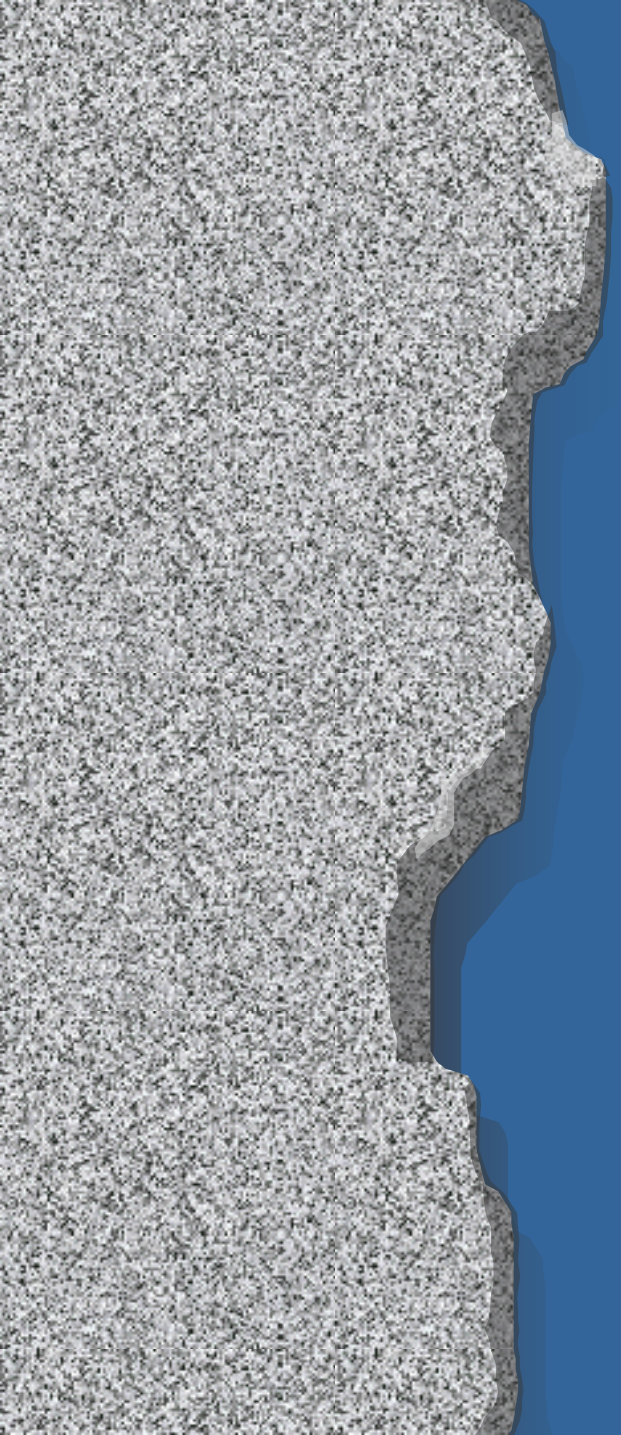

Writing Your First C++ Programs

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La Cañada High School

Program Development
Top Down Design

- Planning is a critical issue
  - Don’t type in code “off the top of your head”
- Programming Takes Time
  - Plan on writing several revisions
  - Debugging your program
- Programming requires precision
  - One misplaced semi-colon will stop the program

Exercise in Frustration

- Plan well (using paper and pencil)
- Start early
- Be patient
- Handle Frustration
- Work Hard
- Don’t let someone else do part of the program for you. Understand the Concepts Yourself!

Six Steps To Good Programming Habits #1

- 1. Analyze the Problem
  - Formulate a clear and precise statement of what is to be done.
  - Know what data are available
  - Know what may be assumed
  - Know what output is desired & the form it should take
  - Divide the problem into subproblems

Six Steps To Good Programming Habits #2

- 2. Develop an Algorithm
  - Algorithm:
    - a finite sequence of ***effective*** statements that when applied to the problem, will solve it.
  - Effective Statement:
    - a clear unambiguous instruction that can be carried out.
  - Algorithms should have:
    - a specific beginning and ending that is reached in a reasonable amount of time (Finite amount of time).

