Dell Monitor Productivity Study:

Examining The Effects Of External Monitors On Remote Worker Productivity

HOTTECH | VISION AND ANALYSIS

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Introduction: Improving Remote Worker Productivity

There has been a dramatic rise in the number of remote workers over the last decade and a half. Recent global events have forced a rapid boom in the number of remote workers, many of whom may remain so permanently. A number of surveys from around the globe have determined that many companies will likely transition some of their previously on-site workforce to permanent remote work positions.

Remaining productive while working from home can be a major challenge for some users, who are not accustomed to performing their duties under less than optimal conditions. It is not uncommon for on-site workers to have access to powerful desktop systems, docking stations, and multiple monitors, but when working from home these same users are relegated to their laptop alone. When users are forced to be productive on relatively small, single laptop displays, and cramped laptop keyboards and touchpads, they often have to make unfortunate trade-offs that may hinder productivity. For example, users may have to bounce between open applications and windows, or shrink down their application windows to fit alongside each other on a laptop display, which often necessitates additional scrolling and sub-optimal ergonomic conditions. These trade-offs are mitigated when large or multiple external monitors and proper input devices are connected, which enable easier viewing and navigation of multiple applications, simultaneously. Ideal placement and positioning of the monitors can also alleviate many ergonomic issues.

To maximize productivity, choosing the right tools for a particular job is paramount. While higher-performance system upgrades are often the go-to solution to boost productivity, for many users a faster system may do very little. Users that spend most of their workday entrenched in emails, Word documents, or PowerPoint, don't typically place a heavy enough load on the system to reveal perceptible time-savings during every-day use after a system upgrade. However, the user's input devices and monitors – the devices that a human actually interfaces with to interact with a PC – can have an enormous impact on productivity.

With that premise in mind, we set out to measure the potential productivity gains that can be realized by attaching full-sized input devices, i.e. a keyboard and mouse, and various monitors, to a mainstream, business-class notebook.

Technical Hurdles: Setting Up External Monitors Is Easy

For some users, the thought of installing and configuring multiple displays is daunting. The reality, however, is that the process could not be easier. With the modern Dell Latitude 7400 2-in-1 system and USB-C enabled monitors featured in this study, anyone capable of plugging-in a power cord and data cable can be up and running in minutes. The installation process is as simple as connecting the monitor to power and attaching the USB-C cable to the monitor and PC. Windows 10 will automatically detect the display (or displays) a few moments later and then it's simply a matter of choosing your desired mode, to either extend or duplicate the desktop.


What We Tested: System, Input, And Monitors

For this study, five participants of various technological skill levels were tested on six different system configurations. The baseline configuration was a lone Dell Latitude 7400 2-in-1 device, featuring a 14" Full-HD (1920 x 1080 resolution) display, Intel Core i5-8265U 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.

