

AN AFTERNOON OFF : A COMPARATIVE STUDY OF ADULTS' AND ADOLESCENTS' PLANNING ACTIVITIES

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ABSTRACT

This paper reports a study in which we applied the Hayes-Roth and Hayes-Roth (1979) model of metaplanning and opportunistic planning to women's and adolescents' organization of an afternoon off work. Opportunistic planning accounts for apparently random changes in people's intentions and actions, and originally the concept was developed from single cases in order to generate computer simulation models.

We compared the planning activities of busy women and bright adolescents. A propositional analysis was made of their verbalizations while they worked on a map of central Perth and a list of errands. The women were more efficient in their planning than the adolescents, worked at a more abstract level in time and space, and engaged in more opportunistic on-the-job planning. Adolescents worked on immediate tasks, in single instances of time and space, and showed more random behaviour. An argument is made for the usefulness of a model of essential human planning for examination of group and individual differences in organizing activities.

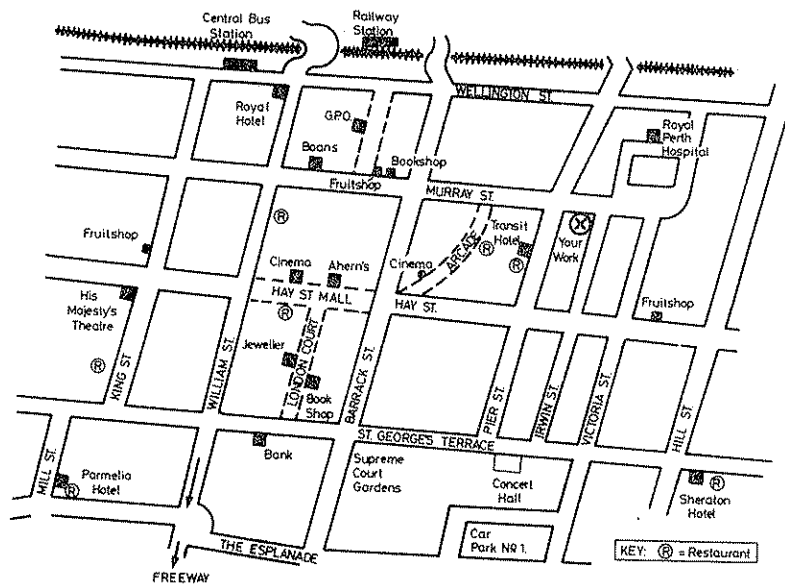
Planning is purposeful, goal-directed cognitive activity which is used to guide human action. Recent cognitive studies or problem-solving have shown the importance of planning for obtaining efficient solutions to constrained and open-ended types of problem-situations, for example solving laboratory chemistry problems (Pitt, 1983) and studying new university courses (Dodds and Lawrence, 1983). Most planning studies have focused on the cognitive work which precedes activity either conceptually or temporally. Hayes-Roth and Hayes-Roth argue that such concentration on a priori, higher-level planning misses much of the efficiency people display when they plan their activities. Individuals alter goals and modify prior intentions when new possibilities arise, or when opportunities are generated out of a mixture of their own prior experiences and the unique flow of events.

The teacher may shift the morning's music lesson and move up tomorrow's biology demonstration when the school cat has kittens in her desk. She is engaged in what Hayes-Roth and Hayes-Roth call opportunistic planning. The concept of opportunistic planning accounts for apparent random changes in people's intentions and actions.

The idea of flexible schedules and levels of planning behaviour provides new directions for understanding the relations between plans and actions. The purpose of this study was two-fold. First, we were interested in examining the implications of the opportunistic planning paradigm for describing essentially human goals and intentions. Then the basic concepts and planning paradigm were extended to a study of developmental differences in adults' and adolescents' use of higher-order a priori plans and on-the-job opportunistic plans on an "afternoon off".