Six Steps To Good Programming Habits #3

- 3. Document the Program
  - Programming Style
  - Comments
  - Descriptive Variable Names
  - Pre & Post Conditions
  - Output

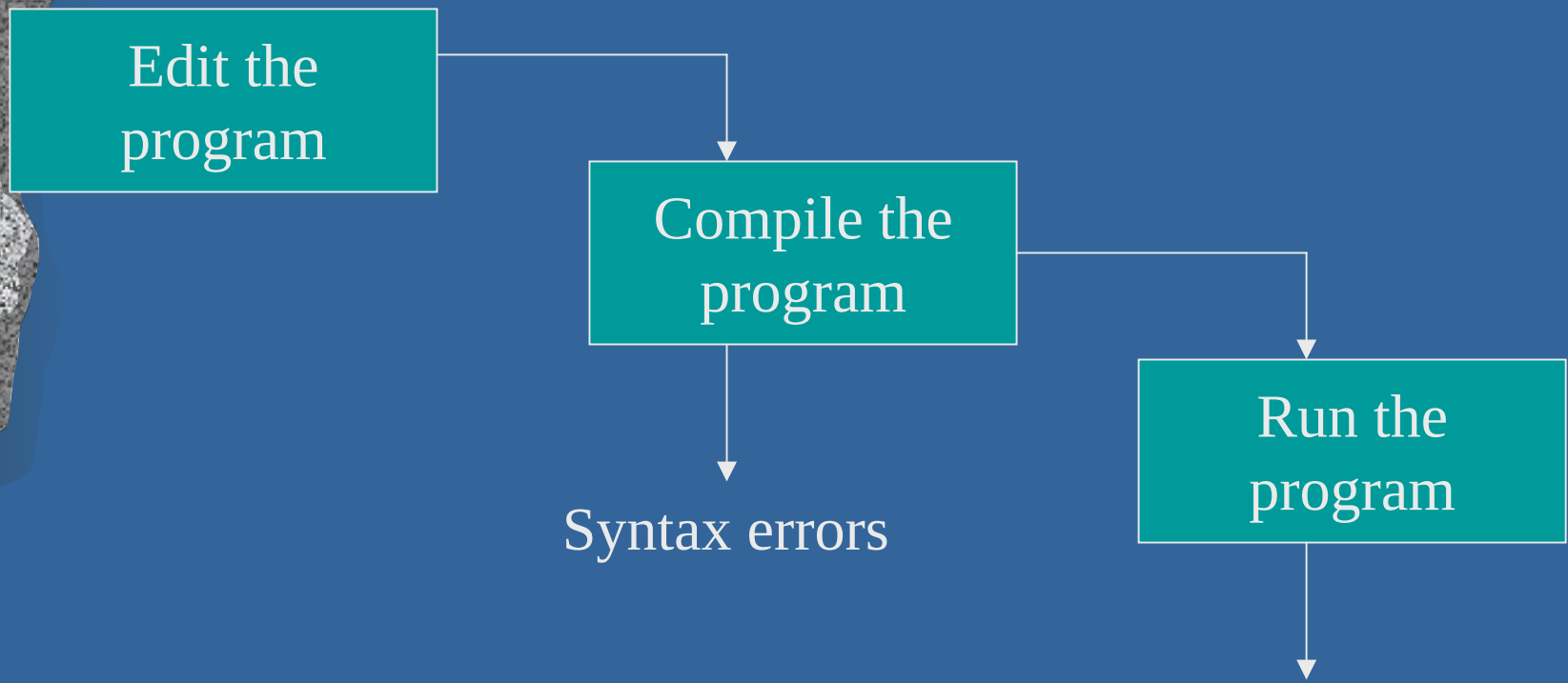
Six Steps To Good Programming Habits #4-5

- 4. Code the Program
  - After algorithms are correct
  - Desk check your program
- 5. Run the Program
  - Syntax Errors (semi colon missing, etc.)
  - Logic Errors (divide by zero, etc.)