We attached an array of peripherals and displays to the Dell Latitude 7400 2-in-1, including a Dell KM717 Premium Keyboard and Mouse Combo, one or two Dell UltraSharp 24 USB-C Monitors (model U2419HC), a Dell 27 USB-C Monitor (model P2719HC), and a Dell UltraSharp 34 Curved USB-C Monitor (model U3419W). 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 display in conjunction with the external monitors.
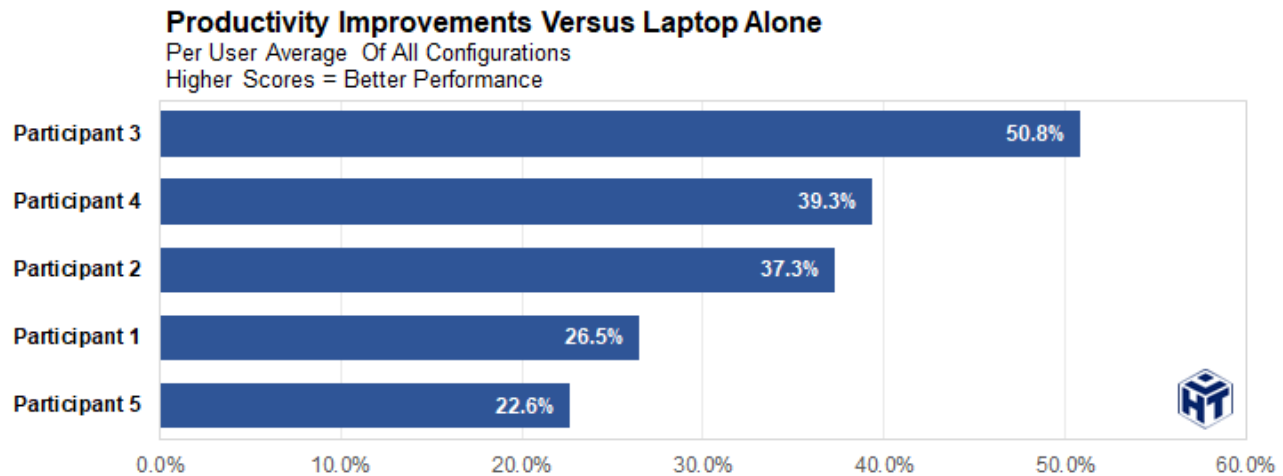
Our goal was to ascertain what potential productivity benefits could be achieved by incorporating full-sized input devices, increasing the overall usable screen area and providing a multi-desktop user experience.
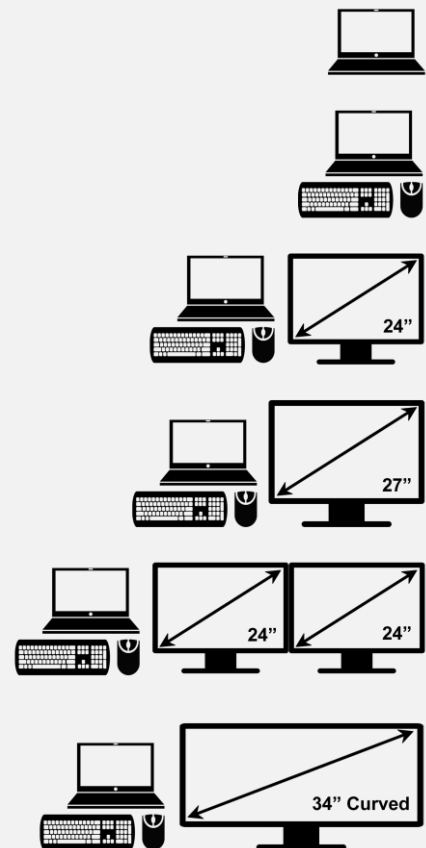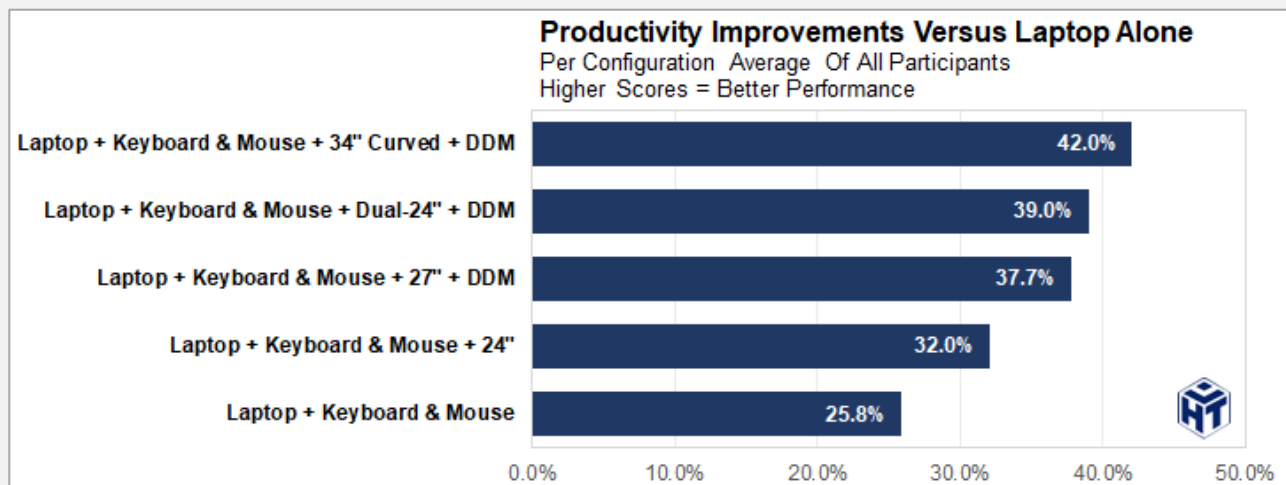
Per-Participant Productivity Improvements

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

Productivity Improvements Versus Laptop Alone
Per User Average Of All Configurations
Higher Scores = Better Performance

Participant	Improvement
Participant 3	50.8%
Participant 4	39.3%
Participant 2	37.3%
Participant 1	26.5%
Participant 5	22.6%

Our per-participant results revealed significant productivity improvements across the board. The chart above signifies the average time-savings across all five upgraded configurations, versus the laptop alone. The median improvement was 37.3%, though one user was able to complete the required tasks over 50% faster.

