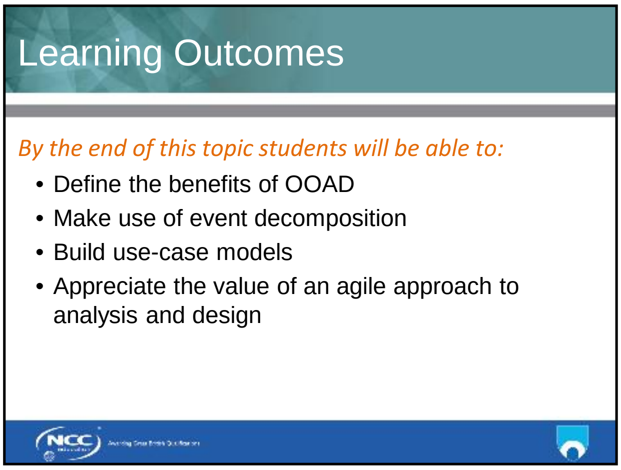
Awarding Great British Qualifications

Analysis, Design and Implementation

Topic :

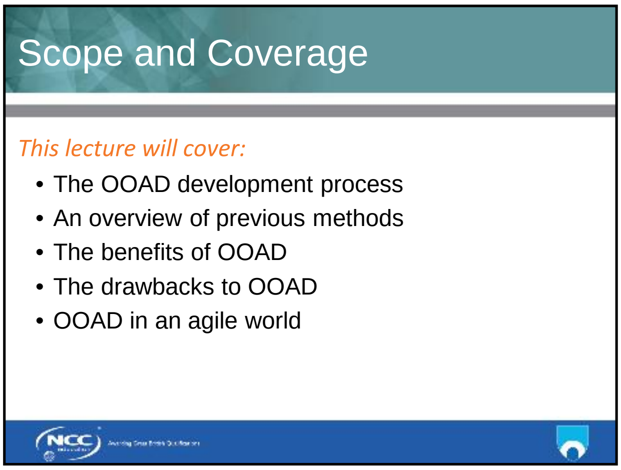
Agile Object Orientation



Learning Outcomes

By the end of this topic students will be able to:

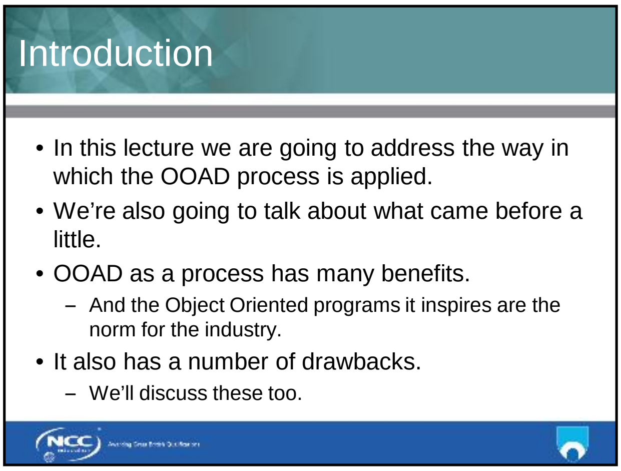
- Define the benefits of OOAD
- Make use of event decomposition
- Build use-case models
- Appreciate the value of an agile approach to analysis and design



Scope and Coverage

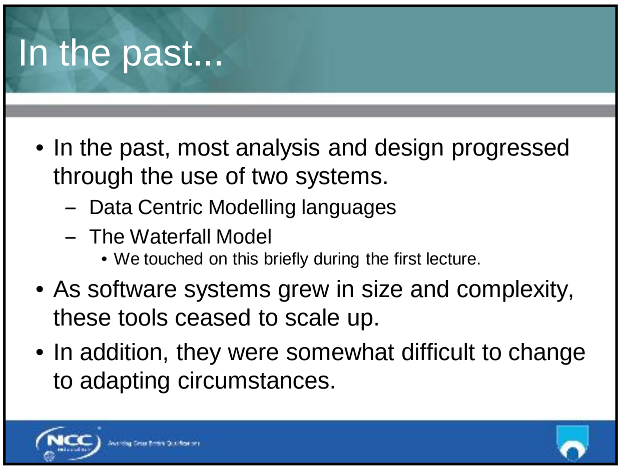
This lecture will cover:

- The OOAD development process
- An overview of previous methods
- The benefits of OOAD
- The drawbacks to OOAD
- OOAD in an agile world



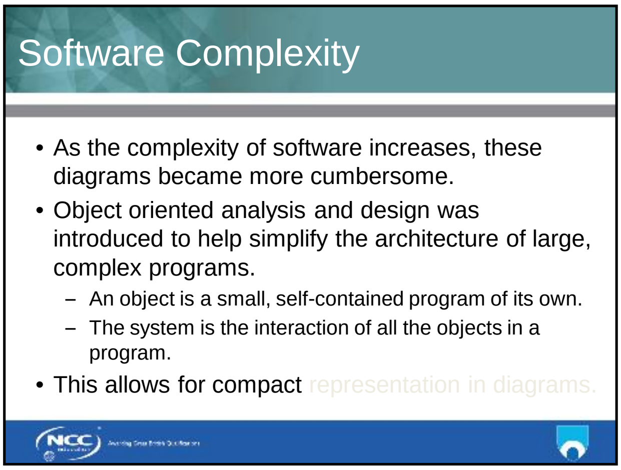
Introduction

- In this lecture we are going to address the way in which the OOAD process is applied.
- We’re also going to talk about what came before a little.
- OOAD as a process has many benefits.
  - And the Object Oriented programs it inspires are the norm for the industry.
- It also has a number of drawbacks.
  - We’ll discuss these too.