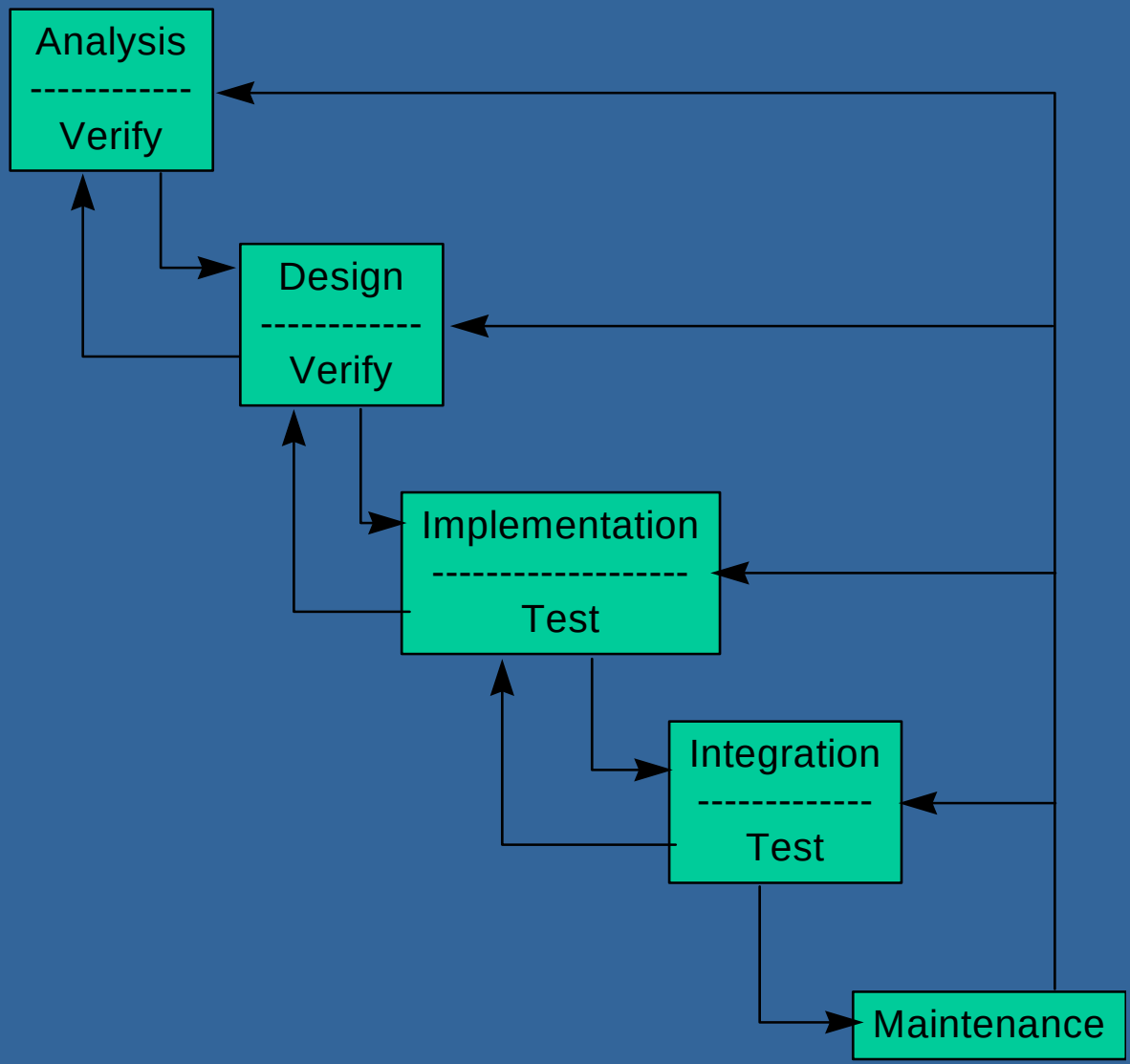
Six Steps To Good Programming Habits

- 6. Test the Results
  - Does it produce the correct solution?
  - Check results with paper and pencil.
  - Does it work for all cases?
    - Border, Edge, Extreme Cases
  - Revise the program if not correct.

