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THE STRESS OF STREAMING DELAYS

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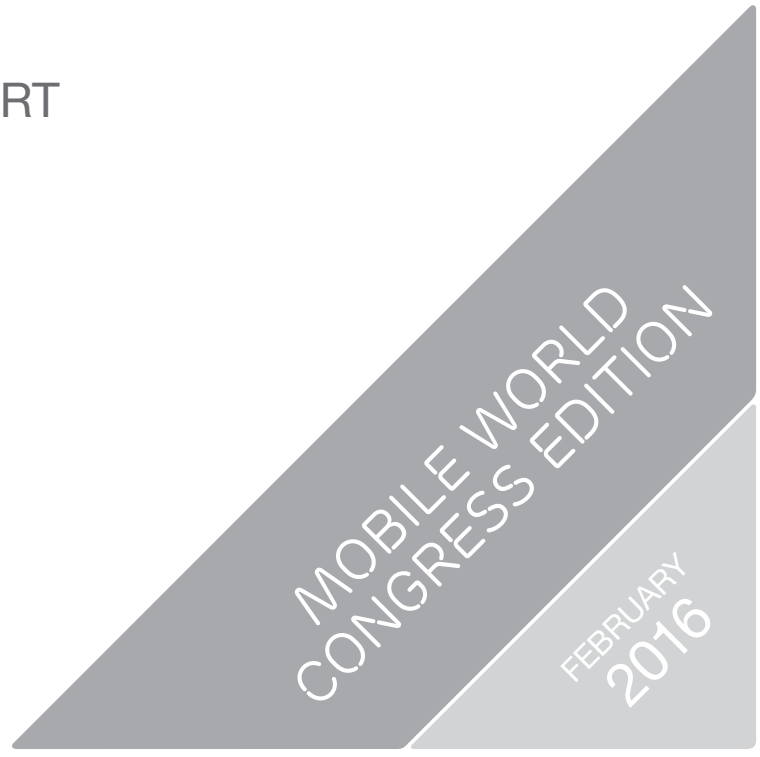


THE STRESS OF STREAMING DELAYS

When consumers turn to their smartphones to find information quickly, they want an instantaneous response. A neuroscience study measuring user reactions to network performance has shown that delays in loading web pages and videos while completing tasks under time constraints are taxing – heart rate and stress levels increase. Both time-to-content and additional delays due to re-buffering lead to decreases in Net Promoter Scores (NPS). On the other hand, smooth browsing and video streaming lead to increased NPS for a mobile broadband service provider

Forming a more objective picture of user experience

Who?

Ericsson ConsumerLab engaged a neuroscience consultancy[1] to study user reactions to varied levels of network performance during a smartphone experience.

What was measured?

Brain activity, eye movements, and pulse were recorded while subjects completed various tasks by browsing the web and watching video clips. Changes in the perception of mobile network operators and content providers before and after network usage experiences were also measured.

How?

Participants were exposed to a high degree of delays, a medium degree of delays or no delays at all while they completed tasks, allowing a detailed analysis of how the duration and extent of delays affected emotional engagement and stress.

Why?

The results help to uncover how variations in network performance can impact consumer experience and ultimately affect brand equity.

The study revealed that delays in loading web pages and videos lead to increased heart rates and stress levels. On average, single delays resulted in a 38 percent increase in heart rate.

As for stress, participants already exhibited an increase from pre-task baseline levels, which was attributed to the pressure of having to complete tasks within a set time limit. With the introduction of delays, the stress levels then increased further.