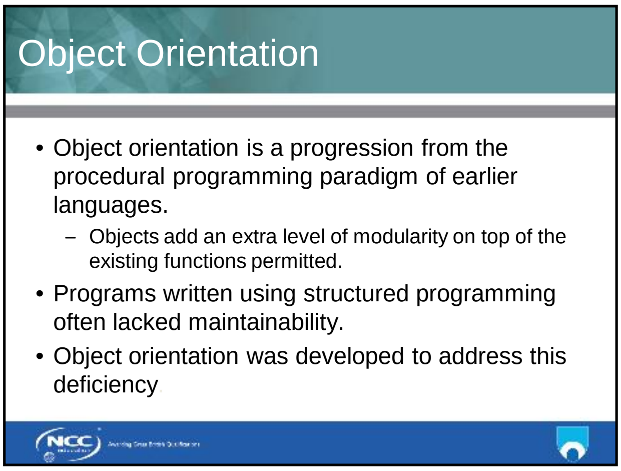
In the past...

- In the past, most analysis and design progressed through the use of two systems.
  - Data Centric Modelling languages
  - The Waterfall Model
    - We touched on this briefly during the first lecture.
- As software systems grew in size and complexity, these tools ceased to scale up.
- In addition, they were somewhat difficult to change to adapting circumstances.



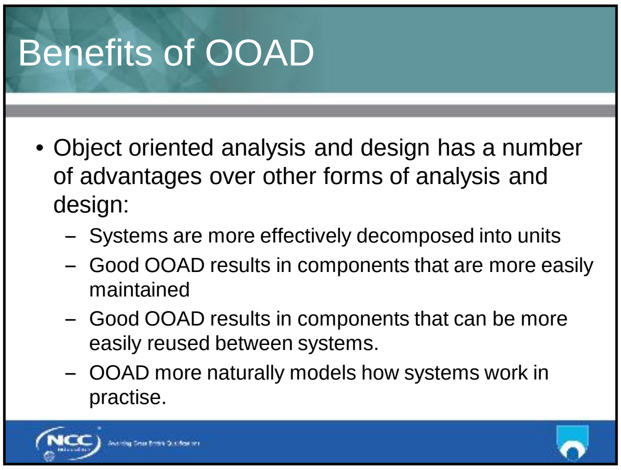
Software Complexity

- As the complexity of software increases, these diagrams became more cumbersome.
- Object oriented analysis and design was introduced to help simplify the architecture of large, complex programs.
  - An object is a small, self-contained program of its own.
  - The system is the interaction of all the objects in a program.
- This allows for compact representation in diagrams.



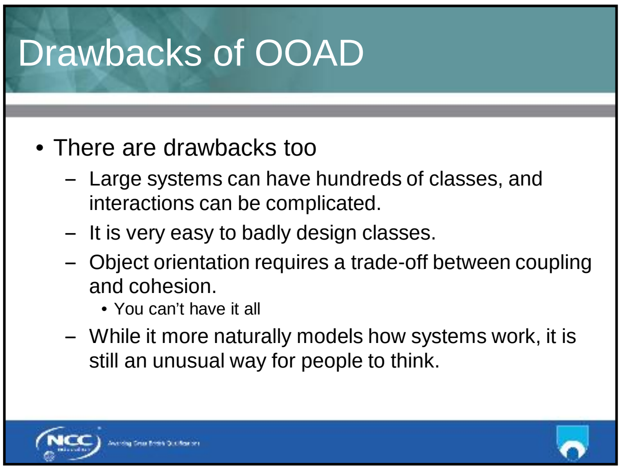
Object Orientation

- Object orientation is a progression from the procedural programming paradigm of earlier languages.
  - Objects add an extra level of modularity on top of the existing functions permitted.
- Programs written using structured programming often lacked maintainability.
- Object orientation was developed to address this deficiency



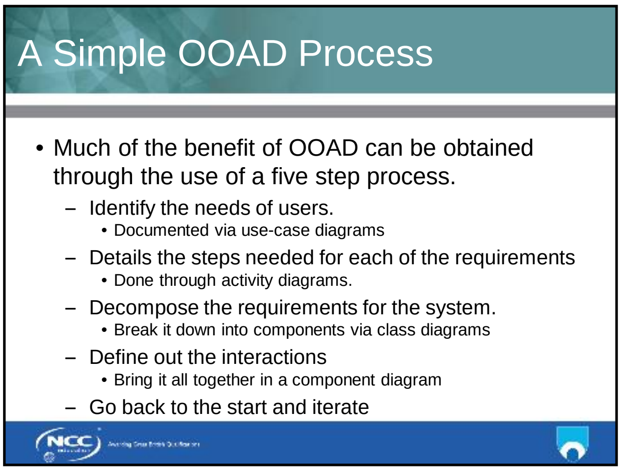
Benefits of OOAD

- Object oriented analysis and design has a number of advantages over other forms of analysis and design:
  - Systems are more effectively decomposed into units
  - Good OOAD results in components that are more easily maintained
  - Good OOAD results in components that can be more easily reused between systems.
  - OOAD more naturally models how systems work in practise.



