and configuring this current generation of Dell monitors is also quick and easy, relative to previous-gen products. USB-C and DisplayPort streamlines the installation process and can consolidate the connections into a single cable. Having multiple cables connected to a notebook for audio, video, power and data is no longer a necessity.

The additional screen area and the ability to leverage Dell Display Manager also allows users to remain productive while participating in tasks that would normally dominate a lone laptop display. For example, the number of video conferences has skyrocketed as face-to-face meetings have decreased, due to limited air travel. With a laptop display alone, a multi-participant video conference can easily dominate the entire laptop screen and prevent users from simultaneously viewing and working with other applications. With additional screen area and DDM at their disposal, however, the video conference could be relegated to only one display (or a small part of a larger display), which would allow the user to remain productive and working on other tasks simultaneously.

When polled, 100% of the participants in this study agreed that having an additional display available during video conferences would be preferable and afforded the ability to participate in the video conference, while also performing other tasks.



Summary Of Findings And Conclusion

All of the participants in this study achieved meaningful and significant productivity gains with the external monitor configurations. The added screen real-estate and increased pixel resolutions, in conjunction with the ergonomic benefits of the full-sized keyboard and mouse and adjustable monitor positions, resulted in significant time savings for all participants across all of the external monitor configurations we tested.

To further increase productivity, we'd recommend opting for the largest, highest-resolution display possible. Our results ranked the single display configurations thusly:

i. Dell UltraSharp 25 USB-C Monitor - U2520D (QHD) – **31.4%**

ii. Dell UltraSharp 30 Monitor with PremierColor - UP3017 (WQXGA) – **33.6%**

iii. Dell UltraSharp 32 4K USB-C Monitor - U3219Q (4K) – **33.9**%

iv. Dell UltraSharp 38 Curved USB-C Hub Monitor - U3821DW (WQHD+) – **38.3%**

v. Dell UltraSharp 43 4K USB-C Monitor - U4320Q (4K) – **38.4%**

vi. Dell UltraSharp 40 Curved WUHD Monitor - U4021QW (WUHD) – **39.8%**

vii. Dell UltraSharp 49 Curved Monitor - U4919DW (DQHD) – **43.8%**

A clear pattern emerged from our testing. Although the time savings and productivity gains don't correlate exactly across every participant and configuration, when averaged, the mean results show that as screen size and resolution is increased, generally speaking, so too is productivity.

Appendix A: How Participants Were Tested

Participants in this study were timed while completing an array of common tasks that involved a web browser, image editor (Microsoft Paint), and three Microsoft Office Applications: Word, Excel, and PowerPoint.

In an effort to mitigate familiarity with the tests and repetition, we created multiple groups of documents, and randomized their use across the different display configurations that were tested. We also randomized the order in which participants were tested on a particular display configuration.

All participants were given a chance to familiarize themselves with the configurations, position the monitor and input devices to their liking, read the instructions (and ask questions), and get comfortable with the setups before the timer was started.

For the display configurations where Dell Display Manager was used, participants were given the option as to where Word, Excel, and PowerPoint were positioned on screen.

There were an identical amount of data and number of tasks required to complete the testing with all document groups. The order of operations, however, was also randomized where possible (some steps, like Copying and Pasting an image, must be performed consecutively).

The testing steps included:

1) Downloading a .ZIP file from the Gmail web interface (account credentials were pre-saved to prevent any potential delays due to a mistyped username or password).

2) Extracting Word, Excel, and PowerPoint files from the .ZIP and saving them to the desktop.

3) Copying thousands of rows of data from multiple columns in Excel (data locations were randomized).

4) Pasting the data from Excel onto different tabs, where charts were auto-generated.

5) Ascertaining the Chart Titles from the Word and PowerPoint files (locations in the documents were randomized).

6) Copying the completed charts into Paint and saving them as image files to the desktop.

7) Inserting the charts into the Word and PowerPoint files (locations in the documents randomized).

8) Editing font and page layout attributes of the Word file (font and margin sizes randomized).

9) Duplicating and editing slides in PowerPoint.

10) Exporting the Word and PowerPoint documents to the PDF file format.

11) Creating a .ZIP file with the completed documents and attaching it to a new email.

