Peripheral Computing During Presentations: Perspectives on Costs and Preferences

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ABSTRACT

Despite the common use of mobile computing devices to communicate and access information, the effects of peripheral computing tasks on people's attention is not well understood. Studies that have identified consequences of multitasking in diverse domains have largely focused on influences on productivity. We have yet to understand perceptions and preferences regarding the use of computing devices for potentially extraneous tasks in settings such as presentations at seminars and colloquia. We explore costs and attitudes about the use of computing devices by people attending presentations. We find that audience members who use devices believe that they are missing content being presented and are concerned about social costs. Other attendees report being less offended by multitasking around them than the device users may realize.

Author Keywords

Attention, multitasking, presentation, laptops

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g., HCI): Miscellaneous.

General Terms

Experimentation, measurement.

INTRODUCTION

The pervasive use of mobile computing devices such as laptops, tablets, and smartphones is a feature of the modern-day landscape. These devices enable users to tap into a tremendous amount of information and to communicate virtually anywhere and anytime. With the benefits come costs. Such costs are revealed in a stream of media reports about accidents or operational aberrations linked to the extraneous use of mobile devices in situations such as driving cars and trains, piloting commercial airplanes, and even during real-time newscasts [8].

Whether the costs of peripheral computing outweigh the benefits will depend on the individual and the situation. Much research has focused on identifying costs of

multitasking in domains such as desktop computing and driving, where division of attention may be common or even unavoidable [1, 6]. Our work examines the extent to which people are aware of such costs when they multitask in a context typically associated with a single focus of attention. The multitaskers we studied believe that they are paying a price, yet engage in peripheral activities. We also find that concerns that they report about how their behavior is perceived may not be well founded.

Our study focuses on multitasking during colloquium-style presentations. For those attending, computing devices can enhance a presentation when used as an auxiliary source of information or for note-taking, but they are often used for unrelated tasks such as checking and sending email or text messages. In meetings and classroom lectures where attention is mandatory, device use is viewed with caution for these reasons [5]. However, for the type of presentations considered in this paper, attendance and attention is voluntary. In these settings, access to peripheral computing may raise the likelihood that people will attend, and thus get some exposure to content they would otherwise miss entirely. Beyond understanding the effects of device use, we are interested in whether speakers or other listeners consider device use impolite in these settings.

We studied perceptions of audience attitudes and behavior in colloquium-style presentations at Microsoft Research. These widely-publicized talks are open to all employees. Motives for attending vary. In contrast to course lectures, speakers are not responsible for ensuring that material is learned. In finding more awareness of the costs of peripheral computing and more acceptance of device usage than expected, we identify challenges in managing attention where technology is ubiquitous.

PILOT STUDY OF SELF AWARENESS OF INATTENTION

As five colloquium-style presentations in Microsoft Research lecture rooms were concluding, we distributed a brief paper questionnaire to audience members in the room (averaging 35; others watch live video feeds). To avoid influencing the responses, we did not describe the specific purpose of the survey. An early question was "Which of these best describes your experience today?" followed by the choices "I picked up all of the lecture information that would be useful to me," "I picked up most of the lecture information that would be useful to me," and "I missed significant information." Several unrelated questions

	Reported getting all useful information	Reported missing useful information
Had laptop	19 (41%)	27 (59%)
No laptop	72 (57%)	54 (43%)

Table 1. Breakdown of useful information reported as learned across attendees with and without device

followed. The final question was the only one to mention technology: "Which of these items did you have with you in the lecture?" followed by the choices Tablet, Laptop, Phone, Pen, and Paper. We did not ask whether a device was used for extraneous computing, to avoid any hint of the study purpose that could bias responses.

172 audience members completed the questionnaire. 46 had brought laptops with them. We observed the audiences, noting that most laptop carriers used them during the lectures. Only a few people used phones during the lectures.

Laptop possessors were more likely to report that they missed useful information (Table 1). The difference is significant, with one-tailed LOR of 0.64, $z=1.83$, $p=.034$. Not all laptop possessors used them; the effect is probably stronger among people who do use them.