Per-Configuration Productivity Improvements

As mentioned, we tested five different system configurations against the laptop alone. Adding the Dell UltraSharp 24 USB-C or Dell 27 USB-C Monitor to the laptop, effectively doubled the number of display pixels presented to participants. Adding dual UltraSharp 24 USB-C monitors tripled the number of pixels. And adding the Dell UltraSharp 34 Curved USB-C Monitor resulted in approximately 3.5X the number of pixels – and all upgraded monitor configurations added significant usable screen area to complement the laptop's display.

Productivity Improvements Versus Laptop Alone
Per Configuration Average Of All Participants
Higher Scores = Better Performance

Configuration	Improvement
Laptop + Keyboard & Mouse + 34" Curved + DDM	42.0%
Laptop + Keyboard & Mouse + Dual-24" + DDM	39.0%
Laptop + Keyboard & Mouse + 27" + DDM	37.7%
Laptop + Keyboard & Mouse + 24"	32.0%
Laptop + Keyboard & Mouse	25.8%

As the number of usable pixels and screen area increased, so too did the average performance of the participants. The average (mean) improvement across all configurations that included an additional monitor was greater than 37.6%.

## Additional Productivity And Ergonomic Benefits

Over and above the measurable time savings, adding monitors and proper input devices to a laptop offers a number of additional benefits as well. The larger, properly spaced keys and the ability to locate the input devices and monitors in optimal positions has clear ergonomic benefits. And fine tuning the monitor's height and tilt further enhance comfort and usability. In turn, all of the ergonomic benefits will usually result in less fatigue, an enhanced user experience, and increased overall comfort, which would boost productivity in the long term.

Connecting and configuring the monitors is quick and simple as well, relative to previous-gen products. USB-C streamlines the installation process and consolidates it to a single cable. Having multiple cables connected to a notebook for audio, video, power and data is no longer a necessity.

Having 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 being held during the current pandemic has skyrocketed. With a laptop display alone, a multi-participant video conference would often dominate the laptop screen and prevent users from simultaneously viewing and working with other applications. With the additional screen area and DDM at their disposal, however, the video conference could be relegated to only one display (or one part of a larger display), which would allow the user to remain productive while working on other tasks. Below is an example of one such configuration with the Dell Latitude 7400 2-in-1 laptop connected to a Dell UltraSharp 34 Curved USB-C Monitor.

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.

The average time-savings for all participants, across every upgraded configuration was:

35.3%
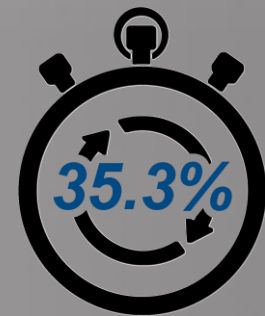
Appendix A: How We Tested

Participants in this study were asked to complete an array of common tasks -- while being timed -- that involved a web browser, image editor (MS Paint), and three Microsoft Office Applications – Word, Excel, and PowerPoint.

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

All participants were given a chance to familiarize themselves with the configurations, read the instructions (and ask questions), and get comfortable with the setup 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 number of tasks required to complete the testing with all six groups of documents, but the order of operations was also randomized where possible (some steps, like Copying and Pasting an image, must be performed consecutively).

The testing included:

1) Downloading A .ZIP file from the Gmail web interface (account credentials were 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, to auto-generate multiple charts.

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

6) Copying the completed charts into MS 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 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 PDFs.

11) Creating a.ZIP files with completed documents and attaching it to a new email.
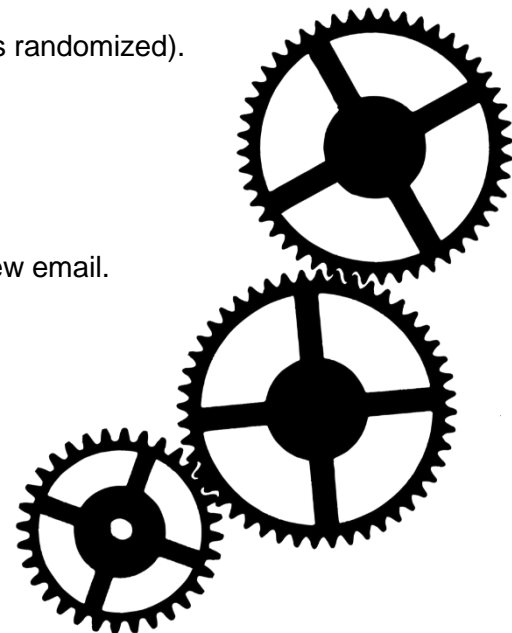
Appendix B: System And Device Specifications