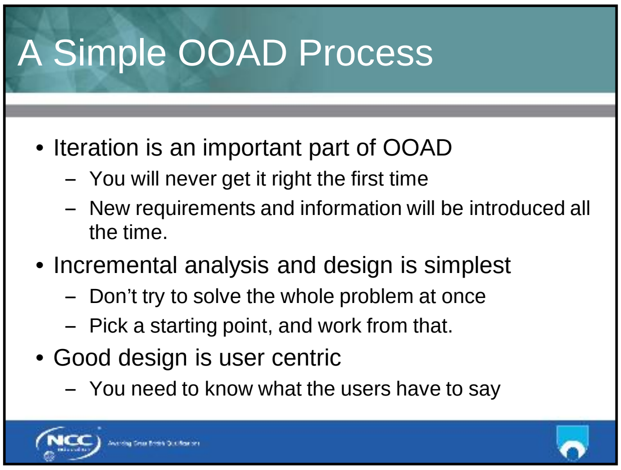
Drawbacks of OOAD

- There are drawbacks too
  - Large systems can have hundreds of classes, and interactions can be complicated.
  - It is very easy to badly design classes.
  - Object orientation requires a trade-off between coupling and cohesion.
    - You can't have it all
  - While it more naturally models how systems work, it is still an unusual way for people to think.



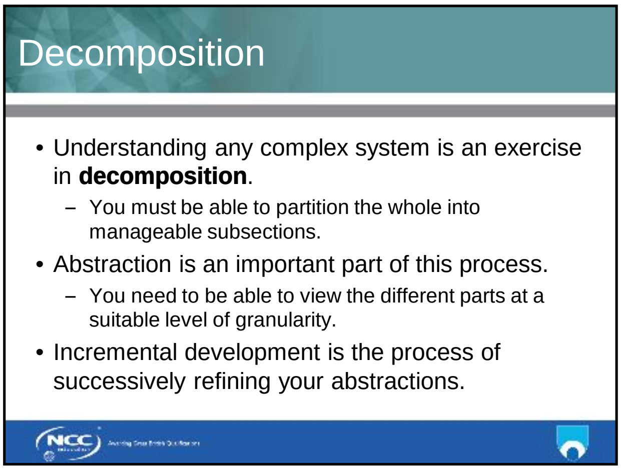
A Simple OOAD Process

- Much of the benefit of OOAD can be obtained through the use of a five step process.
  - Identify the needs of users.
    - Documented via use-case diagrams
  - Details the steps needed for each of the requirements
    - Done through activity diagrams.
  - Decompose the requirements for the system.
    - Break it down into components via class diagrams
  - Define out the interactions
    - Bring it all together in a component diagram
  - Go back to the start and iterate



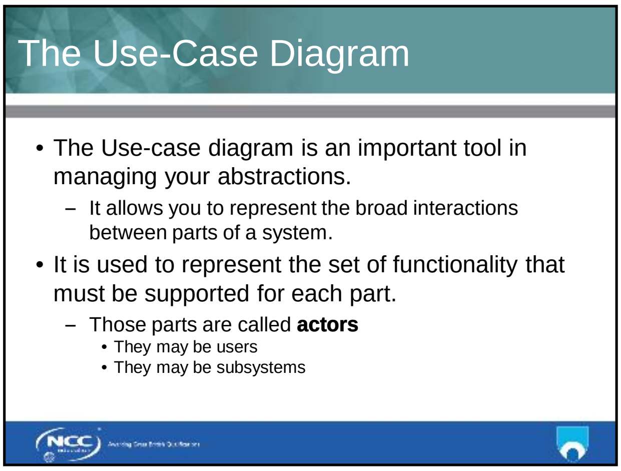
A Simple OOAD Process

- Iteration is an important part of OOAD
  - You will never get it right the first time
  - New requirements and information will be introduced all the time.
- Incremental analysis and design is simplest
  - Don't try to solve the whole problem at once
  - Pick a starting point, and work from that.
- Good design is user centric
  - You need to know what the users have to say