It is likely that a significant portion of laptop users who reported that they missed useful information linked their peripheral device use to the presumed loss of content. That such participants multitask is evidence that they perceive tangible benefits in device use that outweigh the cost of possibly losing useful information. However, in a setting where the expected norm is paying attention to the speaker, device usage could be influenced by perceptions of social costs, such as incurring the disapproval of speakers or other attendees. Our next study examined this issue through direct data collection.

STUDY OF PERCEIVED COSTS AND BENEFITS OF MULTITASKING DURING LECTURES

Understanding why audience members choose to use devices despite potential costs could lead to better policies regarding multitasking or to changes in presentation styles. Also, mismatches in speaker and audience perceptions could presage changes that will align perceptions. Towards this goal, we investigated in detail how speakers and audience members (device users and non-users) reacted to multitasking, posing these questions:

1. What are speakers' assessments of costs and benefits of the use of devices by members of the audience?

2. What do audience members believe about the influence of multitasking on speakers and others in the audience?

Methodology

Surveys were administered to speakers and their audiences. Survey questions covered the prevalence and patterns of device usage during lectures, perceived social impact, benefits and distraction costs, and strategies to manage attention. All participants received a small gratuity.

Participants

The speaker survey was administered to external speakers, including university professors and industry researchers, and to members of our research organization who frequently deliver lectures to academic and industry audiences. External speakers were contacted through their hosts and handed a survey before or after their talk. The same survey was made available online to employees with lecturing experience. The audience survey was sent to employees via a lecture announcement mailing list.

Survey Results

The speaker survey received 62 responses out of 250 survey recipients (11 external, 51 internal). The audience survey drew 112 responses from a distribution list of about 1000.

Perceived prevalence of device usage

Only 16% of the speakers reported that they never or rarely noticed audience members using a device. About 75% estimated that over 10% of audience members used devices. Some speakers estimated device usage to be over 50%.

40% of audience members reported using laptops and 33% reported using smartphones during at least one in four of the lectures that they attend. The 60% who do not frequently use devices reported being somewhat distracted by people who do (67% for laptops, 42% for smartphones). 56% reported being distracted by laptop use only when it was conspicuous; 35% reported not being affected at all. For smartphones, 42% reported being affected only when conspicuous and 51% not at all.

Patterns of device usage by audience members

Only 24% of laptop users and 8% of smartphone users reported using devices solely for lecture-related tasks such as taking notes, looking up references, or communicating about the lecture. The rest reported unrelated content generation (writing or editing text, code, diagrams, etc.), communication, web access, awareness (checking status or incoming information), and the reading of content unrelated to a lecture. Over 80% reported using devices for awareness and communication 'occasionally,' 'often,' or 'always.' Half reported browsing the web for content unrelated to the presentation.

When do people turn to a device for tasks unrelated to the lecture? About 75% report often using a device when a lecture does not meet expectations. 5% reported always switching in this situation. Need, desire, and choice to multitask also arose when they were "interested only in parts of the lecture" (10% always, 65% often).

Benefits, Costs and Social Implications

Table 2 summarizes responses to questions on perceived costs and benefits on a Likert scale of 1 (strongly disagree) to 7 (strongly agree). We contrast responses of speakers to audience members for both laptops and smartphones.

There was wide agreement that laptop use can enhance presentations, although audience members were more positive about this than speakers. Speakers did not feel that smartphones could enhance the experience; audience members showed high variance on this issue. Both groups

		Speaker	Audience	P
Device use supplements lecture	Laptop	**4.65***	**5.48****	0.023
	Smartphone	**3.21****	3.34	0.755
	P	0.00	0.038	
Device use enables multitasking	Laptop	4.5	**5.00***	0.187
	Smartphone	3.97	**5.00***	0.006
	P	0.02	0.17	
Device use distracts from lecture	Laptop	**5.76****	3.76	0.001
	Smartphone	**5.62****	3.84	0.001
	P	0.27	0.025	
Multitasking is impolite		3.84	**5.48****	0.001
It is a part of today's world		**5.13 ****	**4.9****	0.39
Multitasking should be minimized at lectures		4.44	4.19	0.437