Appendix B: Monitor, System and Device Specifications

Monitors:

	Display Size	Resolution	Refresh Rate	Panel Type
Dell UltraSharp 24 USB-C Monitor - U2419HC	24"	1920x1080	60Hz	Flat
Dell UltraSharp 25 USB-C Monitor - U2520D	25"	2560x1440	60Hz	Flat
Dell UltraSharp 27 USB-C Monitor - U2721DE	27"	2560x1440	60Hz	Flat
Dell UltraSharp 27 USB-C Monitor - U2719DC	27"	2560x1440	60Hz	Flat
Dell UltraSharp 30 Monitor with PremierColor - UP3017	30"	2560x1600	60Hz	Flat
Dell UltraSharp 32 4K USB-C Monitor - U3219Q	32"	3810x2160	60Hz	Flat
Dell UltraSharp 43 4K USB-C Monitor - U4320Q	43"	3840x2160	60Hz	Flat
Dell UltraSharp 38 Curved USB-C Hub Monitor - U3821DW	38"	3840x1600	60Hz	Curved
Dell UltraSharp 40 Curved WUHD Monitor - U4021QW	40"	5120x2160	60Hz	Curved
Dell UltraSharp 49 Curved Monitor - U4919DW	49"	5120x1440	60Hz	Curved

Input Devices:

	Wireless Receiver	Pointing Device	Hot Keys Function
KM7321 W Premium Keyboard and Mouse Combo	USB, Bluetooth 2.4GHz	Mouse, Laser Sensor	Sleep, volume, search, mute, play/pause, forward

Laptop:

	Processor	Memory	Storage	Display	BIOS	Windows Version
Dell Latitude 7410 2-in-1	Core i5-10310U	8GB (DDR4-2667)	128GB	14" FHD (1920x 1080)	v1.8.0	Windows 10

Appendix C: Participant Results and Comparisons

	Results In Minutes				
	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5
Laptop Only (No Monitor, No KB/M)	34.80	43.02	44.23	38.78	41.97
Dell UltraSharp 24 USB-C Monitor - U2419HC (1920x1080)	25.68	27.62	28.57	30.37	32.37
Dell UltraSharp 25 USB-C Monitor - U2520D (2560x1440)	24.65	26.80	28.32	29.90	32.20
Dell UltraSharp 30 Monitor with PremierColor - UP3017 (2560x1600)	23.15	26.62	25.68	30.68	25.30
Dell UltraSharp 32 4K USB-C Monitor - U3219Q (3840x2160)	28.17	24.40	23.67	28.33	24.37
Dell UltraSharp 43 4K USB-C Monitor - U4320Q (3840x2160)	25.17	21.60	22.07	28.72	21.72
Dell UltraSharp 38 Curved USB-C Hub Monitor - U3821DW (3840x1600)	24.37	22.72	22.15	28.70	23.02
40" Curved (U4021QW x 1, Resolution - 5120x2160)	23.92	22.42	22.55	26.68	22.80
49" Curved (U4919DW x 1, Resolution - 5120x1440)	20.27	21.90	22.15	25.43	21.87
Dell UltraSharp 25 USB-C Monitor - U2520D (2560x1440) x 2	19.70	23.72	23.20	28.17	23.72
Dell UltraSharp 27 USB-C Monitor - U2721DE + U2719DC (2560x1440 ea.)	19.53	23.35	23.00	27.93	23.48
Dell UltraSharp 32 4K USB-C Monitor - U3219Q (3840x2160) x 2	21.02	22.55	21.93	27.40	23.88

