Java Fundamentals

2-12

Develop a Complete Animation

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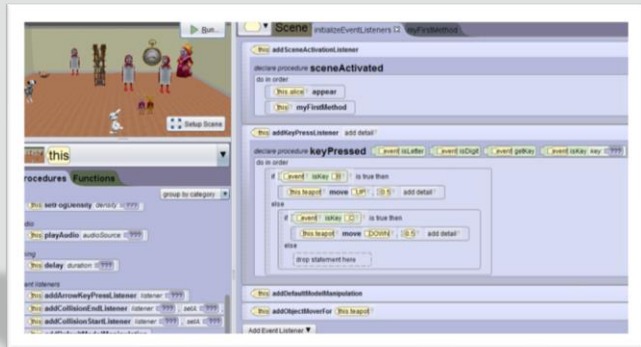
Objectives

- This lesson covers the following objectives:
    - Use functional decomposition to write a scenario and storyboard
    - Complete an animation
    - Test an animation
    - Reposition objects at run-time
    - Export your animation
    - Plan the presentation of a completed animation project

Animations

- An animation is a sequence of actions that simulate movement
- Use Alice 3 to construct the scene and write the sequence of actions for your animation, and Alice 3 will render the animation for you

Rendering is a process where the software program converts your code into the animation that you see. Alice 3 renders the animation based on the instructions provided by the programmer.

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Animations Require Planning

- Animations can be complex to plan and develop
- To simplify and organize this complex task, you can:
  - Use a methodical process to identify and solve the problems that arise along the way
  - Break down the development into manageable steps

Functional decomposition is the methodical process of identifying a complex problem and breaking it down into smaller steps that are easier to manage.

Remember the more time you take to create a detailed design the less time is required to complete the coding.

Functional Decomposition Example

- Examine this high-level process:
  - Consider a math concept that requires many steps
  - Identify the high-level steps for the math concept
  - Further refine and define the low-level tasks needed for each high-level step

Animation Development Process

- The process to develop an animation is similar to the problem-solving process
- Compare the two processes below
  - Problem-Solving Process

Step 1: Identify the Problem	Step 2: Develop a Solution	Step 3: Implement the Solution	Step 4: Test and Revise the Solution

  - Animation Development Process

Step 1: Define the Scenario	Step 2: Design a Storyboard	Step 3: Program the Animation	Step 4: Run the Animation

Both of these approaches are what you would probably do instinctively to solve a problem this is just formalizing the process.

Step 1: Define the Scenario

- Professional animators begin by developing a scenario—or story—that gives the animation a purpose
- Examples:
  - A story that presents a conflict and resolution
  - A lesson that teaches a math concept
  - A simulation that demonstrates a process
  - A game that entertains or trains

When you are first given a problem to solve you need to know exactly what it is you are trying to achieve. The list above gives an example of possible categories that you could place your problem in.

Scenario and Animation Examples

Scenario Type	Scenario	Animation
Problem and a solution	A cat needs help to get down from a tree	A firefighter climbs up the tree to save the cat
Teach a concept	Memorizing chemistry symbols is difficult	A timed game matches chemistry symbols with their definitions
Simulate or demonstrate a process	A car has a flat tire	A demonstration shows how to change a tire on a virtual car
Play a game	An airplane must avoid objects in its path as it flies through the sky	An interactive game maneuvers an airplane around objects in the sky

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Step 2: Design a Storyboard

- Two types of storyboards are often used to plan an animation:
  - Visual:
    - A series of illustrated images that represent the main scenes of the animation
  - Textual:
    - A detailed, ordered list of actions that each object performs within each scene of the animation

Both of these have their uses A visual storyboard can be an excellent tool to showcase the look and feel of your animation to your client as well as detailing the stages of the animation. A textual storyboard identifies the logical steps required to code your solution.