One way of finding out how people plan their activities is to give them a task and ask them to think out loud while deciding how to accomplish the task. The think-aloud technique yields rich verbal evidence of what people are thinking (Ericsson and Simon, 1980; Lawrence, 1981). The Hayes-Roths used this technique, but their exclusive use of one unreduced protocol illustrates a problem created by the richness of the methodology. Another aim of our study was to extend analysis to more than a single case, and to compare the planning statements of two groups of subjects. Such comparative research can provide the basis of an understanding of developmental differences which conceptually precedes educational intervention. We developed a coding system which permitted the comparison of emphasis across all statements emitted by the two groups of different ages. When data are coded at the single proposition level inter-judge agreement can be computed and the reliability of the system made public.

Our Australian task was a more explicit version of the original planning of a list of errands to be done on a free afternoon in a hypothetical town. Our map was an actual section of central Perth with land-marks and time constraints similar to the Hayes-Roths', but reflecting Australian conditions. The map was clear and sufficiently confined not to require detailed first-hand knowledge of the area in order to plan the afternoon's activities. Subjects were told that they had an afternoon off work with set starting and finishing times and a number of possible errands. Task instructions and map are shown in Figure One.



- You work on the corner of Irwin and Murray Streets, Perth. The boss gives you the day off at 11.30am. You can plan to spend the rest of the day as you like. However, you must pick up your car from Car Park No. 1 by 6pm, and then go straight home.
- You would like to see one of two films on your list of "films I must see" if possible. The films are shown at 1pm, 3pm and 5pm. You have a friend in Royal Perth Hospital whom you would like to visit. Visiting is on a half hour limit, anytime between 1pm and 6pm.
- Other errands on your list which may be done or not done as you decide are as follows. All shops close at 5.30pm except the bank.
- . go to bank which closes at 3pm.
 - . post a special delivery letter.
 - . check out 2 or 3 hotels for overseas visitors.
 - . meet a friend at Central Bus Station and take to lunch at 12.30pm.
 - . special order for a book for class.
 - . buy fresh vegetables for dinner.
 - . pick up watch in London Court.
 - . buy theatre tickets for His Majesty's next week's show.
 - . buy child a toy at department store.

What do you do and how do you organise the day?

Figure 1 : Afternoon Off Task and Map

Development of a Comparison Planning Model

The development of a model was informed by the Hayes-Roth model which specified levels of the actual moves required to organize and carry out the list of errands. However, we also were mindful of the specialities of human, cognitive organization. Any set of diverse tasks requires several different cognitive activities and different levels of planning operations which may be more efficient in one individual or group than in another. The Hayes-Roth model provided no way of conceptualizing this comparison.

Previously we have developed a working model of students' plans to work on a university course (Dodds and Lawrence, 1983). In the development of that model we had been influenced by Polya's (1957) emphasis on the effective influences exerted by a person's identification of the features of a particular task, over-all planning, monitoring and checking behaviours. Those dimensions had provided a base for describing individual differences in the way students set their own goals, organized the materials and developed plans for tackling the course. We generated a descriptive scheme by combining the Hayes-Roth emphasis on a priori metaplans and on-the-spot modifications of plans with Polya's identification of the importance of attention to the givens, checking and monitoring. The descriptive model yielded categories by which we could code individual observations from the verbal data of the women and adolescents. Categories were refined on two pilot protocols and three of the eighteen analyzed here. Planning and checking procedures and knowledge generation with the inter-connections between the categories are shown in Figure Two.

