



# AHEAD OF THE CURVE

Exploring how a more visually immersive experience can improve productivity

*A report by Samsung in partnership with Stephen Westland,  
Professor of Colour Science, University of Leeds.*

**SAMSUNG**

# Ahead of the Curve Report: Foreword

Written by Professor Stephen Westland

Today digital technology is ubiquitous in our work lives and in our social lives. Digital displays have literally transformed the way we do things and this is particularly the case in the workplace.

Adults in Britain on average spend nearly nine hours each day looking at a screen. That adds up to over 10,000 days over a typical 80 year lifetime<sup>1</sup>. In fact, according to one recent study we spend more time on media devices than we do asleep so it's unlikely that our usage of digital displays will decline any time soon<sup>2</sup>.

Many of us use digital displays as part of our jobs and suffer no ill effects. However, inefficient configuration of a workstation can result in eye strain, backache, or in some cases, repetitive strain injury. Many companies are careful to ensure that workers use computers and the associated displays correctly. However, what is often given less consideration, is the stress that results from performing intensive search and navigation tasks – tasks that can strain the eyes and also strain us mentally. These tasks frequently involve switching between multiple windows that are rich in information content.

With the ever-increasing amount of digital information<sup>3</sup>, displays are getting bigger. A number of studies have concluded that using a large display enables improved user performance when compared with using a small display. We know that many users, especially those that work in data-intensive fields, have resorted to using multiple screens.

Those that have moved to multiple displays invariably say they will never go back to a single display. The use of two displays is very common because almost all desktop computers can easily accommodate two displays without any modification to the computer hardware.

Reports that show that larger displays are more effective than smaller displays also identify that using a single large display is better than having several smaller ones. For displays in the workplace at least, where mobility is not an issue, it really does seem that bigger is better.

However, as an imaging scientist and Professor of Colour Science and Technology, I am aware of the technical and usability problems that using the wrong type of technology can lead to.

Modern displays are designed to be viewed at right angles to the plane of the screen. The larger the display, the greater the distortions in colour and text that occur towards the edges. These distortions can themselves be a source of eye strain and could reduce user performance and user satisfaction. That is why, as a professional imaging scientist with over 30 years' experience, I am surprised that curved displays are not a regular fixture in the office.

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## EXECUTIVE SUMMARY

## We increasingly spend our time staring at screens to answer emails



95%

The percentage of British office workers who receive up to 100 emails a day



22

Minutes between checking emails



2

Number of hours 50% of us spend working on email each day

## It seems that we are increasingly demanding more screen real estate



40%

Of British office workers are already using two or more connected devices (tablet, smartphone, laptop etc.)



38%

Of office workers have two screens attached to their PC

## The majority of office workers are in open-plan offices



22

The number of minutes office workers can focus on a single task before being interrupted



The use of a large curved display would provide a more private and immersive experience

## Office workers' claims and feelings on productivity



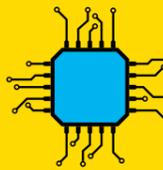
3.6

The average number of days in a week that UK office workers think they have achieved something

90%

Of office workers feel satisfied, happy or motivated when they have a productive day

## How office workers feel about the aesthetics of the technology they use



60%

State that aesthetically pleasing technology is important

2 out of 5

Workers are dissatisfied with the technology that is provided in the workplace

## The display landscape: setting the scene

## Large screens are good

Studies show that users spend more time resizing and moving windows when they use a small screen than when they use a large screen. Larger screens also allow workers to complete data-intensive tasks more quickly and with fewer errors. Because very large screens have tended to be expensive in the past, office workers and IT professionals regularly use multiple displays connected to their workstations as a way to efficiently manipulate, understand and process the increasing amount of digital information that forms part of their everyday working lives. In this sense, consumers have been ahead of display manufacturers. They have exploited the fact that most modern computers (both hardware and operating systems) can easily accommodate two displays and also taken advantage of the drop in price of flat LCD display technology.

## Curved large screens are better

The issue with large displays is that the optical performance falls sharply as the viewing angle increases – again, impacting productivity. This is something that all researchers in this field are aware of and the problem is more pronounced with LCD displays than it was with the older cathode-ray tube technology. **The solution to this problem is to use large curved displays.**

The user does still have to turn their head (or eyes) but the display is maintained at a fixed reading distance and this will result in less eye strain. For colour-critical tasks the fact that the user is always looking orthogonal to the plane of the display could have a huge impact with substantially greater colour performance across the whole display.

## Technology should look good

Over 60% of office workers state that it is important that the technology they use is aesthetically pleasing and yet only 38% of office workers thought the technology they were provided with in the workplace met this criteria. Information-technology companies are increasingly realising that if the workplace is more attractive it will impact on workers' self-esteem and general wellbeing. By example, The Cabinet Office has just ordered a technology transformation programme to deliver modern, flexible technology services that are at least as good as those people use at home. One elegant screen can greatly contribute to the aesthetics of an office.