Storyboard Formats

- Develop your visual and textual storyboards using a variety of formats
- Examples:
  - Draw them on paper with a pencil
  - Create them using digital tools such as a word processor, drawing software, or presentation program
  - Write a textual storyboard within Alice 3 in the Code editor using comments to organize the steps in your program

Use whatever tool you are most comfortable with. As long as you achieve the objective of a finalized design then it doesn't matter what method you used to create it.

Visual Storyboards

- The visual storyboard helps a reader understand:
    - The scene components
    - How the initial scene will be set up
    - The moving and non-moving objects in a scene
    - The actions that will take place
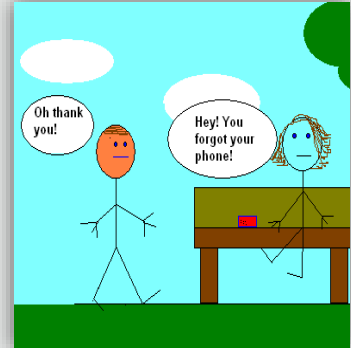   - The user interactions that occur during the animation execution

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Visual Storyboard Example
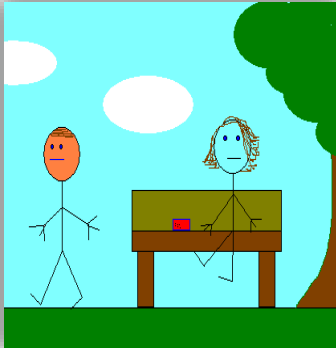
Boy and girl sit on a park bench. The boy walks away, leaving his phone behind
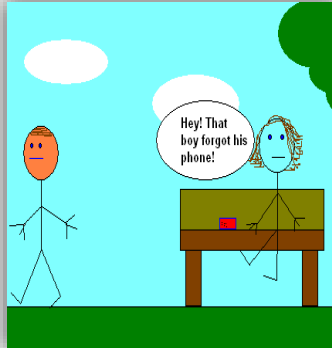
Girl notices the mobile phone. She thinks, "Hey! That boy forgot his phone!"

Girl says out loud, "Hey! You forgot your phone!" Boy turns around and walks back to bench. He says, "Oh! thank you!"

Textual Storyboards

- A textual storyboard helps the reader understand the actions that will take place during the animation
- The moving and non-moving objects can be easily identified within the action statements, but a more detailed description may be necessary if multiple programmers are involved in implementing any scene

In computing, a textual storyboard is called an algorithm: a list of actions to perform a task or solve a problem.

Algorithms can be simple or complex and can be created at multiple levels so that you can create a fully refined design. Remember one textual storyboard level may describe a character walking. A more refined storyboard will explain how all of the joints work together to achieve the walking motion

Textual Storyboard Example 1

- Program the following actions in order:
  1. Boy and girl sit on a park bench.
  2. Boy stands up and walks away, leaving his phone on the park bench.
  3. Girl turns to look at the phone.
  4. Girl thinks, "Hey! That boy forgot his phone!"
  5. Girl says out loud, "Hey! You forgot your phone!"
  6. Boy stops and turns around.
  7. Boy walks back to the park bench and says, "Oh! Thank you!"

Textual Storyboard Example 2

- This example shows how you can develop your storyboard by first writing comments in the Code editor of your program
- Afterwards, you can start to develop the animation directly from the storyboard

▼ Scene | initializeEventListeners | myFirstMethod

declare procedure **myFirstMethod**

do in order
- // Boy and girl sit on a park bench.
- // Boy stands up and walks away, leaving his mobile phone on the park bench.
- // Girl turns to look at the phone.
- // Girl thinks "Hey! You forgot your phone!"
- // Boy stops and turns around.
- // Boy walks back to the park bench and says, "Oh! Thank you!"
- // End of program.

Taking the textual storyboard and converting it into comments ensures that no part of the solution is missed during the coding process.