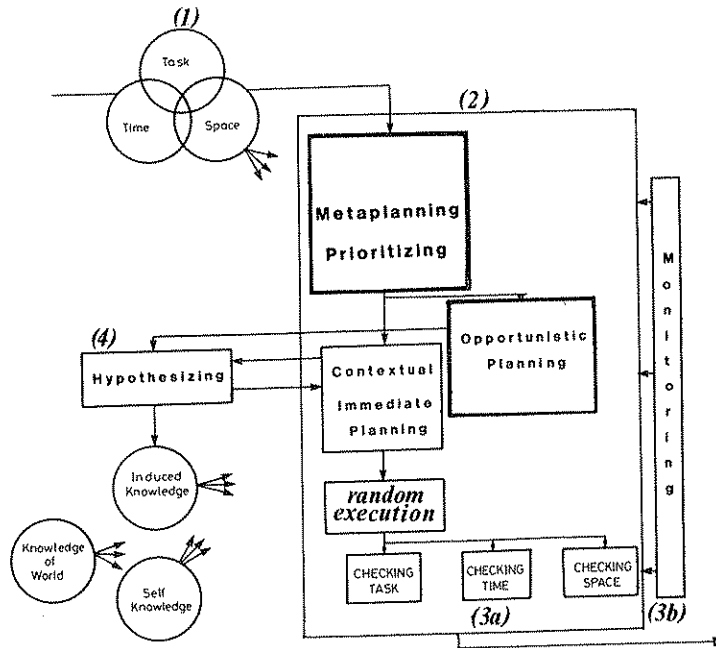


Figure 2 : Planning Model

Section 2 of the figure shows four levels of planning statement. At the most abstract and general level is metapanning as the expression of overall approaches to planning the task and prioritizing into more and less important errands, for example 'I've got two separate hours to get all that shopping done' (S9). Immediate, contextual planning involves organization of single errands which are concretely centred in time and space, for example, 'There's the bank, I'll go there after I have been to the bookshop'. They also represent work on specific features of overall plans. Random execution is characteristic of no or minimal organization and while it may be located in time and space, is neither related to previous or following actions, nor overall purposes and organization. In the figure opportunistic planning is located between metapanning and contextual work. While the Hayes-Roths had regarded it as an alternative to pre-planning, our model allows for emergent, on-the-job plans which may be in the service of general organizational intentions, or may replace them. Thus opportunistic planning can be done at different levels of abstraction, generated as part of the overall plan or as ideas which are generated once the work is in progress. For example, S5 begins the task with a decision to telephone the hotels from the Post Office and thus covers a major errand in her initial planning. S17, on the other hand, had decided initially not to visit the bookshop in order to save time but decides in the middle of the task to do it 'because there is a bookshop close by'.

Section 1 of the figure breaks down the identification of given information into listing of errands and temporal and spatial markers. The checking of completed parts of the task mirrors the identification of information and, like it, includes checks on errands and temporal and spatial constraints. Following Polya, checking procedures are the final step in the planning process and appear as Section 3b at the bottom of the figure.

Subjects' application of knowledge to the task is presented in Section 4 as information about the world or self, or as knowledge that is induced from the givens by hypothesis formation and testing. Overall monitoring of the task, shown as Section 3b at the right, involves metacognitive activity and may appear at any stage in the planning process. For example a subject who realizes that she has made a mistake and corrects it by replanning the whole or part of the task is monitoring overall performance.

It was expected that the categories of the model would be able to differentiate the planning activities of subjects different in age and experience.

Method

Subjects

Subjects were nine women university students and nine (two female, seven male) bright grade ten students from Perth. The women were students in an advanced course in educational psychology. All were part-time students and had jobs and other responsibilities. The grade ten students were members of an extension science course for gifted students at a high school near the university. The ages of the women ranged from twenty-three to fifty-nine years, with a mean age of 45.2 years. The mean age of the adolescents was 15.1, s.d. .08. Both groups had some introductory experience of problem-solving approaches, and all had some familiarity with the central Perth area.

Procedure

Each subject was interviewed individually within a class session. The women were given the task by other members of the university class, tenth graders by university staff and graduate students. Standardized instructions were read aloud by the subject and she or he was given the list of errands for reference, a map which could be marked, and scratch paper. Each interview was audiotaped and took approximately twenty minutes. Audiotapes were transcribed for coding.