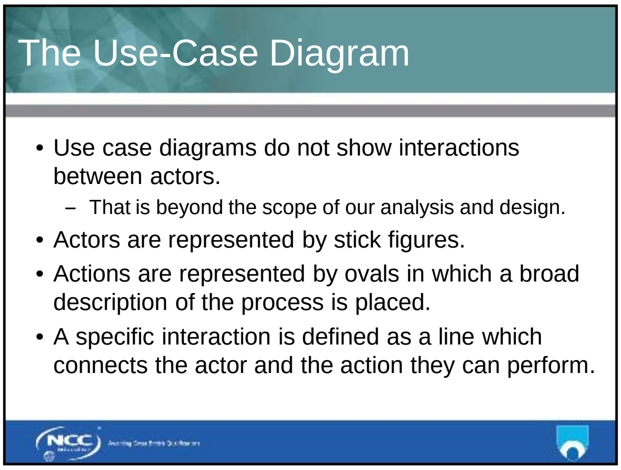
Decomposition

- Understanding any complex system is an exercise in **decomposition**.
  - You must be able to partition the whole into manageable subsections.
- Abstraction is an important part of this process.
  - You need to be able to view the different parts at a suitable level of granularity.
- Incremental development is the process of successively refining your abstractions.



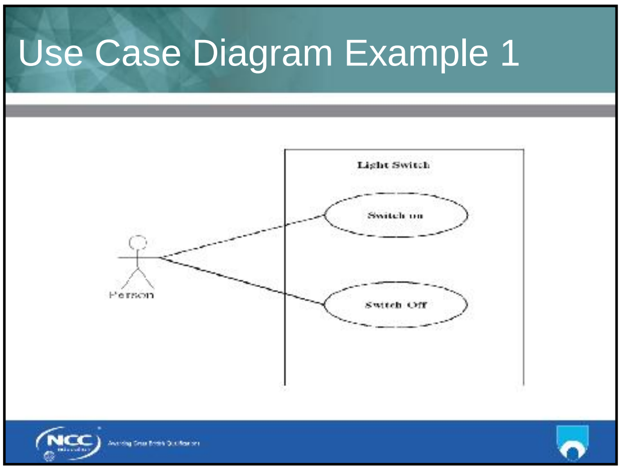
The Use-Case Diagram

- The Use-case diagram is an important tool in managing your abstractions.
  - It allows you to represent the broad interactions between parts of a system.
- It is used to represent the set of functionality that must be supported for each part.
  - Those parts are called **actors**
    - They may be users
    - They may be subsystems

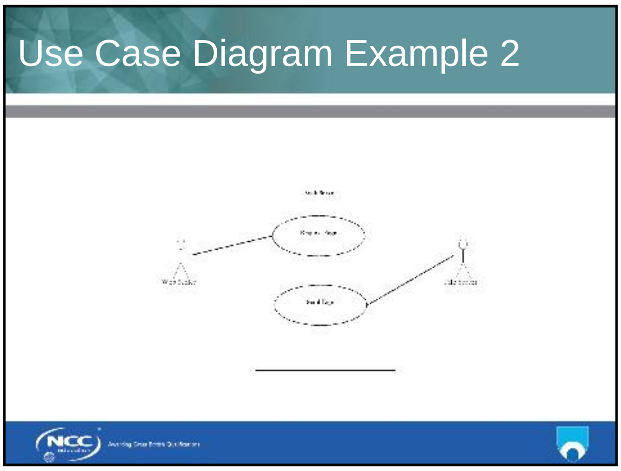


The Use-Case Diagram

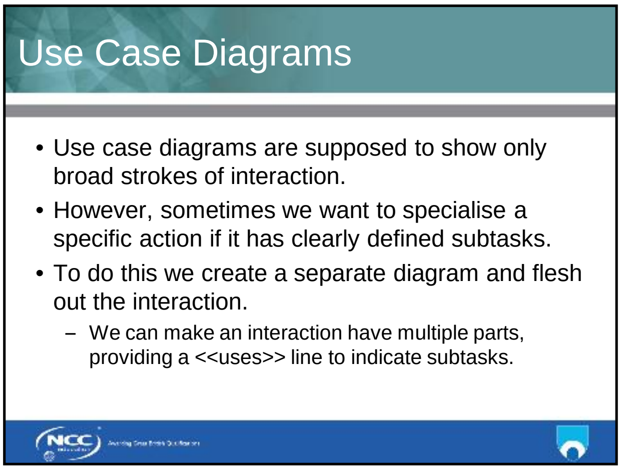
- Use case diagrams do not show interactions between actors.
  - That is beyond the scope of our analysis and design.
- Actors are represented by stick figures.
- Actions are represented by ovals in which a broad description of the process is placed.
- A specific interaction is defined as a line which connects the actor and the action they can perform.



