HUMAN FACTORS ISSUES IN THE DESIGN OF USER INTERFACES 
FOR PLANNING AND SCHEDULING 

PRESENTED AT THE SPACE NETWORK CONTROL CONFERENCE ON 
RESOURCE ALLOCATION CONCEPTS AND APPROACHES 

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PREFACE 

THE SYSTEM MUST BE BASED UPON A SIMPLE, CONCEPTUALLY 
USEFUL MODEL OF THE SCHEDULING PROCESS, THE USER 
INTERFACE MUST BE NATURAL AND INTUITIVE, AND THE 
COMMANDS MUST PROVIDE A DIRECT MAPPING OF THE 
INTENTION INTO ACTION. 

--FOX, 1989 

. . . THE FIRST STEP FOR THE DESIGNER IS TO DETERMINE THE 
FUNCTIONALITY OF THE SYSTEM BY ASSESSING THE USER TASK 
DOMAIN. 

--SHNEIDERMAN, 1987
AGENDA

- INTRODUCTION
- ISSUES
- GUIDELINES
- DISPLAY CONCEPTS
- GENERAL RECOMMENDATIONS

INTRODUCTION

- PURPOSE — PROVIDE AN OVERVIEW OF HUMAN FACTORS ISSUES THAT IMPACT THE EFFECTIVENESS OF USER INTERFACES TO AUTOMATED SCHEDULING TOOLS
- SCOPE — SELECTED ISSUES ADDRESSED IN RECENT WORK FOR NASA-GODDARD CODE 522.1
INTRODUCTION (2)

• METHOD
  - SURVEY OF PLANNING AND SCHEDULING TOOLS
  - IDENTIFICATION AND ANALYSIS OF HUMAN FACTORS ISSUES
  - DEVELOPMENT OF DESIGN GUIDELINES BASED ON HUMAN FACTORS LITERATURE
  - GENERATION OF DISPLAY CONCEPTS TO ILLUSTRATE GUIDELINES

ISSUE: VISUAL REPRESENTATION OF THE SCHEDULE

• OBJECTIVE: REDUCE MENTAL MANIPULATION AND TRANSFORMATION OF DATA

• OPERATIONAL NEED:
  - ALTERNATIVE LEVELS OF ABSTRACTION
  - SUPPORT FOR VISUALIZING RELATIONSHIPS BETWEEN EVENTS
  - SUPPORT FOR REORDERING EVENTS
  - REDUCED DEMAND ON MEMORY
ISSUE: VISUAL REPRESENTATION OF THE SCHEDULE (2)

- GUIDELINE: CONSIDER ALLOWING A SPECIFIC TEMPORAL ORDERING OF EVENTS TO EVOLVE OVER THE SCHEDULE'S LIFE CYCLE.

- DISPLAY CONCEPT: PRECEDENCE SCHEDULING
  - FOCUS ON RELATIONSHIPS BETWEEN EVENTS AND POINTS IN TIME
  - USE EVENT "CLONES" TO REPRESENT ALTERNATIVE SATISFACTION OF CONSTRAINTS ON AN EVENT

DISPLAY CONCEPT: PRECEDENCE SCHEDULING
ISSUE: EVALUATION OF SCHEDULES

- OBJECTIVE: INCREASE THE EASE AND EFFECTIVENESS OF SCHEDULE COMPARISON AND SELECTION
- INFORMATION REQUIREMENTS/Criteria:
  - NUMBER OF REQUESTS SATISFIED
  - LEVEL OF RESOURCE FRAGMENTATION
  - AVERAGE PERCENTAGE OF SERVICE PROVIDED
  - PERCENTAGE OF SERVICE PER USER

ISSUE: EVALUATION OF SCHEDULES (2)

- GUIDELINE: PROVIDE A CAPABILITY THAT SUPPORTS QUICK VISUAL COMPARISON OF SCHEDULES
- DISPLAY CONCEPT: HISTOGRAM
  - CONVEYS RELATIVE EFFECTIVENESS OF ALTERNATIVES
  - REDUCES MENTAL COMPARISON OF DISCRETE QUANTITIES
ISSUE: IDENTIFICATION OF AVAILABLE RESOURCES

- OBJECTIVE: SUPPORT OPERATOR HEURISTICS FOR MAXIMIZING USE OF RESOURCES (E.G., NEGOTIATION WITH USER, RESOURCE SUBSTITUTION)

- OPERATIONAL NEED/INFORMATION REQUIREMENTS:
  - DISCRETE RESOURCE AVAILABILITIES (AMOUNT BY TIME)
  - REQUESTED RESOURCES
  - FUNCTIONALITY FOR COMPARISON OF REQUESTED AND AVAILABLE RESOURCES
ISSUE: IDENTIFICATION OF AVAILABLE RESOURCES (2)

- GUIDELINE: PROVIDE ACCESS TO RESOURCE AVAILABILITIES; SUPPORT COMPARISON OF AVAILABLE AND REQUESTED RESOURCES; SUPPORT RESOURCE SUBSTITUTION.
- DISPLAY CONCEPT: GRAPHICAL REPRESENTATION OF AVAILABLE RESOURCES
  - FEATURES DIRECT-MANIPULATION APPROACH TO COMPARISON OF REQUESTED AND AVAILABLE RESOURCES

DISPLAY CONCEPT: GRAPHICAL REPRESENTATION OF AVAILABLE RESOURCES
ISSUE: SUPPORT FOR CONFLICT RESOLUTION

- OBJECTIVE: PROVIDE SUPPORT FOR OPERATOR'S MENTAL PROCESS OF CONFLICT RESOLUTION
- OPERATIONAL NEEDS/INFORMATION REQUIREMENTS
  - RESOURCE AVAILABILITIES
  - REQUEST CONTENTS AND FLEXIBILITIES
  - CHANGES IN PRIORITIES
  - USERS AND EVENTS IN CONFLICT
  - EXTENT OF EXISTING CONFLICTS
  - RESOURCE USAGE PER USER
  - REQUEST-EDIT CAPABILITY

ISSUE: SUPPORT FOR CONFLICT RESOLUTION (2)

- GUIDELINE: PROVIDE SUPPORT FOR CONFLICT RESOLUTION BASED ON ANALYSIS OF OPERATOR'S GOALS AND MENTAL OPERATIONS; INVOLVE OPERATORS FULLY IN THE DEVELOPMENT PROCESS
- DISPLAY CONCEPTS: DISPLAY OF CONFLICTING EVENTS
  - OPTION 1: HIGHLIGHTING CONFLICTS
  - OPTION 2: SUPPRESSING NON-CONFLICTING EVENTS
DISPLAY CONCEPT: DISPLAY OF CONFLICTING EVENTS
(OPTION 1 - HIGHLIGHTING CONFLICTS)

DISPLAY CONCEPT: DISPLAY OF CONFLICTING EVENTS
(OPTION 2 - SUPPRESSING NON-CONFLICTING EVENTS)
GENERAL RECOMMENDATIONS

- BASE DISPLAY DESIGN ON OPERATIONAL TASK ANALYSIS (FOCUS ON COGNITIVE TASK ANALYSIS)
- SUPPORT VISUALIZATION, DIRECT MANIPULATION OF DATA
- KEEP OPERATORS IN THE DEVELOPMENT LOOP

REFERENCES


COPIES OF THE GUIDELINES DOCUMENT (WEILAND, BAHDER, & MURPHY, 1990) MAY BE OBTAINED BY WRITING TO:

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