Steps in Coding



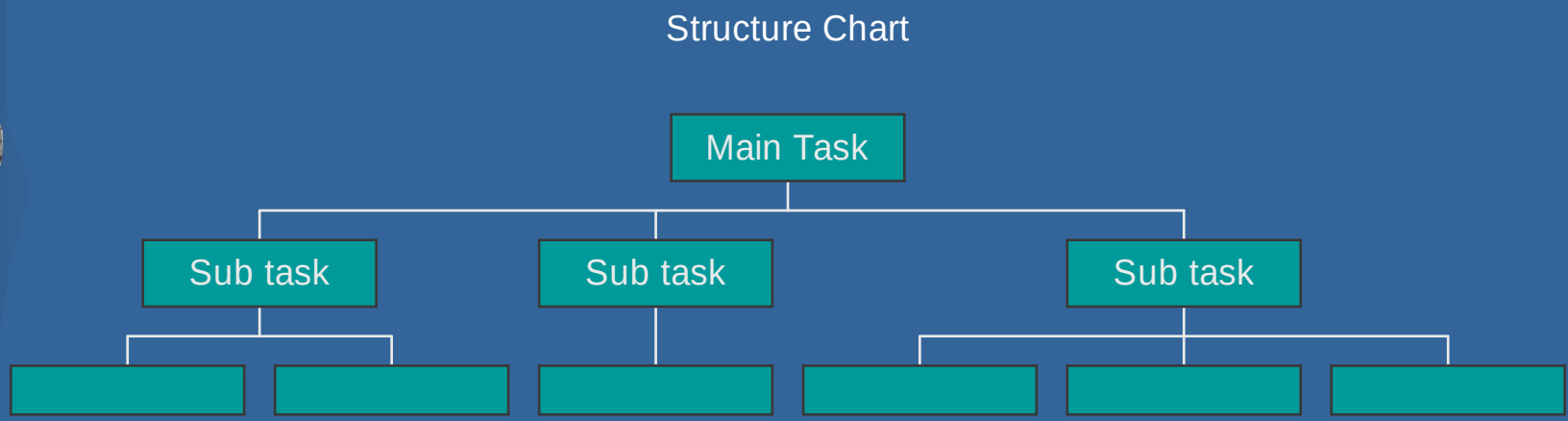
The Software Lifecycle



Top Down Design

- Subdivide the problem into major tasks
  - Subdivide each major task into smaller tasks
    - Keep subdividing until each task is easily solved.
- Each subdivision is called stepwise refinement.
- Each task is called a module
- We can use a structure chart to show relationships between modules.