Use Case Diagram Example 1

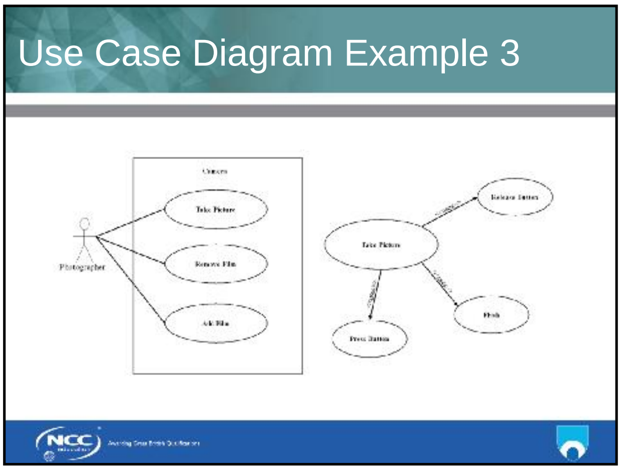


Use Case Diagram Example 2

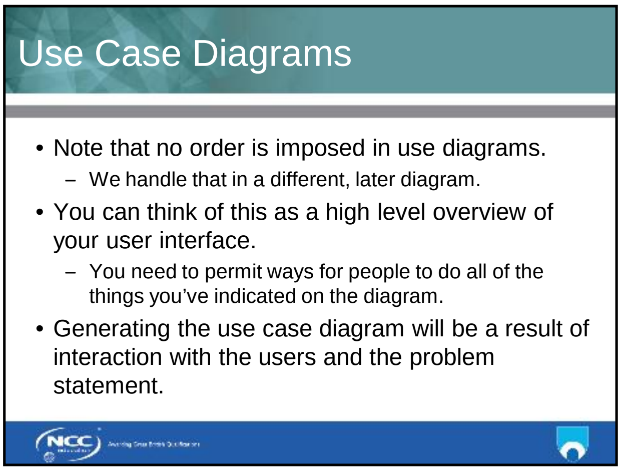


Use Case Diagrams

- Use case diagrams are supposed to show only broad strokes of interaction.
- However, sometimes we want to specialise a specific action if it has clearly defined subtasks.
- To do this we create a separate diagram and flesh out the interaction.
  - We can make an interaction have multiple parts, providing a <<uses>> line to indicate subtasks.

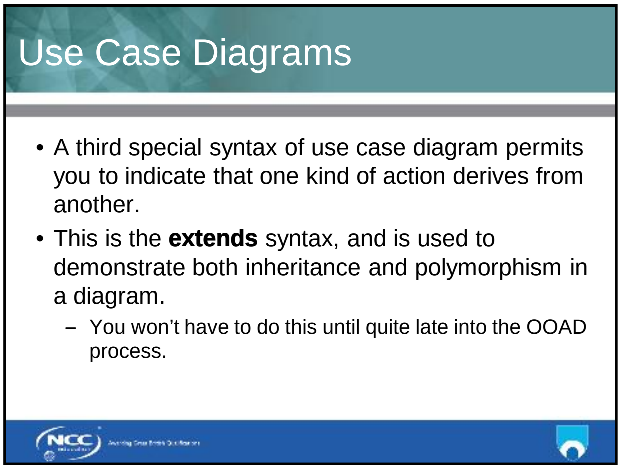


Use Case Diagram Example 3



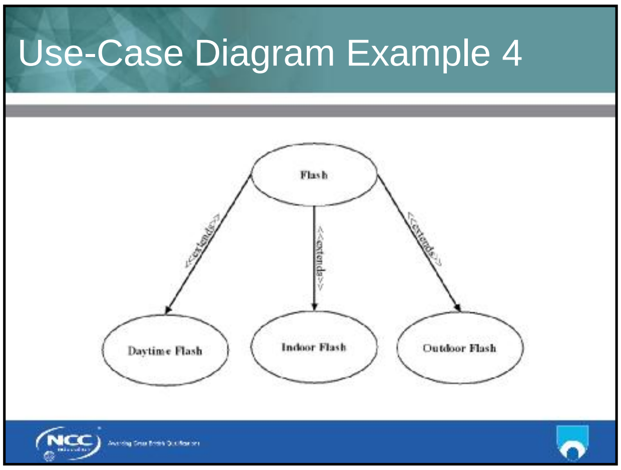
Use Case Diagrams

- Note that no order is imposed in use diagrams.
  - We handle that in a different, later diagram.
- You can think of this as a high level overview of your user interface.
  - You need to permit ways for people to do all of the things you've indicated on the diagram.
- Generating the use case diagram will be a result of interaction with the users and the problem statement.

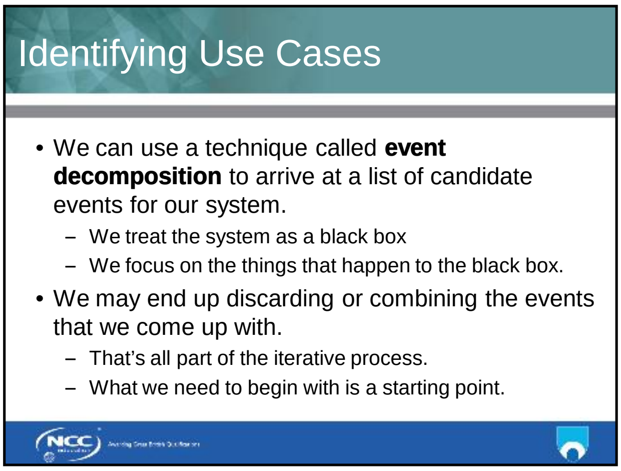


Use Case Diagrams

- A third special syntax of use case diagram permits you to indicate that one kind of action derives from another.
- This is the **extends** syntax, and is used to demonstrate both inheritance and polymorphism in a diagram.
  - You won't have to do this until quite late into the OOAD process.