Textual Storyboard Example 2

- Textual storyboards components:

Component	Definition	Examples
Scene	The place (or "world" in Alice 3) where your story occurs	Park, library, school, home
Objects	Moving or non-moving characters that you program to move and act	Animals, cars, people, trees
Actions	Instructions for how each object should act in the scene	Walk 2 meters, turn left, say "Hello!"
User Interactions	Ways in which the user viewing the animation can manipulate the objects in the animation	Keyboard commands or mouse clicks to make objects move
Design Specifications	How the objects and scenery should look in the animation	Size, position, location, color

Your storyboard should describe everything that happens to the objects in your scene and how the objects interact with each other.

Storyboard Process Flow

- Flowcharting a storyboard helps you organize the flow of actions and conditions within an animation

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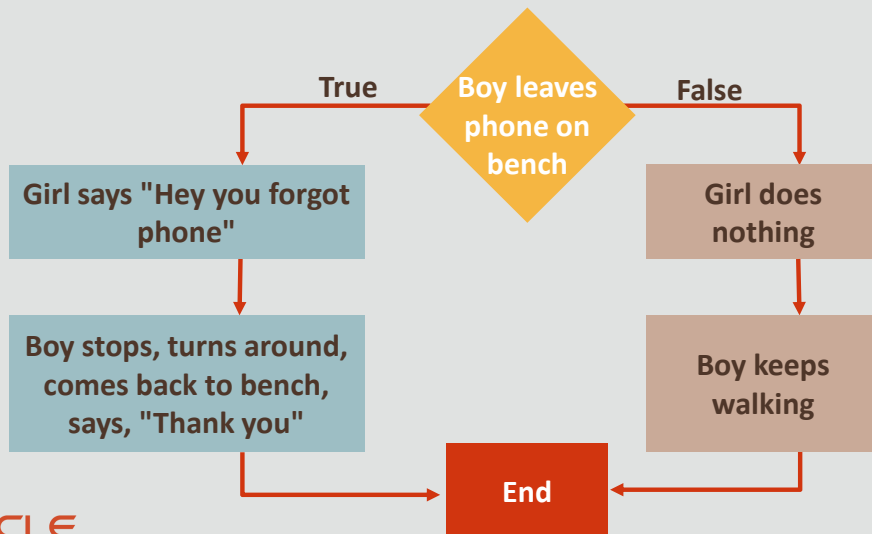
A flowchart is a great tool for planning the outcome of decisions that will be made inside of your animation. The diamonds relate to IF statements within your code.

How Storyboards are Helpful

- There are several ways that storyboards aid in program development:
  - Textual storyboards can be used to generate program comment statements and organize program development
  - Storyboards can also help programmers identify repetitive actions, or actions that may be performed by more than one object

You should ensure that your storyboards cover all of the aspects of the problem you are trying to solve.

Step 3: Program the Animation

- After completing the storyboard, the next step is to program the animation in Alice 3
- As you program the animation, refer to your storyboard for the animation's design specifications
- The code written in Alice 3 provides the instructions for the animation's look at run-time

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Animation Checklist

- During the animation development process, use this checklist to ensure that your animation meets all animation principles

Checklist for Animation Completion

Area	Check	
Scenario	Did you clearly define the scenario?	
Storyboard	Did you think-through the animation by creating a storyboard?	
Textual storyboard	Did you think-through the programming code by creating a textual storyboard?	
Program	Did you complete the programming of the animation?	

Checklists are something that are useful at all stages of your project. They can show the main tasks, but they can also show the sub-tasks that make up the main task and ensure that nothing is missed in the project implementation.

Create a Complete Animation

- Creating a complete animation requires a thorough understanding and application of all the components that you have learned so far:

Completed scene of multiple objects from multiple classes, including props and shapes	Vehicle riding with the setVehicle procedure
Declared procedures	Functions
Movement procedures	IF and WHILE control structures
Object rotation and object sub-part rotation procedures	Random numbers
Simultaneous movement with the Do Together control structure	Math expressions
Variables	Keyboard controls

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If you are unsure of any of the elements of this table then go back to the section that covers the material and re-read it.