Coding and Interjudge Agreement

Transcribed protocols were segmented into each separate proposition expressed by a subject. Each proposition was coded with one only of eighteen original coding categories and any segment showing experimenter probing was not coded. Two judges independently coded three protocols from this study and two pilot protocols. Perfect interjudge agreement was obtained for eighty-five percent of the codings, yielding a Cohen's κ , $\kappa=.83$. (Tinsley and Weiss, 1975). Disagreements were resolved by conference.

Results

By breaking down the protocols into the five aspects of the planning task, we could show that actual planning moves represented about one third of each group's work. (34% for women and 31% for adolescents), even though the women generated nearly twice as many individual propositions. Identification of the givens, and checking and monitoring procedures together accounted for roughly half of verbalized work, as Table One shows. While 16% of the women's expressed work involved generating and applying information, this knowledge component was only 6% of what the younger subjects expressed. Instead, 7% of their expressions were unplanned, random actions.

Table 1 : Percentages of Women's and Adolescents' Verbalized Propositions for Planning an Afternoon-Off

	<u>Category of Proposition</u>					Total Propositions
	Identifying Givens	Planning Moves	Random Execution	Checking and Monitoring	Knowledge Generation	
<u>Group:</u>						
Women	25	34	-	27	16	1010
Adolescents	26	31	7	26	6	519

1. Completion of the Errands

The task involved errands that had to be completed within definite time and spatial constraints or with legitimate alternatives. Eight of the nine women completed the task without error in contrast to only two adolescents. A Fisher's Exact Test was significant at the .05 level. The women met all constraints with the exception of one woman who checked out only one instead of two hotels. The nine adolescents made 22 errors of omission or failure to meet constraints, such as visiting the hospital outside visiting hours.

2. Planning Strategies

There was a difference in the actual planning activities of the two groups. The coding system differentiated high level, a priori metaplans from on-the-job opportunistic planning and intermediate contextual planning and from random moves made apparently without any planning. The women's and adolescent's statements were distributed differently over the four

types, yielding a significant Friedman's two way analysis of variance, $Xr^2 = 25.2$ $p < .01$ (Siegel, 1956). Group average proportions of planning statements are shown in Table Two.

Table 2 : Percentages of Women's and Adolescents' Planning Propositions in Four Types

Group:	Planning Proposition				Total of Planning Propositions
	Over-all Metaplanning	Opportunistic Planning	Contextual Planning	Random Execution	
Women	14	12	73	-	341
Adolescents	6	5	71	19	197

Although about seventy percent of all subjects' planning moves were immediate, contextual plans the women expressed more abstract metaplans than the adolescents (Ferguson's text of independent proportions $z = 2.67$ $p < .01$) and more opportunistic planning ($z = 2.33$ $p < .05$). Unplanned single moves represented nineteen percent of adolescents' statements but none of the women's.

3. Temporal and Spatial Location of Planning

The task was constrained by specific times for particular errands and the total time allowed, and in addition, by the physical location of places on the map. To examine the use of temporal and spatial orientations, each planning statement was identified as having a temporal and a spatial reference point. Reference points could signify a single point in the afternoon's time and on the map (coded as T1, S1) or they could signify relativity or an abstract standing back from specific errands, for example 'I will go to the bank before lunch (T2), or 'I have two hours to shop' (Coded as T2, S2). Plans without temporal or spatial orientation were coded T0, S0.

Time. There was no difference in the two over-all distributions with regard to temporal reference points, but the adolescents located more of their plans at a single point in time (T1), 63% 55%, $z = 2.0$, $p < .05$.

