Field Studies of Work and Co-design

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This workshop will explore the relation between studies of how people work with existing or prototype technologies and the design of innovative, well-integrated new technologies. The workshop is informed both by our extensive experience in doing work research and by our recent efforts to bring that research to bear on the cooperative design of new technologies with intended end-users.

Our experience in doing work research shows that to get access to work in its detail requires going beyond traditional methods for understanding user requirements (e.g. surveys, interviews and focus groups). First, we have found that when it comes to the *details* of how work actually gets done, people are qualified primarily to talk about their own work, not that of others. This means that we cannot simply talk with "decision makers" or information systems managers, but must find those who actually do the kinds of work in which we are interested as designers. This in turn requires refining our understanding of the work site and its operations through repeated, increasingly informed field visits.

Moreover, we have found that even when we locate the relevant people there are limits to what people can *tell* us about what they do. The things in which we may be most interested may be the most routine, and therefore the most unremarkable, to the people who do them. That they are unremarkable means, quite literally, that people would never think of mentioning them. Talking with people about their work in the environments in which the work is actually done, preferably while it is being done, combined with observation and recording of work in progress, gives us access to the work in a way that goes beyond its general description.

Recently we have been developing strategies for integrating our field studies of work with the design and development of new technologies. This involves bringing technology-relevant artifacts into the work setting in order not only to assess the adequacy of early design concepts, but to uncover further details of the work. In doing this, the direction and scope of our studies of work are both constrained and extended by the requirements of the design effort.

In this workshop we will present materials (e.g. video tapes and design artifacts) from a recent work-oriented design project to illustrate how we are attempting to move from field studies of work to design and back, as well as to highlight some of the problems that we face in aligning the interests of field site participants, technology designers and developers, and work practice analysts. The mateials we present will be designed not only to convey our own experiences, but to trigger discussion of interests and concerns brought to the workshop by other participants.

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Managing the Stresses of Participatory Design

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Keywords: Role Stress; Occupational Stress; Technostress; User involvement; I/S Development; Design Paradigms

The proposition that user participation is a critical antecedent of effective information systems design has been supported by a large number of studies and has become established wisdom in many circles. Yet effective and meaningful involvement in the design process by those whose jobs and work lives are likely to be most heavily affected by the system still tends to be the exception rather than the rule. The premise underlying this workshop is that in spite of the many documented benefits of participatory design, the stresses encountered by the diverse array of stakeholders of the design process are often substantial. Many of the well-known phenomena which have characteristically been associated with information systems failure can be understood as ineffective responses to the stresses associated with participatory design. The avoidance of commitment on the part of the users, for example, can often be seen as an attempt to avoid exposure to the stresses of responsibility without control. The retreat into rigid rules and technical jargon on the part of developers, by the same token, can be seen as an attempt to avoid the stresses associated with the unpredictability of human interactions. In essence, achieving effective participatory design means effectively managing stress.

Recent press reports indicate significant and increasing levels of stress among information systems designers, managers, and users, and thus appear to substantiate the existence of considerable stress associated with the development and use of computer-based systems. An exploration of the issues surrounding this phenomenon is the central purpose of this workshop, which will address three central questions:

1) What are the characteristics of information systems design that make the process so inherently stressful? Sample characteristics include high levels of uncertainty regarding project objectives, large and unpredictable impacts on the quality of work life, and significant role ambiguity for both technical and non-technical players.

2) In what ways do the various players experience and respond to stress in the design process? Examples include withdrawal of contact, formalization of communications, and unilateral attempts to achieve control over the design process.

3) What forms of intervention are available to the various stakeholders of the design process? These include *structural* interventions, such as role/task assignment, as well as *process* interventions, aimed at improving self-awareness and mutual understanding between stakeholders.

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The workshop is intended for all stakeholders of the design process, including end users, user managers, programmers, analysts, consultants, and other technical specialists. Participants will be invited to share some of their own experiences and concerns regarding the development and/or impacts of computer-based systems in the workplace. Deeper understanding of the structural and process dynamics of stress buildup in systems design is the primary goal of the workshop. This in turn creates the potential for better working relationships and more favorable individual and organizational outcomes.