## A more immersive and private viewing experience can reduce stress

Studies have revealed that 40% of UK office workers are so stressed that their health is affected<sup>5</sup>. The causes of stress are many but one factor is the increasingly cluttered environment in which we live. Today, we live in an age of information overload where our perceptual and cognitive systems are being pushed to the limit. Large curved displays will enable office workers to use fewer windows and keep their information more organised; with large displays, users will typically perform less window "focus" events (i.e. bringing the window to the top) than with the small display. This, in conjunction with a more private experience (due to the curve of the screen which aids privacy) in open-plan offices could reduce stress.

In addition to obvious productivity and health benefits at work, large curved displays can have clear benefits at home – both for work and play. For example, in gaming, it has been shown that a large screen leads to a more favourable impression on the game character, a more positive mood change, and a significantly higher feeling of being physically present in the game<sup>6</sup>.



## Uncovering Office Worker Behaviours

The Ahead of the Curve Report analyses survey data to explore the habits of office workers and their opinions on the importance of aesthetics for technology in the workplace. The survey was carried out by Samsung during the period 16.03.2015 – 23.03.2015.

### Demographics

A total of 2,000 participants (54% female and 46% male) took part in the research. The participants were from a wide range of industries including manufacturing, financial services, charities and the public sector. The modal age range was 25-34 (34.8%) and the participants were based broadly across England, Scotland, Wales and Northern Ireland, with 22% in London.

Around 60% of the participants never work from home. Most work in open-plan offices with 23% working in a private office.

Figure 1: The number of emails received on an average day

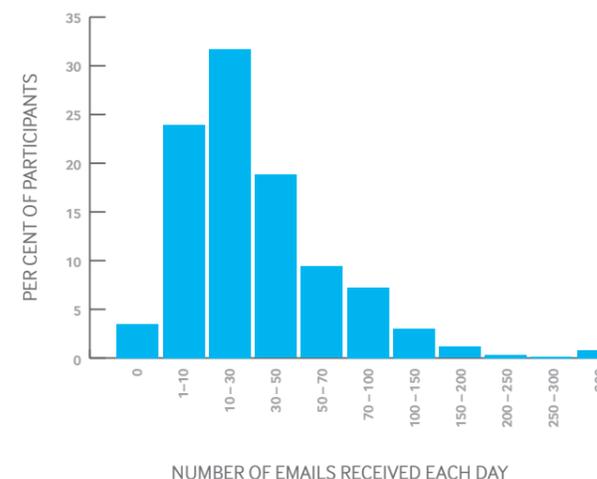
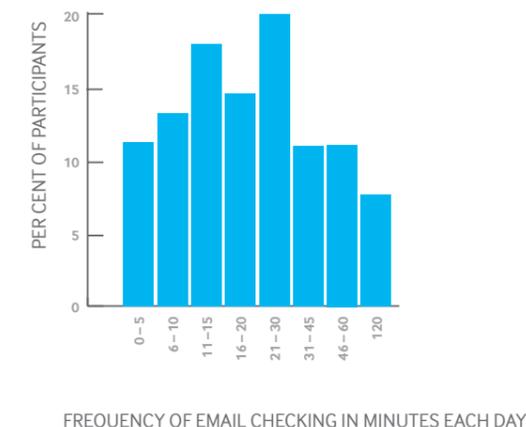


Figure 2: Frequency of email checking



### Emails: a hindrance to productivity?

Email is among the most widespread of online activities with about 183 billion emails sent every day<sup>7</sup>. A recent study showed that the less often workers check their email, the less stressed they are and the higher their well-being levels<sup>8</sup>. Another study also showed that stress reduction can have an impact on a range of outcomes including anxiety, symptoms of depression, and overall perceived quality of work life<sup>9</sup>. However, our study shows that we are likely to interrupt our work every 22 minutes to check our emails.

Several questions were asked about participants' use of email. Figure 1 shows the number of emails received by participants on average over a working day. It shows that 95% of us receive up to 100 emails a day. More than 50% of participants spend at least two hours working on email each day with the average being 1.8 hours.

### Multiple desktop screens

Reports from several studies have suggested that using more than one monitor can increase user productivity. Our study uncovered that 38% of workers have two displays attached to their PC. However, the obvious solution – having one large screen – can result in eye strain and distortion of text because viewing distance can change as the user accesses different parts of the screen. These issues are avoided with the curve screen which increases productivity and reduces eye strain all at the same time.

Our study shows that we are likely to interrupt our work every 22 minutes to check our emails.