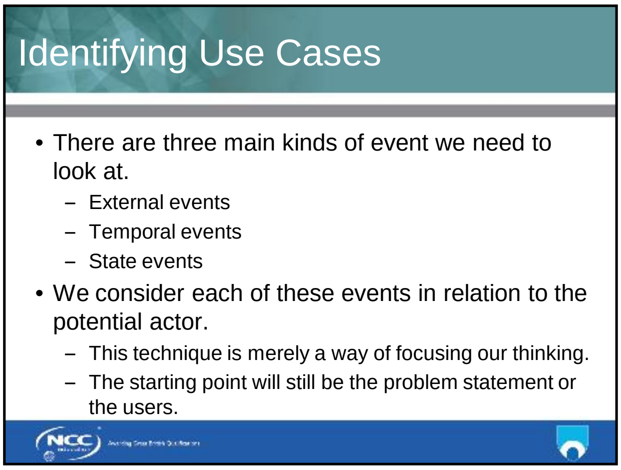


Use-Case Diagram Example 4



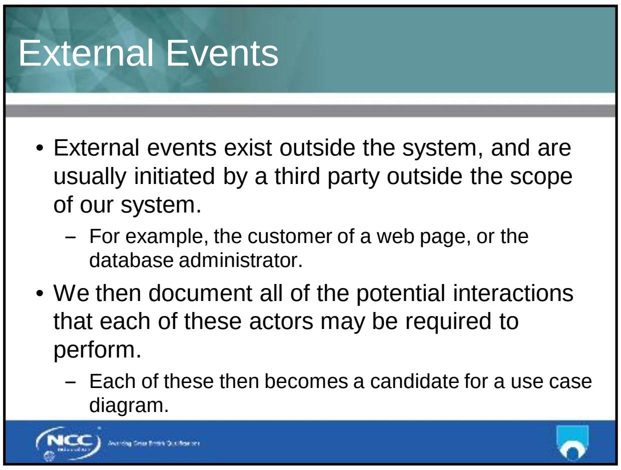
Identifying Use Cases

- We can use a technique called **event decomposition** to arrive at a list of candidate events for our system.
  - We treat the system as a black box
  - We focus on the things that happen to the black box.
- We may end up discarding or combining the events that we come up with.
  - That's all part of the iterative process.
  - What we need to begin with is a starting point.



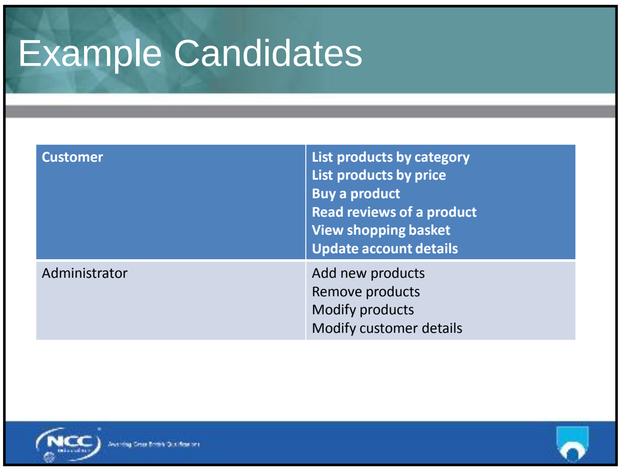
Identifying Use Cases

- There are three main kinds of event we need to look at.
  - External events
  - Temporal events
  - State events
- We consider each of these events in relation to the potential actor.
  - This technique is merely a way of focusing our thinking.
  - The starting point will still be the problem statement or the users.



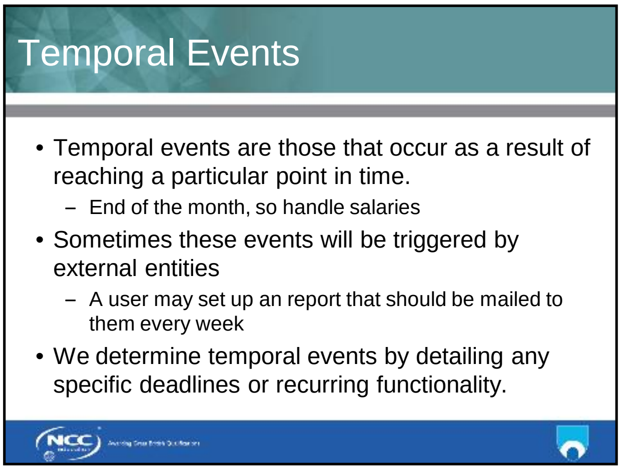
External Events

- External events exist outside the system, and are usually initiated by a third party outside the scope of our system.
  - For example, the customer of a web page, or the database administrator.
- We then document all of the potential interactions that each of these actors may be required to perform.
  - Each of these then becomes a candidate for a use case diagram.