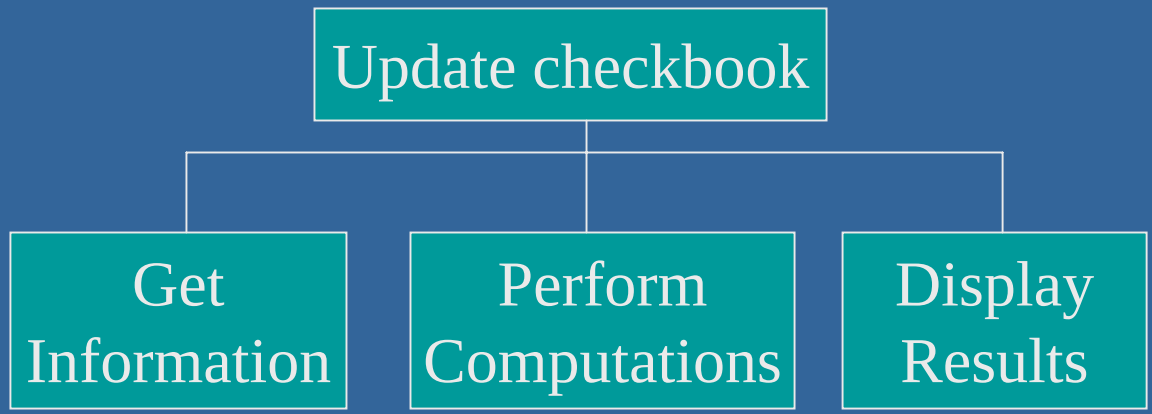
Top Down Design



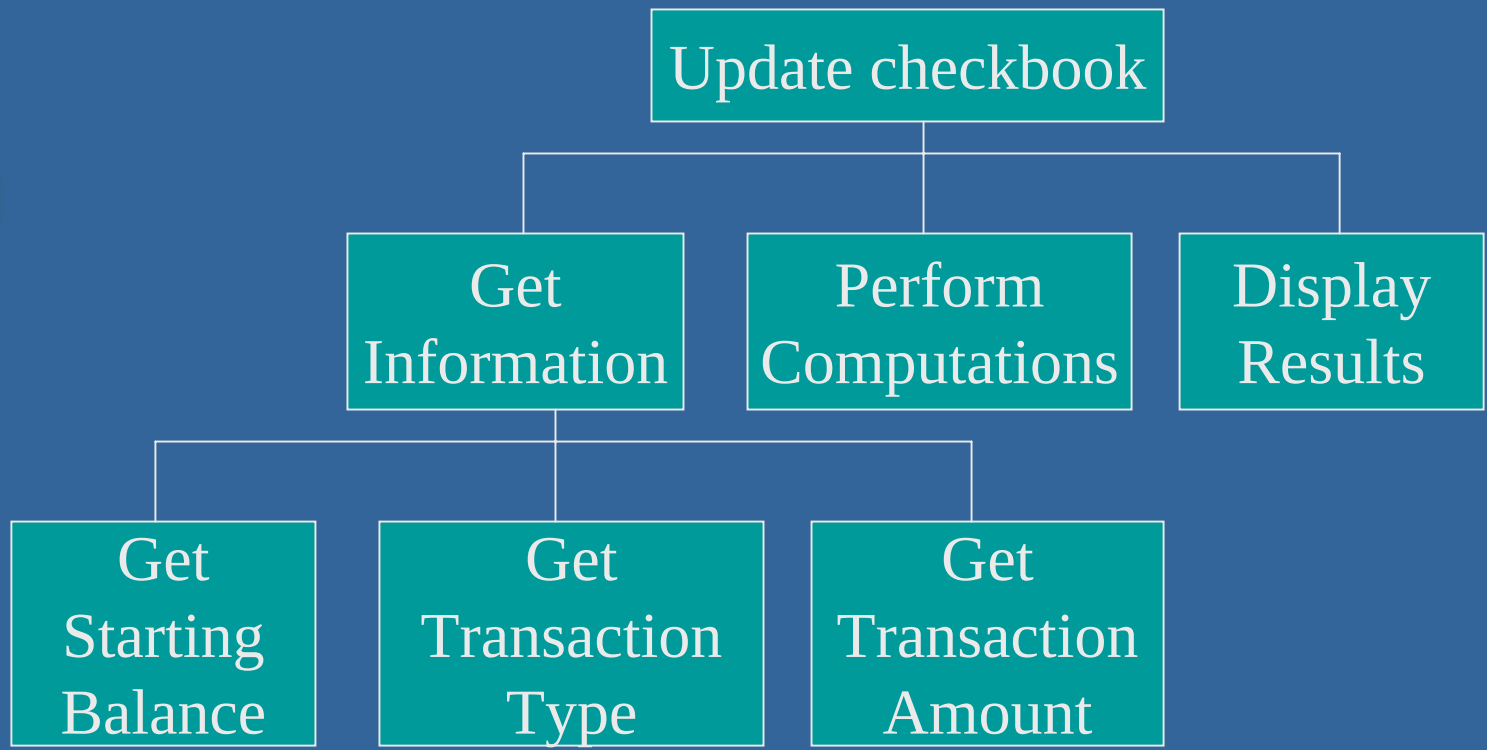
Top Down Design

- Pseudocode
  - is written in English with C++ like sentence structure and indentations.
  - Major Tasks are numbered with whole numbers
  - Subtasks use decimal points for outline.