Space. There was a significant over-all difference in the use of spatial reference points $X^2(2) = 14.41$, $p < .01$. Adolescents again located plans at a single reference point (S1) more often than women, 65% 48%, $z = 4.5$, $p < .01$. Women expressed plans relatively and abstractly more often, 33% 21%, $z = 3.0$, $p < .01$. So while the women showed more attention to temporal and spatial constraints one step back from the specifics, the youngsters were more inclined to treat each errand as a separate, isolated task. The groups did not differ in their identification of the givens of the task, nor in their attention to checking and monitoring their work.

In summary, the categories of the model allowed us to differentiate planning strategies expressed and used by the two groups. The women showed a greater tendency to step back from the specifics of the task. They expressed more overall plans which were instantiated in their contextual planning, and formed more definite priorities. Their metaplans and priorities were informed both by the demands of the task and by personal style. Contextual planning utilized more abstract temporal and spatial locations and they did not make any random, unplanned moves. The adolescents, on the other hand, made few overall plans and their contextual planning used more immediate temporal and spatial markers. A greater proportion of their planning-action statements were random moves. The women adjusted their overall plans to meet conflicting demands and were flexible in their adjustment to unforeseen hurdles or opportunities. The adolescents also used opportunistic planning within the task but it was more often a response to a single temporal or spatial opportunity, for example 'Oh there's the bookshop, I'll go there after all'.

The combination of more prior, overall planning and greater flexibility in contextual planning seems to make the women more efficient in their approach to the task. This is supported by the higher completion rate achieved by the adults. The groups' distribution of temporal and spatial locations of all planning statements is shown in Table Three.

Table 3 : Percentages of Groups' Temporal and Spatial Locations of Plans at Three Reference Points

<u>Reference Point:</u>	<u>Time</u>	<u>Space</u>
<u>Abstract and Relative</u>		
<i>Women</i>	35 ^a	33 ^b
<i>Adolescents</i>	27 ^a	21 ^b
<u>Single, Contextual</u>		
<i>Women</i>	55 ^c	48 ^d
<i>Adolescents</i>	63 ^c	65 ^d
<u>Without Reference</u>		
<i>Women</i>	11	19
<i>Adolescents</i>	10	14
<u>Total:</u>		
<i>Women (341)</i>		
<i>Adolescents (197)</i>		

Discussion

The task of organizing an afternoon's errands allowed us to examine people's planning in a partially constrained problem-space which was structured so that different planning strategies could be used, and different outcomes could emerge. The study extended the analysis of planning operations from single protocols to group trends when groups were different in age and education. Our model of identification of givens, planning moves and monitoring and knowledge generation provided a way of describing verbalized similarities and differences in adults' and adolescents' organization of the task. Thus the analysis of individual propositions according to the concepts of the model allows us to extend some of the descriptive power of adult planning models to the realm of developmental differences. Developmentalists and educators have not easily been able to avail themselves of the insights of cognitive science. This study begins to develop a scheme for group data-analysis, and reliable cross-coding of concepts of a model.

The model was informed by Polya's conceptualization of the significance of developing plans and organizational strategies for formal mathematics problems. Their organization of the over-all task and its specifics, and their sensitivity to contextual factors facilitated the greater efficiency and competence of the women's planning. It is possible that the demands of their busy lives gave them a general familiarity with the contingencies of a shopping afternoon. Some of the youngsters said that they were content to "hang around" or go to the movies. Although they were bright, extension students they were not predisposed to effortful on-task organization. In a follow-up study we are finding it difficult to get other high school students to plan even when the errands are attractive to them.

Our data indicate the importance of determining the circumstances under which youngsters will organize their work, and will adapt to the opportunities which emerge within the task. That work is in progress. Theoretically, it is useful to examine further the kind of opportunistic planning exhibited by the women. The use of flexible, adaptive moves once into a task can be a very powerful problem-solving strategy. We need greater understanding of opportunistic planning on other tasks. If our description of over-all and flexible planning can be replicated on this and other tasks, then instruction in the efficient use of planning and contextualization of problems can be employed beyond Polya's mathematics to other problem-solving domains.

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