Heart rate increases 38% with mobile content delays

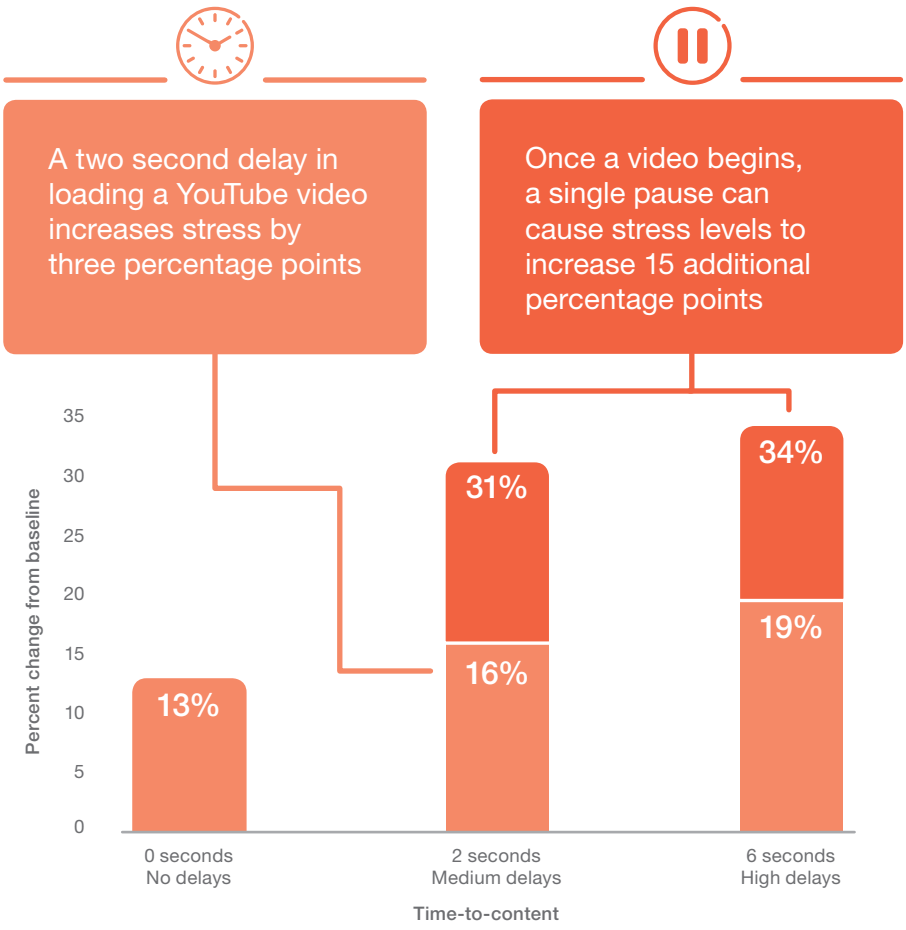
[1] Copenhagen-based Neurons Inc.

Stress and streaming

Participants' responses to initial load time (time-to-content) and pauses due to re-buffering while watching videos were assessed by measuring cognitive load[2], an indicator of stress. With no delays, stress levels during the video tasks averaged 13 percent above the pre-task baseline. A medium delay of 2 seconds when loading videos led to average stress levels to go from 13 percent to 16 percent above the baseline. Once a video started to stream, a pause due to re-buffering caused stress levels to further increase by 15 percentage points. With high time-to-content delays of 6 seconds, half of the participants exhibited a 19 percent increase relative to baseline levels while the other half exhibited signs of resignation – their eye movements indicated distraction and stress levels dropped.

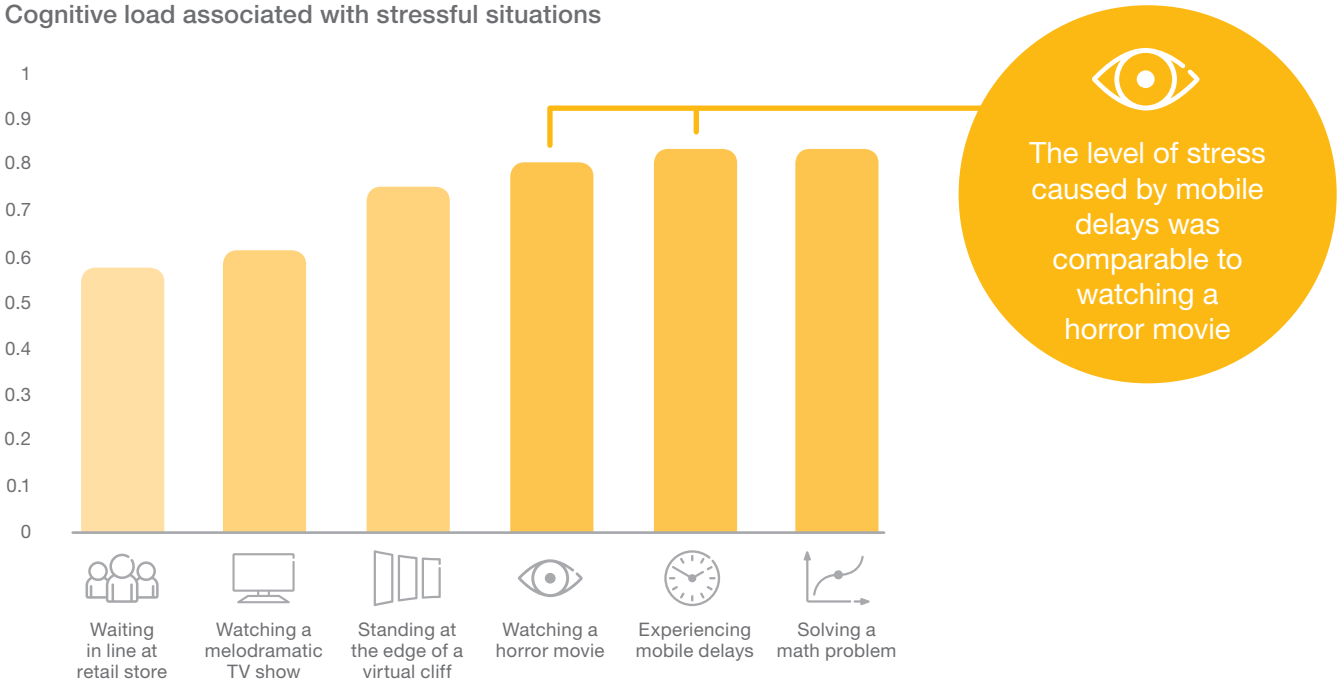
To put the findings of this study in context, the measured levels of stress can be compared to other situations in everyday life. For example, the stress response to delays was similar to that of watching a horror movie or solving a mathematical problem and greater than waiting in a check-out line at the grocery store.