	% Time Saved Versus Laptop Only					
	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Average
Dell UltraSharp 24 USB-C Monitor - U2419HC (1920x1080)	26.2%	35.8%	35.4%	21.7%	22.9%	**28.4%**
Dell UltraSharp 25 USB-C Monitor - U2520D (2560x1440)	29.2%	37.7%	36.0%	22.9%	23.3%	**31.4%**
Dell UltraSharp 30 Monitor with PremierColor - UP3017 (2560x1600)	33.5%	38.1%	41.9%	20.9%	39.7%	**33.6%**
Dell UltraSharp 32 4K USB-C Monitor - U3219Q (3840x2160)	19.1%	43.3%	46.5%	26.9%	41.9%	**33.9%**
Dell UltraSharp 43 4K USB-C Monitor - U4320Q (3840x2160)	27.7%	49.8%	50.1%	26.0%	48.3%	**38.4%**
Dell UltraSharp 38 Curved USB-C Hub Monitor - U3821DW (3840x1600)	30.0%	47.2%	49.9%	26.0%	45.2%	**38.3%**
Dell UltraSharp 40 Curved WUHD Monitor - U4021QW (5120x2160)*	31.3%	47.9%	49.0%	31.2%	45.7%	**39.8%**
Dell UltraSharp 49 Curved Monitor - U4919DW (5120x1440)	41.8%	49.1%	49.9%	34.4%	47.9%	**43.8%**
Dell UltraSharp 25 USB-C Monitor - U2520D x 2 (2560x1440 ea.)	43.4%	44.9%	47.6%	27.4%	43.5%	**40.8%**
Dell UltraSharp 27 USB-C Monitor - U2721DE + U2719DC (2560x1440 ea.)	43.9%	45.7%	48.0%	28.0%	44.0%	**41.4%**
Dell UltraSharp 32 4K USB-C Monitor - U3219Q (3840x2160 ea.)	39.6%	47.6%	50.4%	29.4%	43.1%	**41.7%**
Average Improvement Per Participant	**33.2%**	**44.3%**	**45.9%**	**26.8%**	**40.5%**	
Average Improvement All Participants Combined	**38.1%**					
Average Improvement Per Monitor Configuration	**37.4%**					

* U4021QW Operating At 30Hz Refresh Rate

About Hot Tech Vision and Analysis

Industry Research: With decades of experience in the computing, communications, and semiconductor markets, both at the executive level and as media, HTVA has direct insight into industry trends, forecasts, product execution, and market impact. From whitepaper research data, event coverage, or live speaking engagements on TV, Radio, and Internet channels, our team provides specific, targeted analysis on the hottest technologies that shape the digital landscape. We cover emerging and mature markets within Computing and Semiconductor technologies, but always maintain a pulse on the cutting-edge.

Product and Market Analysis: Excellence in product development can't happen in a vacuum. Who and what are your competitors? And what does your product or product's relative SWOT matrix really look like? If you're competing in the enterprise or client computing, datacenter, storage, VR/AR, AI, PC gaming, mobile/handset, or the IOT markets, contact us. We can help with our depth and breadth of technical knowledge. We can help with decades of experience in product testing, technical benchmarking, use- case/experiential hands-on analysis, and easy-to-digest feedback. And we can help with insight from hundreds of major technology brands and over three decades of tenure in the industry.

Consulting Services: As trusted advisers to dozens of major tech brands, we already live and breathe in the landscape you're trying to navigate. Whether you require specific product guidance, market feedback, competitive analysis, or Marketing and PR strategic planning, we've seen the best and worst of it. More importantly, we know what works and what doesn't. We'll help you achieve your goals with the critical, clear vision and relevant knowledge to become a respected industry leader.

Hot Tech Vision and Analysis
P.O. Box 304
Mendon, MA 01756
(508) 377-7575
www.hottech.com

Disclaimer of Warranties; Limitation of Liability:

HOT TECH VISION AND ANALYSIS (HTVA) STRIVES TO ENSURE ACCURACY AND RELEVANCE IN ALL TESTING SCENARIOS. HOWEVER, HTVA DOES NOT REPRESENT OR WARRANT THE ACCURACY, COMPLETENESS, OR SUFFICIENCY OF ITS TEST RESULTS OR FINAL ASSESSMENT. THE DATA IN THIS REPORT IS PROVIDED WITHOUT SPECIFIC CLAIM OF USE. HTVA REPORTS ARE PROVIDED AS-IS WITHOUT A WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF USE CASE OR USAGE MODEL. USERS OF HTVA REPORTS DO SO AT THEIR OWN RISK, AND AGREE THAT HTVA, ITS EMPLOYEES, OFFICERS, SUBCONTRACTORS AND AGENTS SHALL HAVE NO LIABILITY IN ANY CLAIM OF LOSS OR DAMAGE OF ANY KIND.