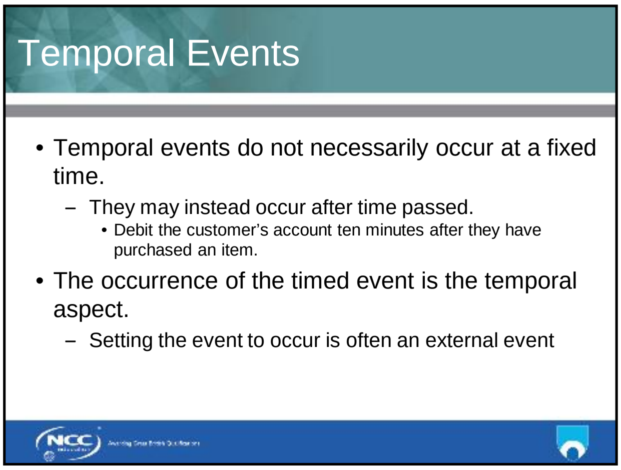
Example Candidates

Customer	List products by category List products by price Buy a product Read reviews of a product View shopping basket Update account details
Administrator	Add new products Remove products Modify products Modify customer details



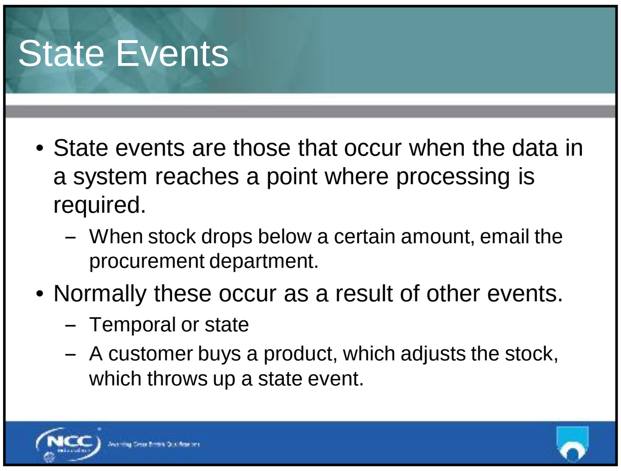
Temporal Events

- Temporal events are those that occur as a result of reaching a particular point in time.
  - End of the month, so handle salaries
- Sometimes these events will be triggered by external entities
  - A user may set up an report that should be mailed to them every week
- We determine temporal events by detailing any specific deadlines or recurring functionality.



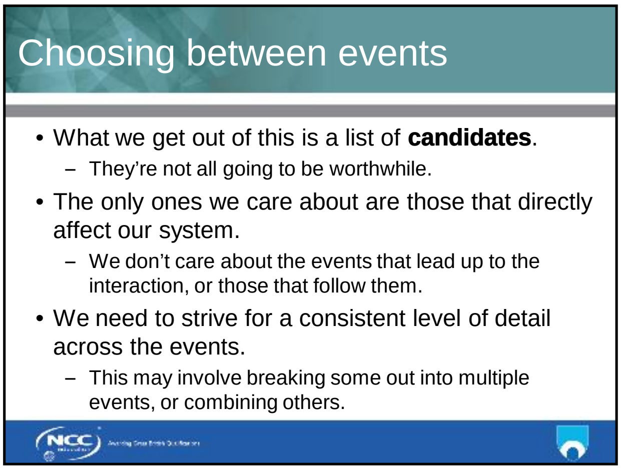
Temporal Events

- Temporal events do not necessarily occur at a fixed time.
  - They may instead occur after time passed.
    - Debit the customer's account ten minutes after they have purchased an item.
- The occurrence of the timed event is the temporal aspect.
  - Setting the event to occur is often an external event



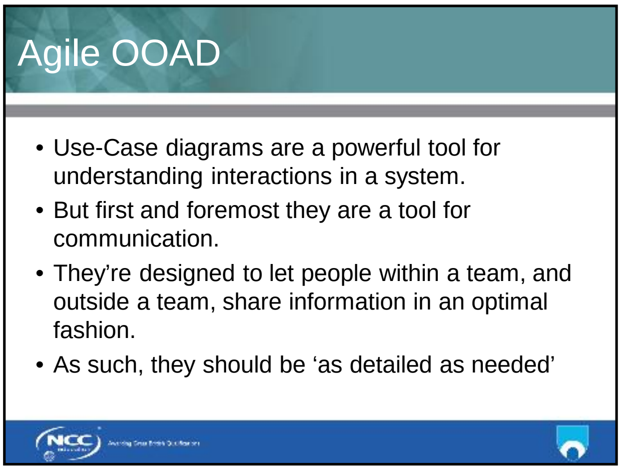
State Events

- State events are those that occur when the data in a system reaches a point where processing is required.
  - When stock drops below a certain amount, email the procurement department.
- Normally these occur as a result of other events.
  - Temporal or state
  - A customer buys a product, which adjusts the stock, which throws up a state event.