A presentation by workshop facilitators will include a framework for organizing the above issues, and will draw upon research from several fields including organizational behavior, sociotechnical design, occupational stress, and management information systems, as well as upon fieldwork conducted in 12 organizations over the past seven years.

"Intentional Tension": Work Systems Design as an Approach to Radical Change

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This workshop will begin with a panel discussion by an interdisciplinary team that has been involved in the redesign of a work process for the past year. After a 45 minute panel, we will break into small groups and conduct a workshop on Work Systems Design.

Key Issues

The panel discussion will consider the radical redesign of a work system, T.1 Provisioning, at NYNEX Corporation. This work system had evolved as part of a regulated monopoly business but was under serious competitive pressure as a result of significant changes in both technology and the regulatory environment. The redesign effort was an attempt to break cultural norms and think creatively concerning embedded assumptions about work, people, and technology.

The T.1 Provisioning project addressed a work process that, for a single order, required involvement by an average of 41 people who were employees of five different Assistant Vice Presidential organizations. The project was geared to radically change this work process. We faced a set of assumptions, commonly held in today's corporate and industrial environment, about organizational change:

- that work is a "rational" process that can be understood solely through discrete task analysis
- that design about change should be solely in the hands of managers making decisions about their work units
- that ideas for improvement can be abstracted (i.e. are not essentially situated)
- that technology should be used primarily to effect change through automation.

We designed the T.1 Provisioning project to challenge these assumptions. It was "action research," an effort to develop new ways of thinking about effecting change in the context of solving an actual acute business problem.

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The underlying principles of the effort were:

- participative design: empowerment by management of those closest to the work to design changes to that work
- radical redesign: a search for radical vs. incremental improvement
- change management: implementation of changes by those who designed the work and would work in the new work system
- social analysis: discovering the ways in which informal social work practices are crucial to getting work accomplished and using it in designing the work system
- co-production: collaboration of workers and senior management in development and implementation of the new work system, and
- "organization-friendly system": design of technology to support the work system following design of the work system itself.

The approach employed some traditional aspects of socio-technical design. It was structured as three teams of people (1) a "core" or "design" team composed of workers in various departments encompassed by the work process; (2) a team of "facilitators" composed of a knowledge engineer, an anthropologist, a computer scientist, a quality specialist, and a veteran of 30 years in telephone company operations; and (3) a "steering committee," with a Vice President as "champion," and each of the general managers responsible for a piece of the operation.

Our approach toward Work Systems Design was developed with "intentional tension," that is, with advance knowledge that members of the Facilitating Team, Design Team and Steering Committee would be in conflict about what had to be done to move toward an effective redesign. We believe that "intentional tension" of multiple perspectives produces creative thinking and action, and establishes a powerful learning environment for producing change.

Workshop

This workshop will lead the participants through a mini-redesign process. We will ask all participants to develop both a plan of action for undertaking the redesign of a work process, and develop a list of people and their roles in such a redesign. We will facilitate four small groups as they develop a plan. We will also provide some guidelines using a list of crucial issues in works systems design. All participants should come prepared with a work process which they think should be redesigned. Four to five of these will be selected for redesign. The workshop will be limited to 20 people.

Workshop and Panel Members

Jim Euchner (NYNEX Science & Technology, Director, Expert Systems Laboratory)

Patricia Sachs (NYNEX Science & Technology, anthropologist)

Beth Graham (NYNEX Science & Technology, knowledge engineer)

David Torok (NYNEX Science & Technology, computer scientist)

Paul Kowalski (NYNEX Science & Technology, consultant with 30 years experience in New York Telephone)

Michael Picciano (New York Telephone, General Manager)

Paul Lippertshauser (New York Telephone, switching equipment technician)

The "Conducivity Game": Developing worker's skills for self-redesign of tasks

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Summary

This game tests a new methodology for worklife change based on new combinations of worker's skills in production settings. Thus it is a design game for organizational structures (i.e., not a design game for products). It is participatory in the sense that the workers, engineers, managers etc. whose activities are affected by the organizational design are the ones who participate in the design process. The method is grounded in the existing participatory methods of worklife change which have evolved in Scandinavia in the last several decades - "action research", "democratic dialogue methods", "participatory design", etc. To this base, the Conducivity Game method adds: a) a visual association tool, b). expanded socio-technical elements, and c). an attempt to make future organizational arrangements concrete.

