

# Case-Based Plan Adaption: An Analysis and Review

1

HÉCTOR MUÑOZ-AVILA AND MICHAEL T. COX

# Case Based Planning

2

- Cases associated with past problem and goal description
- Planning problems include goals and conditions
- Solution is a sequence of steps derived from past plans and following a sequence of steps
- Example:

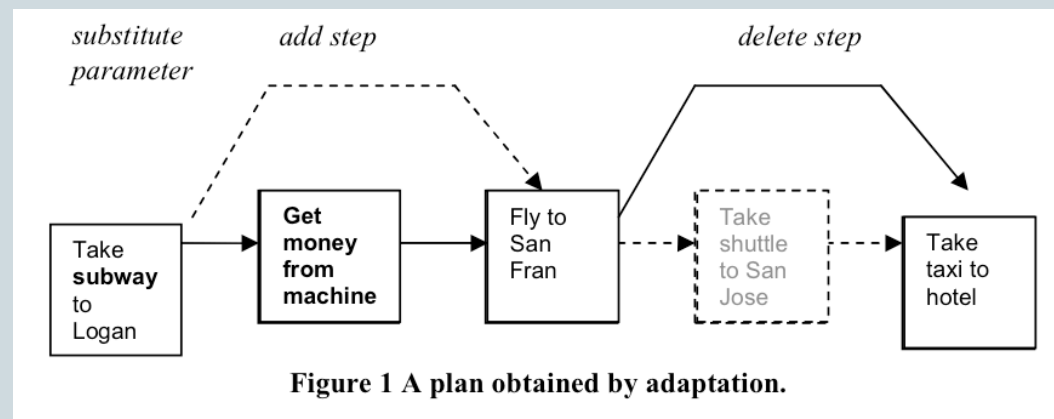


Figure 1 A plan obtained by adaptation.

# Plan adaptation

3

## Six technical dimensions:

- Adaptation type
- Case role
- Case contents
- Case merging
- Representational formalism
- Computational complexity

# Adaption type

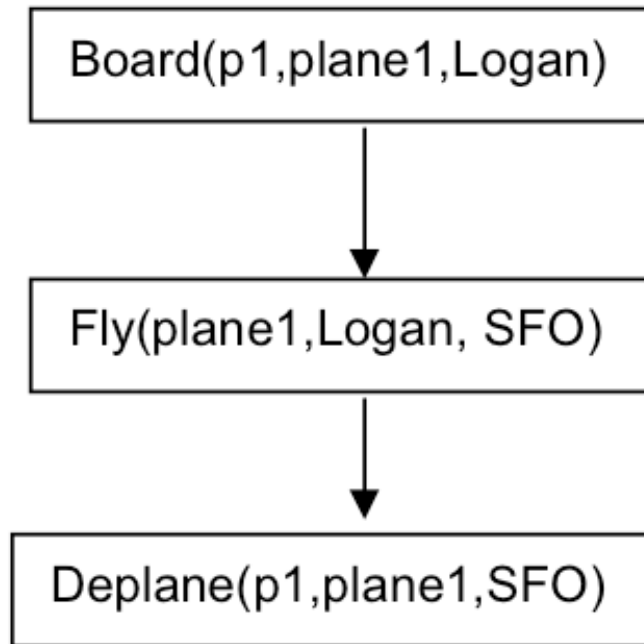
4

- **Transformational**
  - cases contain solution plans for previous problems
  - suitable changes with transformation operators
  - does not consider how plans are derived
- **Derivational**
  - cases contain a derivational trace
  - planner can replay the trace to a new problem
  - no transformation operators
  - appropriate when plans require extensive adaption

# Adaption type

5

- Derivational trace example



1. Create action, a1, flying plane1 from Logan to SFO
2. Create action, a2, boarding passenger p1 into plane1
3. Create action, a3, deplaning p1 from plane1
4. Order a2 before a1
5. Order a1 before a3

Rationale at step 1:  
:alt-pruned  
Board  
(p,pl,subw) no  
ops for state  
at(pl,subw)

# Case role

6

- **Domain knowledge**
  - case provides domain knowledge only
  - adaption is typically transformational
  - generate new knowledge about the domain
- **Search control**
  - knowledge about how to generate plan
  - planner may not know right step ordering
  - case provide meta-knowledge for using domain theory to produce plans
- **Both**

# Case contents

7

- **solution plan**
  - readily available with a CBR approach
- **trace**
  - sequence of planning steps needs to be derived
  - manual or automatic generation
- **adaptation information**
  - how to apply transformation
  - can be in form of annotations