Structure Chart for The Checkbook Problem



Second-Level Refinement



Pseudocode

1. Get Information
   - 1.1. Get starting balance
   - 1.2. Get transaction type
   - 1.3. Get transaction amount
2. Perform computations
   - 2.1. If deposit then
     - add to balance
     - Else
     - subtract from balance
3. Display the results
   - 3.1. Display starting balance
   - 3.2. Display transaction
     - 3.2.1. Display transaction type
     - 3.2.2. Display transaction amount
   - 3.3. Display ending balance

Checkbook.cpp

Writing Programs

- C++ Vocabulary
  - reserved words
    - have a predefined meaning that can't be changed
  - library identifiers
    - words defined in standard C++ libraries
  - programmer supplied identifiers
    - defined by the programmer following a well defined set of rules

Writing Programs

- Words are CaSe SeNsItIvE
  - For constants use ALL CAPS (UPPERCASE)
  - For reserved words and identifiers use lowercase
- Syntax
  - rules for construction of valid statements, including
    - order of words
    - punctuation

Library Identifiers

- Predefined words whose meanings could be changed.
- Examples:
  - iostream
    - cin cout
  - iomanip
    - setprecision setw
  - math
    - pow sin sqrt

Identifiers

- Must start with a letter of the alphabet or underscore _ (we will not use underscores to start identifiers)
- length determined by compiler
  - Turbo C++ Win 4.5 32 characters
  - Borland C++ unlimited
  - Codewarrior 255 characters
  - aim for 8 to 15 characters
- common use is to name variables & constants

Basic Program Components

- Comments
- Preprocessor Directives
- Constant Declaration Section
- Type Declaration Section
- Function Declarations
- Main Program Heading: int main( )
  - Declaration Section
  - Statement Section

A Sample Program reserved words

Reswords.doc

Reswords.cpp

Writing Code in C++

- Executable Statement
  - basic unit of grammar
    - library identifiers, programmer defined identifiers, reserved words, numbers and/or characters
  - A semicolon almost always terminates a statement
    - usually not needed AFTER a right curly brace }
      - Exception: declaring user defined types.
- Programs should be readable

noformat.cpp

noformat.txt

format.cpp

format.txt

Simple Data Types

- Type int
  - represent integers or whole numbers
  - Some rules to follow:
    - Plus signs do not need to be written before the number
    - Minus signs must be written when using negative #'s
    - Decimal points cannot be used
    - Commas cannot be used
    - Leading zeros should be avoided (octal or base 8 #'s)
    - limits.h int_max int_min

Simple Data Types

- Type double
  - used to represent real numbers
  - many programmers use type float, the AP Board likes the extra precision of double
  - avoid leading zeros, trailing zeros are ignored
  - limits.h, float.h
    - dbl_max, dbl_min, dbl_dig

Simple Data Types

- Type char
  - used to represent character data
    - a single character which includes a space
    - See Appendix 4 in our text
  - must be enclosed in single quotes eg. ‘d’
  - Escape sequences treated as single char
    - ‘\n’ newline
    - ‘\’’ apostrophe
    - ‘\”’ double quote
    - ‘\t’ tab

Simple Data Types

- Strings
  - used to represent textual information
  - string constants must be enclosed in double quotation marks eg. “Hello world!”
    - empty string “”
    - new line char or string “\n”
    - “the word \”hello\”” (puts quotes around “hello”)
  - String variables use:

#include “apstring.cpp”

- use quotes for user supplied libraries

Output

- #include <iostream.h>
  - cout pronounced see-out
  - cout << '\n';
  - cout << endl;
  - cout << "Hello world!";
  - cout << "Hello world!" << endl;

printadd.cpp

printadd.txt

Formatting Integers

- #include <iomanip.h> (input/output manipulators)
- right justify output
  - cout << setiosflags (ios::right);
- specify field width
  - cout << setw(10) << 100 (output: ********100, where * represents a space.)
- specify decimal precision
  - cout<<setiosflags (ios::fixed | ios::showpoint | ios::right)<< setprecision (2);

Setprecision

- Precision is set and will remain until the programmer specifies a new precision
  - The decimal uses one position
  - Trailing zeros are printed the specified number of places
  - Leading plus signs are omitted
  - Leading minus signs are printed and use 1 position
  - Digits are rounded, not truncated.

Test Programs

- Test programs are short programs written to provide an answer to a specific question.
- You can try something out
- Play with C+ +
- Ask “what if” questions
- Experiment: try and see