This method was originally developed in the NordNet project (Karasek, 1992) in Sweden to develop practical tools for organizational change in the context of small subcontracting networks in the manufacturing industry. The primary idea was that organizational changes which increase worker skill could be linked to organizational changes which increase the innovativeness and flexibility of production processes. This dual focus is intended to both capture the humane necessity of improved worker wellbeing and economic imperative of productivity - albiet, productivity in a humane, skill-based form. Another basic goal was to increase the speed of the participatory work redesign process: such process are often delayed by insufficent "vocabularies" to deal with organizational change or insufficient tools to develop overviews of the work process.

Theoretically, the method builds on the "conducivity" concept (Karasek, 1992; Karasek and Theorell, 1990): a skill-based model of production and distribution which emphasizes new combinations of worker skills inside the workplace and and new worker/customer interactions outside the workplace. One forerunner of the Conducivity Game is the "democratic dialogue' perspectives emerging out of the Swedish LOM program (Gustavsen, 1990), which in turn, have been intellectually anchored in Habermas's (1984) conception of "communicative rationality." The goal of the "conducivity game" is to combine elements of the new "communicative" rationality practice above with elements of technical-economic rationality which remain relevant for many organizational roles. This joint goal has lead to the development of a new type of communication tool: a group-based, visual communication process which interfaces with verbal dialogue processes.

The Game also attempts to develop a "rapidly applicable" method to reach shared images of future work structures (what could be, instead of what is). Actual job change would follow as the next step).

Conducivity Game elements and process

The Conducivity Game process involves developing comphrehensive images of coworker's operations. New language elements are built which, "verbalize" social and technical relations in the work process, and constraints on work redesign - by means of visual tools. During the game participants identify new skill combinations between themselves which could satisfy customer demand in new ways ("conducivity' simulation). The game also attempts to developing a democratic participatory judgement process for the technical-economic feasibility of such new ideas. It attempts to integrate democratic dialogue with concrete technical, economic, and customer-relevant information related to a particular production process. Other examples of such games are found in Ehn's Utopia project (1988), and and in an expanding range of visualization tools for physical work environment change. The following game elements are used:

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a. The Person: in the Conducivity Game the central position is occupied by persons or organizations: worker, engineers and managers (i.e. growth-capable entities) - rather than having products (i.e. non-developing material objects) in the central position, as in the conventional economic model.

b. Skill and capabilities. The person skills relative to the work groups or relative to some production goal (a service goal is, of course, also relevant) must be centrally displayed.

c. Product (or client) - the focus of labor application - that which the customer is to appreciate.

d. Primary Technology (machines),

e. Material Flows

f. Information Flows.

g. Group Status.

h. Inter-group Communication Roles.

Conducivity Game process

The beginning of the game involves building a "current situation" picture of how the production process works at the present time, with all communication flows and product flows illuminated (this process takes about one hour). Employees, technicians, managers jointly decide on one product to use for the game.

On the basis of its "current situation" picture, each team is asked to imagine how the production process could change to produce new combinations of employee skills and capabilities. There can be several goals for these changes: to solve existing known problems, to find a new solutions which use underutilized skills - or generate new skills; to reduce unnecessary supervision; or to develop a new product that solves new aspects of the users needs. This is the "creative" stage where the new images of the work process are developed, jointly assessed and validated. Existing company conflicts clearly surfaces at this point as resistance to new ideas - in a very concrete way.

An important question is what kind of learning occurs in the game process. Ehn (1988) discusses "design games' as learning processes. Obviously, there is no learning in the simple sense of task learning - workers do no learn to become better welders by playing the game. However, we feel that there is definitely system-level learning occuring in the conducivity game. Workers begin to develop vocabulary elements for coordination activities, managers begin to understand their own organization decision structures.