Average change in stress when facing streaming video delays



Source: Ericsson ConsumerLab neuro research, 2015
Base: Smartphone users aged 18–52 from Copenhagen, Denmark

Cognitive load associated with stressful situations



Source: Ericsson ConsumerLab, Neurons Inc., 2015

[2] Cognitive load is described on page 7

Patience is a virtue, but not for users

Participants that experienced no performance delays demonstrated a net increase in brand engagement, measured using a motivation index.[3] This suggests that they became happier with their mobile service provider. In comparison, the groups subjected to medium and high delays displayed neutral and even negative brand engagement.

Interestingly, medium delays resulted in a double negative effect on the service provider, as they not only decreased brand engagement with consumers but also caused an increase in engagement with competitor brands. Meanwhile, users who faced high delays responded negatively to all mobile service provider brands. This surprising finding suggests that major delays can even cause the whole industry to suffer a loss of brand equity.

Similar effects were observed when looking at changes in NPS[4], which were calculated using data gathered from a survey administered to participants both before and after they experienced delays. On a scale of 0–10, NPS fell by 4 and 2.5 points for those who faced medium and high delays, respectively.

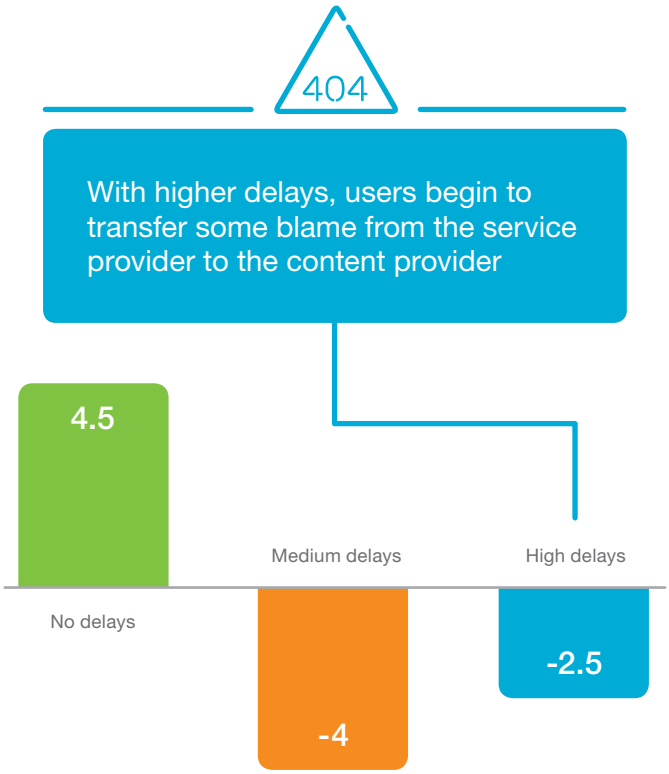
-4 POINTS

Moderate time-to-content and re-buffering delays lead to a four point drop in NPS on average

The lower drop in NPS for those subjected to high delays was attributed to users transferring some of the blame to the content provider.

For those who faced no delays while completing the assigned tasks under time pressure, NPS increased significantly for their own service provider (4.5 points), suggesting that offering customers good network performance when it is needed is a key to improving brand equity.

Change in NPS score for mobile service providers



Source: Ericsson ConsumerLab neuro research, 2015
Base: Smartphone users aged 18–52 from Copenhagen, Denmark

[3] Motivation index is described on page 7
[4] NPS is a quantification of the likelihood that a customer would recommend a company's product or service. Its customers are scored on a scale of 0–10 and then divided into three categories:
> 9–10 – promoters: loyal enthusiasts who keep buying from the operator and referring others, fueling growth
> 7–8 – passives: satisfied but unenthusiastic customers who are vulnerable to competitive offers
> 0–6 – detractors: unhappy customers who can damage your brand and impede growth through negative word of mouth
To calculate an operator's NPS, the percentage of detractors is subtracted from the percentage of promoters. NPS scores analyzed here should be taken as indicative since the study did not encompass a large enough sample of users to provide statistical significance

Methodology: Measuring user response to network performance

A total of 30 volunteers aged 18–52 in Copenhagen were randomly selected from an existing panel of online users. All of the participants were mobile broadband subscribers that regularly browsed and streamed video on their smartphones.