Table 2. Mean ratings of benefits, costs and social perception of device use (1=strongly disagree, 4=neutral, 7=strongly agree). p values across rows indicate difference between laptops and smart-phones, and down columns indicate difference between speaker and audience. Bold values significantly different from the neutral rating of 4; * indicates $p < 0.01$ and ** indicates $p < 0.001$.

agreed that laptops can help listeners multitask, but only audience members felt that smartphones can.

Speakers felt that laptops and smartphones distract their users. Audiences were more neutral. Close to 50% of device users asserted that despite missing some information while interacting with devices, the benefits of peripheral computing make such usage worthwhile (see Figure 1).

Audience members reported feeling that device usage could be disrespectful, but the speakers themselves tended to disagree (M = 3.84, where 4 is neutral). Device users who know that they are not fully attentive may feel somewhat disrespectful (or may feel that they should report that they feel this way): 62% of respondents who rated disrespect high (6 or 7 on the 7-point scale) also reported high laptop usage, and 71% reported heavy smartphone use in lectures.

Speakers cannot be sure what a device is used for, which may deter them from attributing disrespect. One wrote:

"It's hard to tell whether the device is used in a positive way (e.g., taking notes) or a negative way (e.g., distracted by IM)… I find that in general such use is for email/IM and not for enhancing the lecture experience, therefore high use equates to low interest and attention. A note taking participant is looking up at you frequently or while typing - an inattentive user is looking down and reading."

Speakers also realize that the ability to use a laptop could induce busy people to attend:

"There are many reasons to use a laptop that might be tied to the talk (taking notes or looking up a paper the talk reminded you about). Additionally, there are many demands on

everyone's time. Presumably if they are at my talk, they found it important enough to want to hear what I have to say while trying to balance that with other demands on their time."

This sentiment was echoed by audience members, who widely opined that banning devices would be detrimental: "I don't think things should be changed because I think the benefits of the work (and non-work which can be beneficial too) people do during lectures outweigh the loss of information resulting from less attention." Most reacted negatively to the idea of turning off wireless access during presentations.

However, some dissented, maintaining that paying attention should be the top priority of people in the room:

"I think people should be discouraged from coming to lectures if folks can't pay attention to what the speaker has to say. There is nothing worse than having someone doing other work and not paying attention to what is happening in the room. However, I wouldn't want to ban laptops as taking notes via laptop is important."

Others noted that device users could position themselves to minimize distracting the speaker or other audience members. Most accept that multitasking is a feature of our world and accept it when it is discrete.

We asked people whether they would feel more comfortable using devices if more people around them did. Most said that the behaviors of others did not influence them, but some felt that additional usage would increase social acceptability:

"…as that would be an indication of the cultural norms for that setting' and 'the more using their laptop, the more the perceived acceptance of using a laptop during a lecture.'

Some expressed concern about their image and felt that seeing others use devices reduces guilt about marginal behavior: "just because I won't be as obvious" and "because there is a safety in numbers and for myself, I feel device usage is slightly bad behavior." The overall tone reflected the survey finding that audiences feel that device use could create a poor perception of the audience by the speaker (M = 5.1), even though most speakers did not report such feelings.

Strategies for managing attention
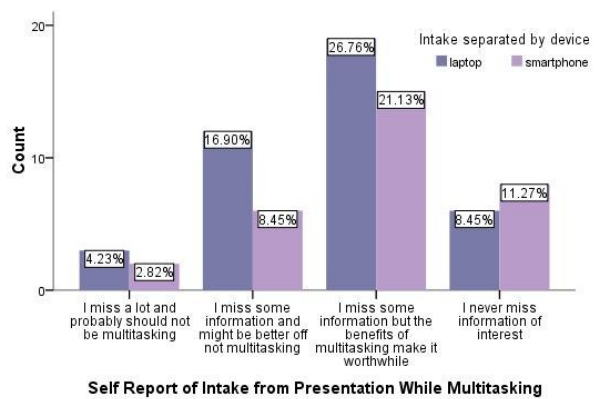74% of laptop users and 71% of smartphone users reported