The Workshop

The workshop will:

A. Discuss backround theories

B. Demonstrate the game elements

C. Play the game in one context

D. Host a group discussions about how such processes might be used in the Conference Participant's work settings.

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A Paradigm Shift to Customer Focus

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Abstract

Traditionally, product definition and development has been centered around business fundamentals such as time to market and return on investment. It is becoming increasing clear that matching customer needs with technology is the more important marketing differentiation. This workshop addresses the topic relevant to this shift in product design perspective and purpose. We will first focus on the foundations of a paradigm shift from economic-centered to a pro-active, *Customer Focused* design philosophy. From this we will offer examples of organization, resource management, and other structures that will help managers and professionals build on this foundation. This includes advancing user-centered design in the product development cycle, setting user-centered objectives based on market conditions, and applying techniques to ensure success. During the course, students will use development scenarios to learn practical techniques in cooperative design and be exposed to the many different ways that customers have creative influence over the definition and design of products.

Key Words

Paradigm shift, user-centered, customer focused, techniques.

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Introduction

In the past, most product development teams got their ideas for new products, features, enhancements and implementations from marketing sales calls, responding to custom complaints and what the team thinks is a *nifty technology* to build. In today's more sophisticated market, that is often times not enough.

Development teams today need to be able to build products that satisfy specific user/customer needs in a timely, cost-effective method. This is a *pro-active* approach that is also responsive to customers, their world, their business and their needs.

To take this *pro-active* approach, development teams need to go through a *paradigm shift* to become customer/user focused. That means making every interaction the team has with the customer/user a learning experience about how to build the product better. That also means seeking out the customers/users as the source for answers to many design and development decisions.

Most teams would react to this concept with:

- That would take too much time
- We don't have the resources
- That's the job of our marketing department
- We've talked to customers before and I don't see that it has done any good for....

What Is A Customer Contact?

In this workshop we will describe what it is like to have taken this shift and how, once past the shift, this new approach can improve many of the ongoing customer interac-

tions. Customer interactions should benefit not only the customers, and their knowledge of our product, but also the product team and their knowledge of the customer. We will describe this receptive/learning way of doing business.

Significant Customer Contacts

Next, we will discuss how there is no text book, cookbook, or checksheet answer to understanding the customer. In order for a design team to develop and learn in a timely, cost-effective, resource-effective manner, the team needs to pick and choose to creatively develop the customer interactive data collection activities that *make sense* for their specific design needs.

How Do I (Case Studies)?

We will describe, using case study examples, many different techniques leveraged from many different philosophies that help teams learn about some portion of their customer base. We will also discuss creative/novel approaches to interacting with customers. The students in this workshop will be highly encouraged to join in and share their ideas at this point.

Applying It All

Finally, the students will be introduced to some decision tools that are used to help determine which activities to use in different situations. The students will then have a chance to practice by developing a plan for collecting data about customers throughout the development of a project, using as many creative ways of interacting with the customers as makes sense for their situation.

Participatory Design Research in the Product Development Process

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Abstract

The product development process will be described using work-in-process slides from a product recently introduced to the marketplace. Then, three participatory exercises relevant to early stages in the product development process will be tried by all workshop participants.

Key Words

- participation
- design research
- product development
- discovery research
- converging operations
- visualization
- projective techniques
- visual artifact

A. The Product Development Process

In its simplest form, the product development process can be characterized by three overlapping types of activity (see Figure 1.0). This process will be explained and demonstrated through a description of an actual project: the development of a new kind of lunchbox for school-age children. A key element to be demonstrated is *converging operations*: the use of two or more methods of investigation to approach any design question. Converging operations identifies overlapping information, i.e., information that is unbiased by research method.