	Dell UltraSharp 24 USB-C Monitor: U2419HC	Dell 27 USB-C Monitor: P2719HC	Dell UltraSharp 34 Curved USB-C Monitor: U3419W
Diagonal Viewing Size:	60.47 cm (23.8 inches)	68.59 cm (27.0 Inches)	86.27 cm (34.14 inches)
Preset Display Area	527.04 mm x 296.46 mm (20.75" x 11.67")	597.88 mm x 336.31 mm (23.54" x 13.24")	799.80 mm x 344.80 mm (31.49" x 13.18")
Panel Type:	In-Plane Switching Technology	In-Plane Switching Technology	In-Plane Switching Technology
Maximum Preset Resolution:	1920 x 1080 @ 60Hz	1920 x 1080 @ 60 Hz	3440 x 1440 @ 60Hz
Viewing Angle:	178° vertical / 178° horizontal	178° vertical / 178° horizontal	178° vertical / 178° horizontal
Connectivity:	1 x DP 1.4 (HDCP 1.4) 1 x HDMI1.4 (HDCP 1.4) 1 x USB Type-C (Alternate mode with DisplayPort 1.4, USB 3.1 upstream port, Power Delivery PD up to 65 W) 1 x DP (Out) with MST(HDCP 1.4) 2 x USB 3.0 downstream port 2 x USB 3.0 with BC1.2 charging capability at 2A (max) 1 x Analog 2.0 audio out (3.5mm jack)	1 HDMI port 1 DP(in) port 1 DP(out) port 1 USB Type-C port 2 USB 2.0 downstream ports (rear) 2 USB 3.0 downstream ports (side)	2 x HDMI 2.0 (HDCP 2.2) 1 x DP 1.2 (HDCP 2.2) 2 x USB 3.0 Upstream port 2 x USB 3.0 Downstream port (side) 2 x USB 3.0 Downstream port (bottom) 1 x USB Type-C (DisplayPort DP1.2 Alternate Mode, Power Delivery up to 90W (Typical), and USB 2.0)

	Wireless Receiver	Pointing Device	Hot Keys Function
KM717 Premium Keyboard and Mouse Combo (Gray)	USB, Bluetooth 2.4GHz	Mouse, Laser Sensor	Sleep, volume, search, mute, play/pause, forward

	Processor	Memory	Storage	Display	BIOS	Windows Version
Dell Latitude 7400 2-in-1	Core i5-8265U	8GB (DDR3-1066)	128GB (Toshiba)	14" FHD (1920x 1080)	v1.7.2	Pro (v1909)

Appendix C: Participant Data And Comparisons

Results In Minutes	Laptop Only	Laptop + Keyboard & Mouse	Laptop + Keyboard & Mouse + 24"	Laptop + Keyboard & Mouse + 27" + DDM	Laptop + Keyboard & Mouse + Dual-24" + DDM	Laptop + Keyboard & Mouse + 34" Curved + DDM
Participant 1	40.57	33.17	32.10	28.67	30.93	24.23
Participant 2	33.73	27.07	22.50	19.70	17.37	19.07
Participant 3	40.75	23.13	21.88	18.00	18.85	18.40
Participant 4	41.40	28.25	26.10	25.55	23.70	22.15
Participant 5	22.73	19.10	17.60	17.37	16.80	17.07
Average Time	35.84	26.14	24.04	21.86	21.53	20.18

Results In Seconds	Laptop Only	Laptop + Keyboard & Mouse	Laptop + Keyboard & Mouse + 24"	Laptop + Keyboard & Mouse + 27" + DDM	Laptop + Keyboard & Mouse + Dual-24" + DDM	Laptop + Keyboard & Mouse + 34" Curved + DDM
Participant 1	2434	1990	1926	1720	1856	1454
Participant 2	2024	1624	1350	1182	1042	1144
Participant 3	2445	1388	1313	1080	1131	1104
Participant 4	2484	1695	1566	1533	1422	1329
Participant 5	1364	1146	1056	1042	1008	1024
Average Time	2150	1569	1442	1311	1292	1211

% Improved Versus Laptop Alone	Laptop Only	Laptop + Keyboard & Mouse	Laptop + Keyboard & Mouse + 24"	Laptop + Keyboard & Mouse + 27" + DDM	Laptop + Keyboard & Mouse + Dual-24" + DDM	Laptop + Keyboard & Mouse + 34" Curved + DDM
Participant 1		18.2%	20.9%	29.3%	23.7%	40.3%
Participant 2		19.8%	33.3%	41.6%	48.5%	43.5%
Participant 3		43.3%	46.3%	55.8%	53.7%	54.8%
Participant 4		31.8%	37.0%	38.3%	42.8%	46.5%
Participant 5		16.0%	22.6%	23.6%	26.1%	24.9%
Average Improvement		25.8%	32.0%	37.7%	39.0%	42.0%

Average Improvement All Configs Versus Laptop Only	
Participant 1	26.5%
Participant 2	37.3%
Participant 3	50.8%
Participant 4	39.3%
Participant 5	22.6%
Average Improvement	35.3%

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