Step 4: Run the Animation

- Run the animation to test that it functions properly and executes the actions planned in the storyboard
- This process is often referred to as testing and debugging the software

Programs can be tested by entering an unintended value in the argument field of a method in an effort to try and "break" the code.
When something is broken or doesn't work as you intended in a software program, it is often referred to as a "bug".
Debugging is the process of finding and eliminating bugs in a software program.

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In Alice 3 you run your program to test that the final project is as you expected. You should make any changes necessary and re-run the test until you are completely happy with the results.

Debugging Tasks

- Test and debug the animation frequently as it is being developed
- Use some of the following debugging techniques:
  - Adjust the direction, distance, and duration that objects move
  - Adjust math calculations that help refine the distance or duration that objects move
  - Refine instructions in the code that do not work as intended
  - Resolve errors created by the programmer

Do not leave your testing till the end. If you do a great amount of coding and then discover an error it can be difficult to pinpoint where the error is. Do small amounts of coding and then test so that it is easier to find and correct the error.

Test Elements of Your Animation

- Test every element to prove that it works without error
- Math expressions calculate as expected
- Objects move with smooth timing
- Control structures operate as expected
- Event listeners trigger the correct responses

Ensure that your code includes comments that clearly identify the purpose or the functionality of blocks of statements in your program. Referring to the comments will help you test and debug your program.

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User Input to Reposition Objects at Run-Time

- To create an interactive program, a Listener object must be added to the scene
- The addDefaultModelManipulation procedure creates a Listener object that targets a mouse-click on any object in the scene and responds by allowing the user to drag that object around the scene while the animation is running

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Test your events individually and by causing multiple events to happen at the same time. Keep a note of your results.

Steps to Add the addDefaultModelManipulation Procedure

- Go to the Scene tab
- Click the edit button next to initializeEventListeners
- Drag the addDefaultModelManipulation procedure (Scene class) into the initalizeEventListeners Code editor

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Using the addDefaultModelManipulation Procedure

- This procedure allows you to reposition objects at run-time:
  - Click and drag the object with your cursor to move it around the scene
  - Press the Control (Ctrl) key, and then click and drag the object with your cursor to turn it right and left
  - Press the Shift key, and then click and drag the object to move it up and down
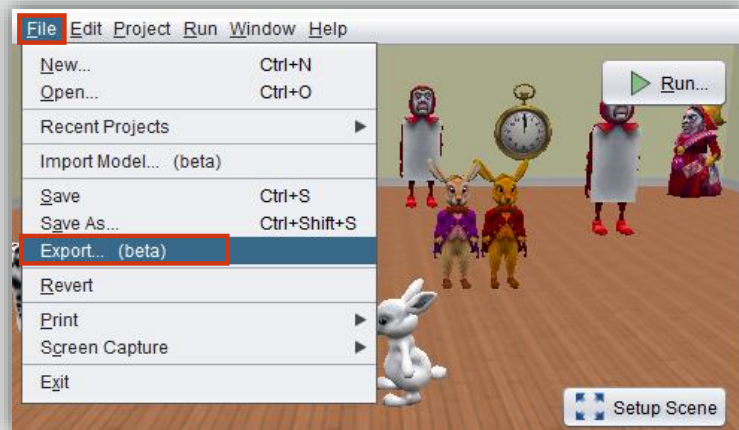
Alice Player

- Once you have completed your animation, you can use the Alice Player to share and run your Alice 3 creations
- The Alice Player is a separate application and can be found here:
  http://www.alice.org/get-alice/alice-3-beta-vr/
- It is important to make sure the Alice worlds you are running on the player were exported from a compatible version of Alice 3

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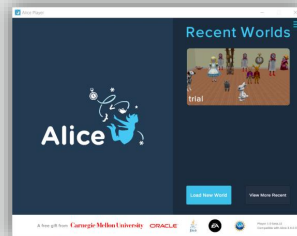
Follow the instructions on the site provided in the slide to download and install the necessary software.