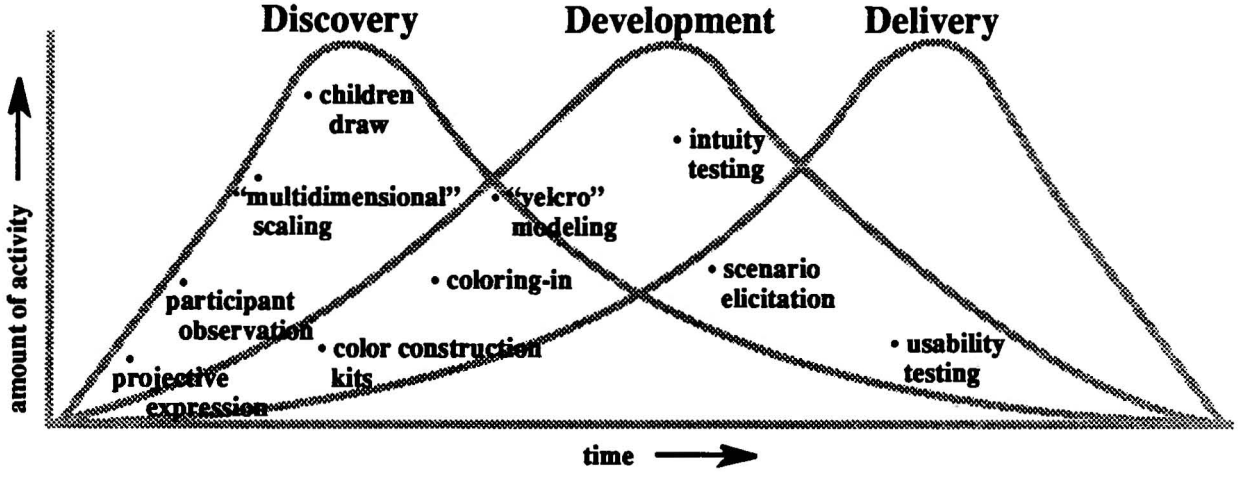

Figure 1.0 Participatory Methods in the Product Development Process [SM]

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B. Participatory Design Research: Three Exercises

A Hypothetical Product: The Hotel Clock Radio

We'll explore the design development process using a hypothetical product: a clock radio for hotel rooms. A critical feature of this clock is that it is designed for the first-time user. It will need to be so self-evident in its operation that one need not consider calling the front desk for a wake-up call.

Discovery Research Techniques

We'll begin the development process by getting hands-on experience. We will use three participatory methods that researchers at Fitch RS have found to be particularly useful during the discovery phase. These methods rely heavily on the use of visual stimuli and the spatial relationships between stimuli as potent sources of information. The *visualization* techniques will be supported by the simultaneous elicitation of talk-aloud protocols.

Procedure

Everyone will participate in the first exercise. Each of you will present your results, followed by a collaborative group analysis and interpretation.

Workshop participants will then choose to do either Exercise 2 or Exercise 3. Within each group "participants" and "enablers" will be selected. Participants will perform the exercises while enablers observe and make notes.

Results

Each exercise will result in several *visual artifacts*. These artifacts will be presented and discussed by all the workshop participants. Then we will summarize the results of the workshop in the form of design implications for the further development of the hotel clock radio.

Exercise 1: "Multidimensional Scaling" with Post-It Notes

Each participant (potential end-user) will be given a stack of post-it notes. Each note will have the name of a different "thing" on it. You'll be asked to arrange the notes on a large sheet of paper so that the "things" that are similar are close together and the things that are not similar are farther apart. You'll be asked to describe your organization of things to the other workshop participants when you are done.

Exercise 2: Projective Expression of Product Personality

Small groups of participants will work together to create collages from a preselected set of photographs, illustrations, phrases, words, etc. The enabler for each group will make notes as the participants speak aloud about their reasons for choosing specific pictures and words for their collages.

Exercise 2 represents one of a set of *projective techniques* which use research materials having ambiguity of meaning in order to tap into subconscious user motives. Projective techniques can be useful when supported by other techniques in the converging operations approach.

Exercise 3: "Velcro"-Modeling and Scenario Elicitation

Small groups of participants will work together with three-dimensional forms, components, and "controls," all made with Velcro to construct physical models of the hotel clock radio. You'll test the rough physical models by role-playing typical scenarios. Then you'll revise the physical models accordingly.