# Case Merging

8

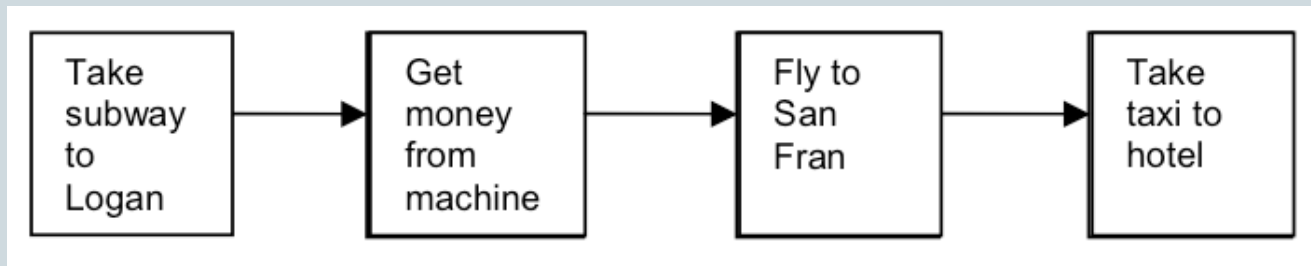
- **Sequential merge strategy**
  - goals achieved by plans are independent
  - adaptation performed simply in case retrieval order
- **Ordering-based interleaved strategy**
  - replaying the plan derivation until step ordering constraint
  - reasons about relative ordering of steps
  - steps are added according to any single-case adaptation policy
- **Choice-and-ordering strategy**
  - considers operator choice and step ordering for determining the next partial case



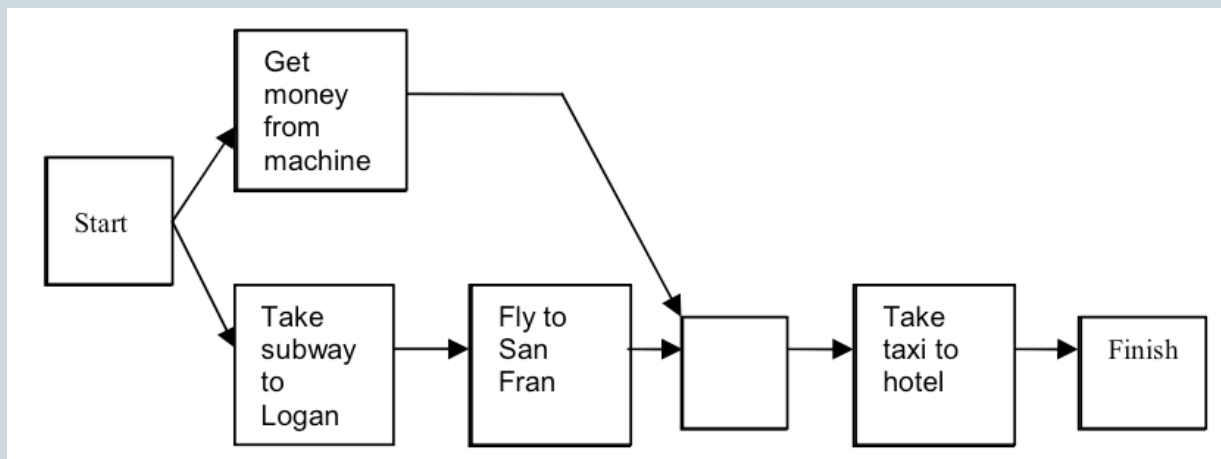
# Representational Formalism

9

- Total order planning



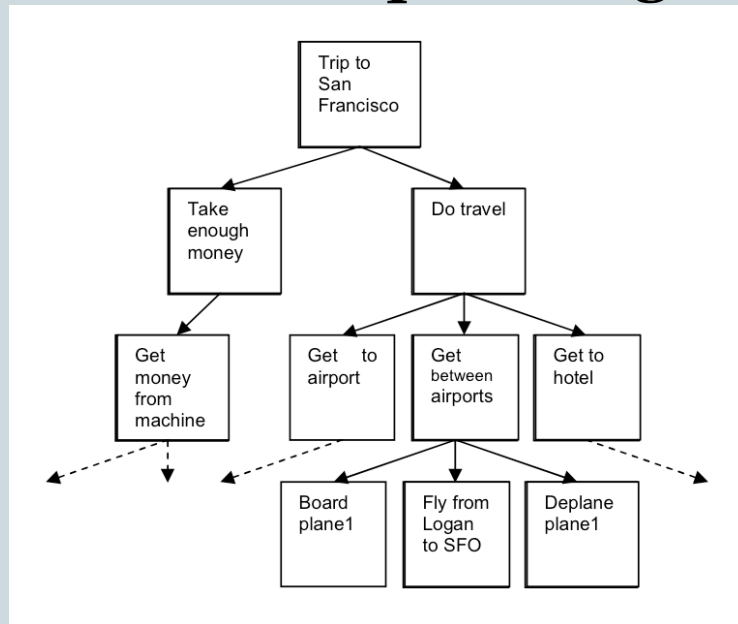
- Partial order planning



# Representational formalism

10

- Hierarchical planning



- Planning graphs

# Conclusion

11

- Five aspects for designing CBP systems
  - adaptation type
  - case role
  - case contents
  - case merging
  - representational formalism
- Critique: paper has some flaws and lacks examples