Figure 1. Audience perceptions of balance between intake of information from presentation and multitasking on device. The *y* axis shows count of respondents agreeing with the statement on the *x* axis (% of total respondents are on each bar).

mostly focusing on the talk and occasionally switching to a device when other tasks demand attention. As one user said:

> "While my use of devices at lecture tends to be limited, I occasionally need to: - look at the slides directly on my laptop (maybe i am a slide ahead or behind or it is hard to see the screen from my seat) - keep an eye for high priority email that may come my way. - take a couple of notes (as opposed to typing every word the speaker says) - look up some related information online There may be rare occasion where someone may show up at a talk and find out it is quite different then what they expected. While in general it would be best to leave at that point, there may be occasion where it would create too much disruption and using your device discretely is a better way to go."

Device users also reported a desire to demonstrate to speakers that they are paying attention. Frequent eye contact, asking questions, and putting away a device were commonly cited ways to show interest and respect.

67% of speakers considered device use an indicator of loss of interest in their lecture, but only 23% reported acting on it in real time. 12% reported tailoring lectures in advance to take audience multitasking into account. One commented:

> "When I seem to be losing the audience for any reason, I modify my delivery. Lots of heads down over laptops with users appearing to be reading rather than mostly looking up while writing means that they have drifted off into email or web pages and I need to pull them back in."

Reservations about modifying lectures to incorporate or inhibit device usage include the ambiguity of use, which could be for taking notes, looking up related material and references, or tweeting about the talk. In the colloquium setting we studied, most speakers felt that it was up to audience members to decide how to focus their attention.

DISCUSSION

Related studies report on costs [2, 5] and benefits [3, 4] of using laptops in classroom settings, where students are expected to devote full attention. Campbell and Pargas [3] note that laptop use in classroom settings can be "beneficial and integral" to learning and identify opportunities for educators to adapt lesson plans to exploit devices. Hembrooke and Gay [5] highlight disruptive effects of laptop use on learning, and attribute reduced performance to distractions from applications that divert attention from lectures. Barkhuus [2] found polarized uses of laptops in classrooms: both as a supplement to a lecture and for multitasking on unrelated tasks such as surfing the web, email, and working on other assignments. For business meetings, another setting where a single focus of attention is often expected, Newman [7] studied sources of disruption and found that laptop users often drift to less relevant activities, have difficulty reengaging in the conversation, and when they do may raise topics that are no longer relevant.

In the setting we studied, speakers do not have formal accountability for teaching. Listeners have discretion about attending and paying attention. Less obligated to attend to the lecture, our participants may assume greater flexibility to focus on peripheral tasks as long as their behavior is not socially disruptive. The fact that attendees used computers during lectures for which they felt they missed potentially useful information and where they expressed concern about speaker attitudes suggests that behavioral changes in this setting may be difficult to enforce through persuasion or policy. Instead, speakers could engage a dual-tasking audience by such means as walking through the audience while speaking, mentioning people who are present by name, and creating tasks for them during the lecture. This is an even more salient consideration in settings where speakers have greater responsibility for audience learning.

We focused on perceptions of distraction and social costs of device usage. Future research complementing these studies could explore device usage for parallel social interactions related to the lecture. Also, detailed in-situ studies of attention-switching and its effects on information intake, coupled with assessed participant interest in the lecture, could provide insight into behaviors and outcomes.

CONCLUSION

We identified attitudes and behaviors related to the use of computing devices during presentations. Our findings suggest that multitasking is likely to continue and become more acceptable in practice. To succeed in the colloquium lecture context we studied, speakers should consider adjusting presentations to a world in which audiences are poised and ready to divide attention with other tasks and interests, made available through connected computing devices.

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