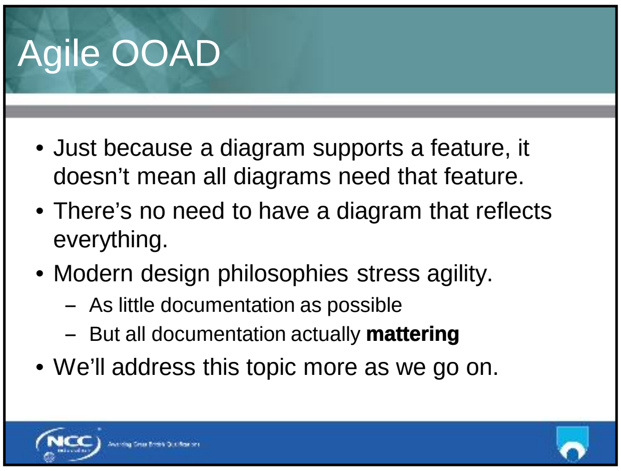
Choosing between events

- What we get out of this is a list of **candidates**.
  - They're not all going to be worthwhile.
- The only ones we care about are those that directly affect our system.
  - We don't care about the events that lead up to the interaction, or those that follow them.
- We need to strive for a consistent level of detail across the events.
  - This may involve breaking some out into multiple events, or combining others.



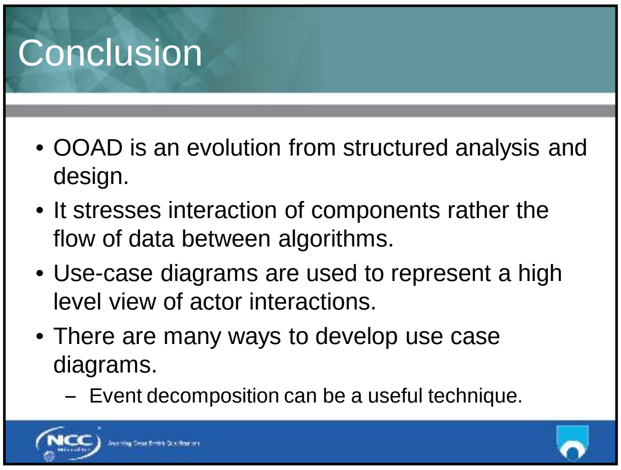
Agile OOAD

- Use-Case diagrams are a powerful tool for understanding interactions in a system.
- But first and foremost they are a tool for communication.
- They're designed to let people within a team, and outside a team, share information in an optimal fashion.
- As such, they should be 'as detailed as needed'



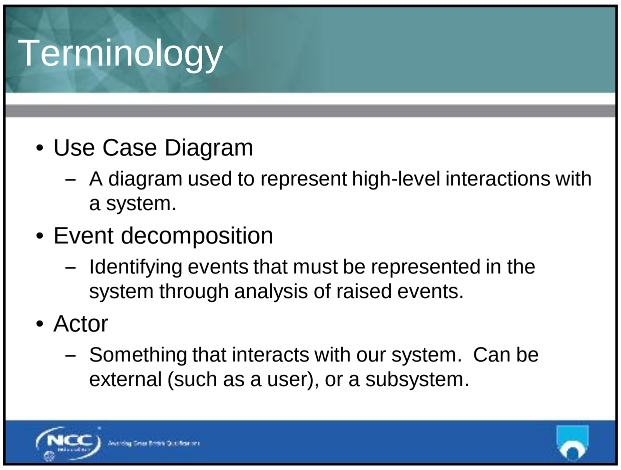
Agile OOAD

- Just because a diagram supports a feature, it doesn't mean all diagrams need that feature.
- There's no need to have a diagram that reflects everything.
- Modern design philosophies stress agility.
  - As little documentation as possible
  - But all documentation actually **mattering**
- We'll address this topic more as we go on.



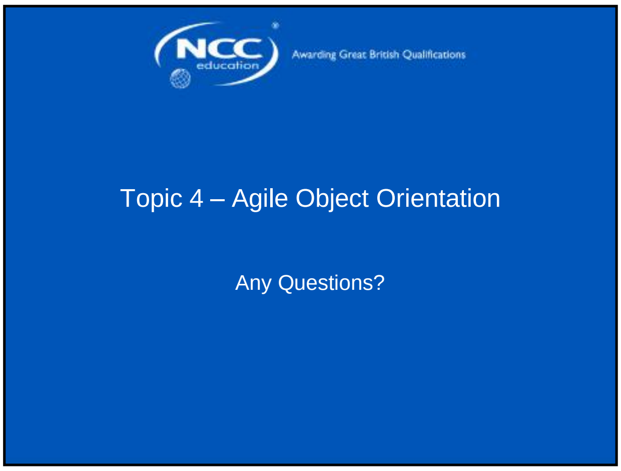
Conclusion

- OOAD is an evolution from structured analysis and design.
- It stresses interaction of components rather the flow of data between algorithms.
- Use-case diagrams are used to represent a high level view of actor interactions.
- There are many ways to develop use case diagrams.
  - Event decomposition can be a useful technique.



Terminology

- Use Case Diagram
  - A diagram used to represent high-level interactions with a system.
- Event decomposition
  - Identifying events that must be represented in the system through analysis of raised events.
- Actor
  - Something that interacts with our system. Can be external (such as a user), or a subsystem.



Awarding Great British Qualifications

Topic 4 – Agile Object Orientation

Any Questions?