Translation in Participatory Design

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Abstract

This workshop will explore the problem of translation between the domains of users and of engineers. We will examine the role that can be played by human translators who have experience in both domains, and will present several case studies that demonstrate the translation of language, task models and user models. We invite attendees to describe case studies of their own to support or challenge the conclusions we draw from ours.

Keywords

Translation, case studies, workplace mechanization, metaphor.

The Translation Problem

We have been asking software engineers of our acquaintance to tell us how they design software for an unfamiliar domain. Here is a typical answer, which will not surprise you: "Either I have to learn enough about what the users do to understand it, or the users have to learn enough about computers to be able to tell me what they want."

How can users participate fully and effectively in design when they do not understand the technology? How can engineers produce a usable product (not just usable software, but software with an appropriate impact on the workplace) without understanding the user's domain?

The process of participatory design requires a deep and effective level of communication between individuals with different kinds of training, different goals, and consequently different languages. Users cannot be expected to describe their work and their needs in the language and from the point of view of an engineer. Conversely, engineers seldom have an intuitive grasp of their users' tasks and concepts or of the environment in which a product will be used. Some kind of two-way translation is needed between the user's domain and the domain of the technical expert.

Participatory design requires more than a translation of terminology. There must also be a translation between task models. Engineers are notoriously bad at performing this translation themselves. Even when both domain languages are formal languages, translation is a nontrivial matter. Knowledge-engineering, as this process is called in software design, is often hampered by the engineer's assumption that he or she knows "exactly what the user needs."

De Zeeuw and Koppelaar [1] suggest that the models that engineers and users develop of each other during design are potentially harmful in their rigidity. Such models lack the clarifying reference to a common experience which only someone practiced in both domains can identify.

To make the views of the domain expert and the engineer converge, the discourse must include models which both

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parties can understand, and which demonstrate that there is, indeed, more than one way to represent the design space in which they are working. These models are metaphors which act as a bridge between one domain and another.

Let's Study Translation by Studying Translators

In our experience, participatory design profits from the involvement of a *translator* — someone with work experience both in the user's domain and in software development — to translate between the domain of the user and the domain of the engineer. It falls to him or her to translate between the terminology, the task models, and the user models of the end user and the engineer.

A good translator can use techniques such as interviewing, scenario building, interface mapping, etc. more effectively than someone without user domain experience. We argue that knowledge of both domains enables the translator to see effective metaphors which help to explain the terms of an unfamiliar environment.

Notice that we do not advocate that the translator replace either users or engineers in the design process. We expect the translator to have knowledge of the kind of work done at a certain kind of workplace by a certain kind of end user, not necessarily knowledge of a specific task, workplace or user. Also, the translators we know are people who used to be end users but who have become software engineers, so their knowledge of the work and workplace may be somewhat out-of-date and colored by memory.

Both of us have served in the role of translator; both of us have also worked on teams with translators. Our own experience leads us to believe that having a translator on a design team leads not only to better task and user models, but also to explicit consideration of the impact of mechanization on workers in the workplace. We would go so far as to argue that there is a need for more software engineers with prior experience in another line of work.

Case Studies — Ours and Yours

Several case studies of the use of translators in the participatory design of software will be presented from our own experience. These will include end users as diverse as physicists, high school English teachers [2], mechanical engineers [3], and psychiatric nursing staff. In each case, the design process depended on the involvement of a computer scientist with work experience in the user's domain.

Our goal in this workshop is to look carefully at cases of successful design efforts that had the benefit of a translator. We hope that a case-study approach will lead to greater insight into the nature of translation between users and engineers, and that such insight will lead, in turn, to greater understanding of how to proceed when a translator is not available.

Attendees are invited to contribute their own experiences regarding the use of translators in participatory design — or about situations where they could have used a translator. Our experience is in software design; we hope that some attendees will offer information about other design areas, as well.

We suggest that attendees who wish to reserve a spot on the workshop agenda for describing a case study speak to one of us before the workshop starts.

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