The participants were fitted with pulse meters and eye-tracking glasses, as well as EEG electrode headsets to record brain activity. They were each issued an Android smartphone, and asked to complete 18 tasks within a 20 minute time period. The smartphones were programmed to appear as if they were using a mobile broadband network connection. The tasks consisted of navigating through news articles on web pages and YouTube videos which were set up with a range of pre-determined delays.

The subjects were split into 3 groups of 10, and each group was exposed to a different level of network performance while attempting to complete the mobile web and video tasks. None of the respondents knew they would be subjected to pre-determined delays.

- Group 1 (no delays)
- Group 2 (medium delays): 4–6 seconds of web page load time; 2 seconds of video load time and 3 video pauses of 3 seconds due to buffering events
- Group 3 (high delays): 10–14 seconds in web page loading; 6 seconds of video load time and 3 video pauses of 3 seconds due to buffering events

To measure consumers' unconscious responses to brands, the participants were shown a series of images including logos of mobile operators and content providers. Participants were also asked whether they were willing to recommend their mobile broadband service provider. The tests were administered both before and after the web and video tasks in order to measure changes in responses.

Measuring consumers' unconscious response to brands opens up insights into how network performance impacts brand perception

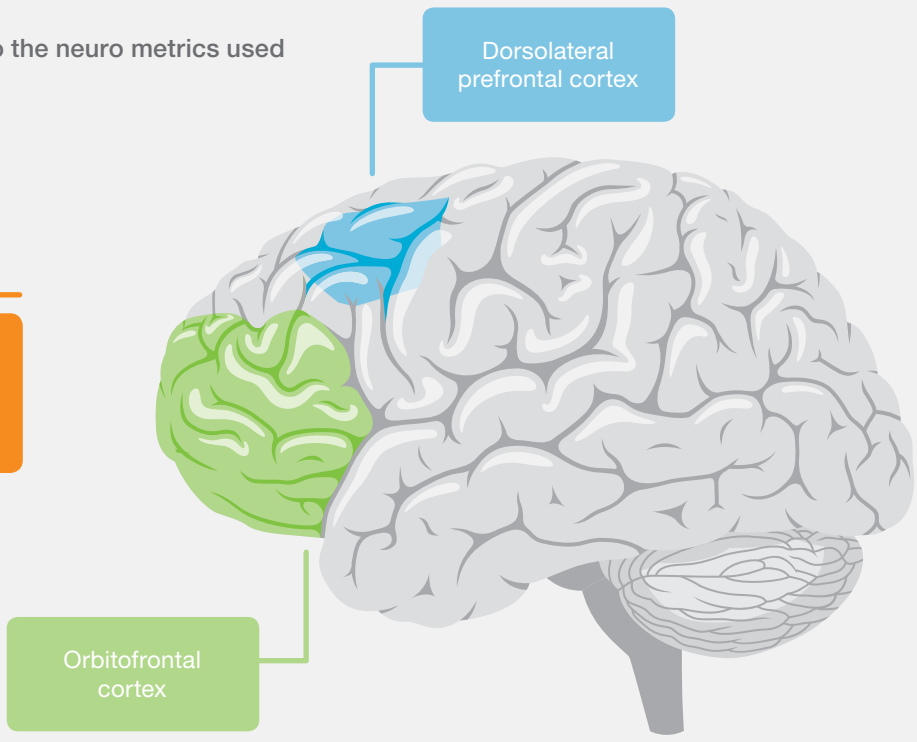
The study was designed around three types of measurements: electrical activity in the brain, eye movements, and pulse. Brain activity captured with EEG headsets was used to assess the two neuro metrics described below.

Cognitive load is a score that measures the amount of information that a person is processing and "holding active" in the dorsolateral prefrontal cortex (DL-PFC) part of the brain. A high cognitive load is part of a stress response. A score up to 0.7 is acceptable and considered normal for proper information processing. However, scores over 0.8 are considered very high and stressful.

The **motivation index** is a calculation of the relative activation of the left versus right orbitofrontal cortex, and is closely linked to approach-avoidance behaviors. Studies have demonstrated that a stronger left than right activation is related to approach motivation and action, while a stronger right than left activation is indicative of avoidance motivation and behaviors. The phenomenon has been studied using EEG, functional magnetic resonance imaging (fMRI) and patient studies, and is considered a simple but robust phenomenon. It was used in this study by having the participants focus on a screen where brand logos were shown for a few seconds at a time while motivation response was measured with EEG.

Functional areas of the brain relating to the neuro metrics used

EEG electrode headsets were used to record brain activity



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