Exporting for the Alice Player

- Open the World in Alice 3
- Select the File drop down in the application menu
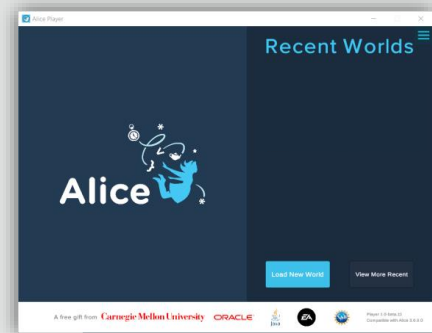- Select Export

Exporting for the Alice Player

- Chose the Location to save the file
  - It is a good idea to create a My Exports folder in the default Alice 3 user directory
- Be sure to name your file
  - It is a good idea to name it to match the Alice worlds it is being exported from
- Click Save
- Your world is now ready to be loaded in the player
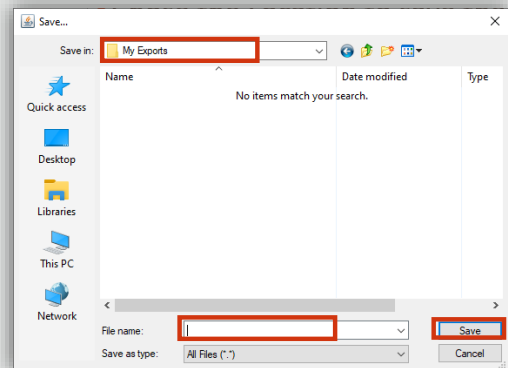
This file will be saved as a .a3w File.

Loading an Alice World in the Player

- Double click the Alice Player.exe (or the Alice Player application if .exe extension is not visible) found in the Alice Player folder
- When you first launch the Alice Player after you install it, there will not be any worlds on the main landing page
- As you open worlds this will start to populate with recent worlds to help you easily launch and play worlds

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Upon launching the application, if you receive a pop up that tells you that you can't start the app because it is untrusted, be sure that the site it is showing as the source is Alice.org.

After you have loaded a world in the Alice Player the player will remember the path for the world so you can easily relaunch it.
To do this:
1. Select the thumbnail from the most recent worlds on the landing screen
2. If you want to play a world that was run before the worlds that are populated on the home page select the View More Recent button and browse all worlds opened on this computer
- If you delete or move the source file on your computer it will no longer show up on this list until you load it again.
- Be careful not to delete the source file. Importing a world does not make a copy inside the application.

Loading an Alice World in the Player

- Select Load New World
- Browse your computer to the location of your a3w files
- Select the File
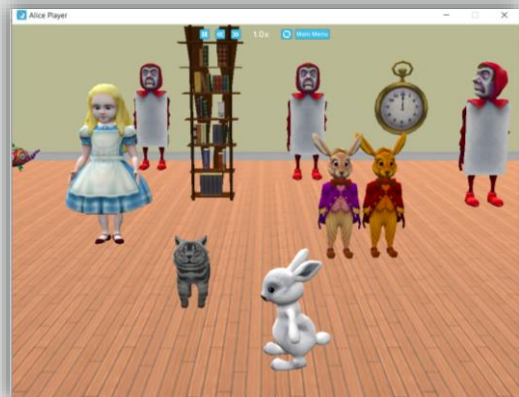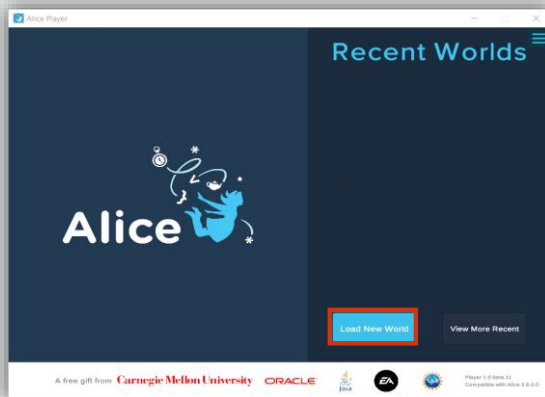
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Using the Player Controls
Once you have started playing a world in the player, there are controls for the player that allow you to change the playback speed, restart the world, and return to the main menu to select a new world to play. You will see these briefly at the top of the player when you first open the world. You can access these controls by mousing over the very top center of the player. The controls do the following:

• Pause: Stop playback till you then click the play button that will replace the pause button

• Lower Playback Speed: Decrease the playback speed with each click

• Increase Playback Speed: Speed up the playback speed with each click

• Playback Speed Value: This will display the current playback speed in a numeric multiplier or by telling you the world is paused

• Reload: This button allows you to reload and restart the world from the beginning

• Main Menu: This button will take you back to the main menu screen to allow you to browse different worlds to play

• If the world isn't performing how you are expecting, be sure to check the playback speed as it may have been set before entering the world

Present Your Animation Project

- It's time to present your complete animation project
- Here are some steps to follow when organizing your animation project presentation:
  - Make sure your presentation is thoroughly tested and complete
  - Plan to demonstrate how you used each of the concepts learned in this course
  - Find out how much time you will have for your presentation
  - If it is a group presentation, plan who will do which parts of the presentation

Now that you have designed, created and uploaded your animation you will be required to present your information to your client. Make sure that you have tested the presentation and it works. Always rehearse exactly what you are going to say in the presentation before you have to deliver it to an audience. Always look at the audience when you are speaking and be able to speak in more depth about the contents of your presentation slides. Knowledge and confidence is what you are trying to portray when giving a presentation.

Prepare a Presentation Outline

- Create a presentation outline to plan your complete animation project presentation
- The following slides show an example presentation outline

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If you are going to be doing multiple presentations then it is good to have a template or outline to follow. This makes it easier for you to create presentations and allows you to adopt a certain presentation style. You should always review your performance after every presentation and make any adjustment to improve your performance for the next presentation.

Presentation Outline: Section 1

- **Section 1**: Introduction
  - Gain your listeners' attention
  - Introduce the theme of the animation project
  - Preview your animation
  - Establish your credibility as a speaker
  - Give the audience a reason to listen to the presentation

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Presentation Outline: Section 2

- **Section 2**: Presentation of animation project
  - Organize the presentation in a logical flow
  - Show all capabilities of your animation project
  - Demonstrate how each course concept was used in the animation project
  - Time visual aids to support the spoken presentation
  - Include helpful transitions between ideas

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Presentation Outline: Section 3

- **Section 3**: Conclusion
  - Summarize the animation in a memorable way
  - Motivate the audience to respond
  - Provide closure

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Practicing Your Presentation

- When rehearsing your presentation:
  - Rehearse aloud
  - Time your speech; if it is too long or short, revise it
  - Rehearse standing up
  - Rehearse in front of someone
  - Tape-record or videotape your speech
  - If you do not have access to recording equipment, practice in front of a mirror
  - Rehearse using visual aids and technology

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You will normally speak faster when delivering a presentation than you do in practice. When practicing take this into account and when delivering your presentation always try to slow down. You may feel you are talking slowly but you are probably just talking at a normal rate. If you are confident in your subject matter then you should enjoy presenting it.

Group Presentations

- If you will be making your presentation with a group, here are some steps your group can follow to make sure all group members have a part in preparing and delivering the presentation
- Include all group members in all steps of the presentation planning
- Divide presentation tasks equally among group members
- Practice the presentation as a group, and give one another constructive feedback immediately following

Don't be embarrassed when practicing your group presentations and always treat it as a professional task.

Terminology

- Key terms used in this lesson included:
  - Algorithm
  - Animation checklist
  - Debugging
  - Comments
  - Functional decomposition
  - Rendering
  - Scenario
  - Textual storyboard
  - Visual storyboard

Summary

- In this lesson, you should have learned how to:
  - Use functional decomposition to write a scenario and storyboard
  - Complete an animation
  - Test an animation
  - Reposition objects at run-time
  - Export your animation
  - Plan the presentation of a completed animation project

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