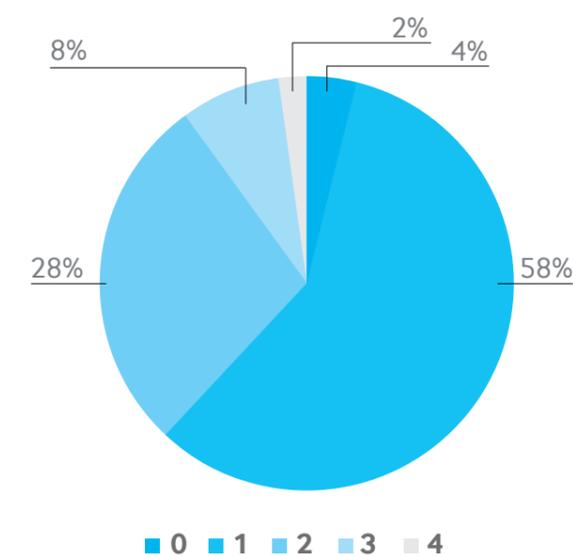


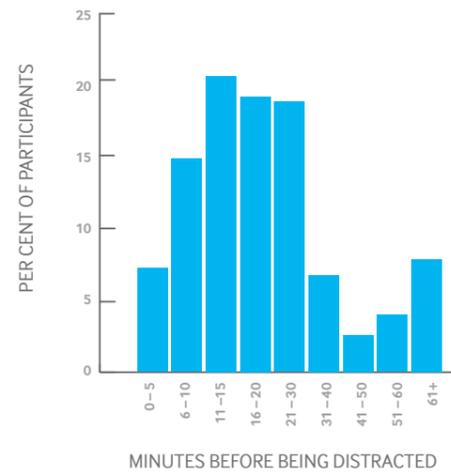
Figure 3: The number of screens that participants attach to their main workstation.

### Distractions in open-plan offices

In this survey, the majority of participants responded that they worked in open-plan offices. Research into open-plan office design has shown that it is negatively related to workers' satisfaction with their physical environment and perceived productivity<sup>10</sup>. However, increased privacy has been shown to positively affect worker satisfaction<sup>11</sup>.

Several distractions were cited by at least 15% of participants including: people talking loudly, tea rounds, the phone ringing, emails, meetings and office gossip. It is likely that the increased privacy of using a large curved screen would address some of these distractions and would lead to a greater level of worker satisfaction. Figure 4 shows the self-estimates by the participants for how long they can work on a single task without being interrupted. The modal time is 11-15 minutes and the average is 22.4 minutes. Wearing headphones (23.9%) and working in a quiet place (31.2%) were most often cited as activities that participants choose when they need to concentrate.

Figure 4: Estimates of how long participants can work on a single task without being interrupted



### Self-evaluation of productivity

When asked about productivity, participants claimed that on average the number of days where they felt they achieved something at work was only 3.6 days in a week. That equates to 70 days a year where workers are unproductive. Yet 90% of participants feel satisfied, happy or motivated when they do have a productive day.

### The aesthetics of technology

When asked whether aesthetically pleasing technology in the workplace was important, 61.5% of participants responded that it was and yet only 38.5% thought that the technology they were provided with in the workplace looks stylish.

## Display decisions: Top tips for choosing your desktop display



#### Increase the amount of display real estate

Increasing the amount of display available will enable workers to be more productive. Most standard desktop computers (and their associated operating systems) support two displays however, a single large curved display is the most effective way to increase space.



#### Technology that looks good will make workers feel good

Office workers want technology that is aesthetically pleasing. Using products that have been designed with style and productivity in mind will help to improve the working environment.



#### Ensure that technology configurations reduce stress and strain

There is legislation that protects users from the stress and strain of using technology for long hours. In addition, make sure that the reading distance is always fixed and comfortable. For very large displays this can be best achieved with curved screens.



# Conclusion

Written by Graham Long,  
Vice President, Samsung Enterprise Business Team

From smart watches to desktop computers, there is no getting away from the fact that we are surrounded by digital technology now more than ever before. Our lives are increasingly becoming 'always on' and the way we work, now and in the future, is changing.

This report highlights that as office workers exponentially increase their digital consumption, their habits are shifting, and therefore require the right technology to effectively manage their levels of work. While the number of office workers using large screens or multi-screens is clearly on the increase, researchers believe that there is a better way for desk-based employees to alleviate the strain of increasing screen-time and fully immerse themselves in their work: the curved display.

Curved displays not only mean that fewer head and neck movements are required to read information, but by following the natural curve of the human eye, they offer a more private, comfortable, and immersive experience to help maintain productivity. Office workers can organise their on-screen information better, making it easier to read, which researchers believe will lead to a greater level of worker satisfaction. So there's no better time to change and be ahead of the curve.



#### About Graham Long

Graham Long is Vice President of Samsung's Enterprise Business Team for the United Kingdom and Ireland. Graham is accountable for driving the success of Samsung's business products and solutions across retail, hospitality, finance, manufacturing, education, transport and healthcare. Graham manages a B2B product portfolio that includes mobile devices, security software, print solutions, desktop and commercial displays, air conditioning, wireless networks and SSD/ODDs.



#### About Stephen Westland

Stephen Westland is Professor of Colour Science in the School of Design at the University of Leeds (UK). With over 30 years of experience in colour imaging science he has published over 150 peer-reviewed papers, books and book chapters in the areas of colour imaging, colour science, and design. He is an active member of the Society of Imaging Science and Technology (USA) and co-chaired the Society's prestigious Color Imaging Conference in Los Angeles (2012). He was the recipient of the Davies Medal (2008) from the Royal Photographic Society (London) for his research into digital colour imaging.



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