Lecture 3 – Managing People (Sommerville Ch. 22)

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Objectives

- To describe simple models of human cognition and their relevance for software managers
- To explain the key issues that determine the success or otherwise of team working
- To discuss the problems of selecting and retaining technical staff
- To introduce the people capability maturity model (P-CMM)

Topics covered

- Limits to thinking
- Group working
- Choosing and keeping people
- The people capability maturity model

People in the process

- People are an organisation's most important assets
- The tasks of a manager are essentially people oriented. Unless there is some understanding of people, management will be unsuccessful
- Software engineering is primarily a cognitive activity. Cognitive limitations effectively limit the software process

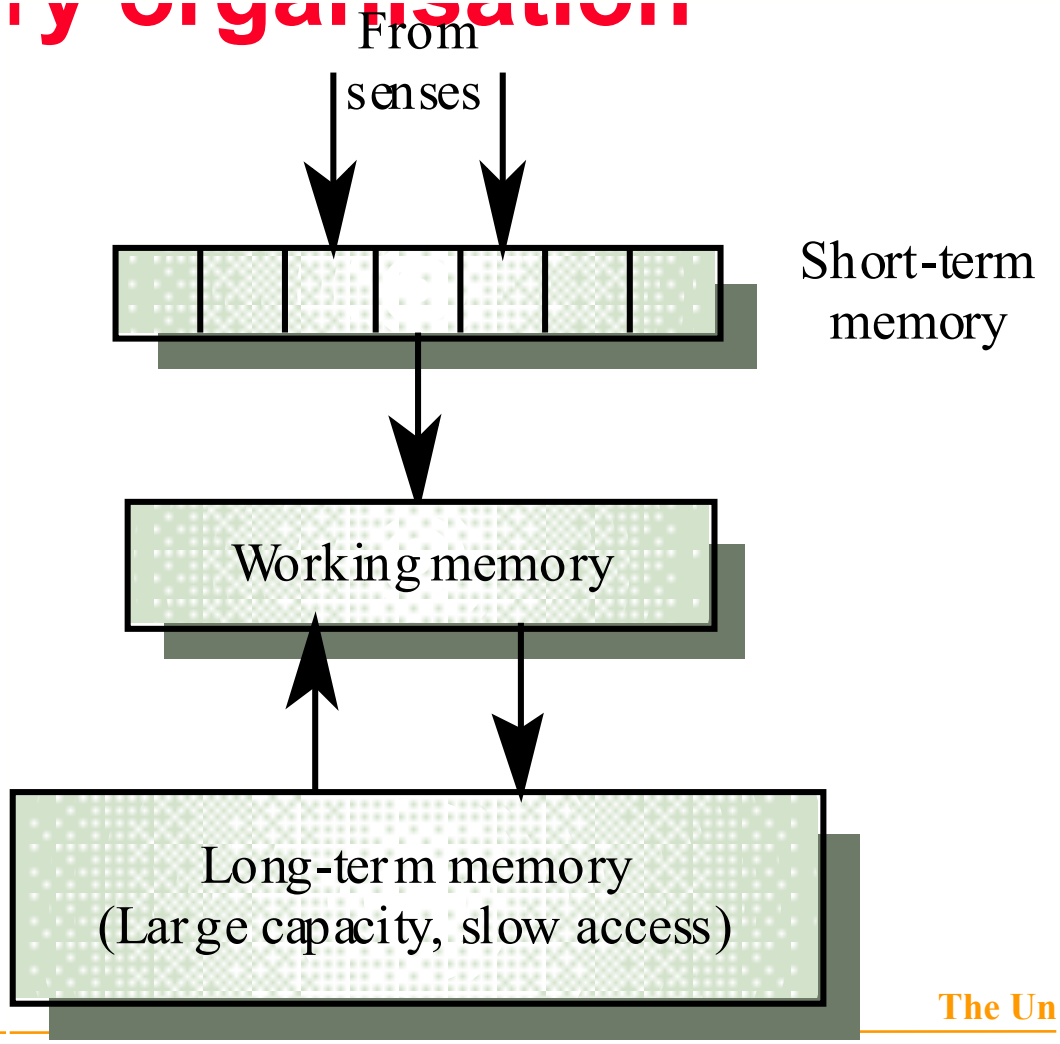
Management activities

- Problem solving (using available people)
- Motivating (people who work on a project)
- Planning (what people are going to do)
- Estimating (how fast people will work)
- Controlling (people's activities)
- Organising (the way in which people work)

Limits to thinking

- People don't all think the same way but everyone is subject to some basic constraints on their thinking due to
  - Memory organisation
  - Knowledge representation
  - Motivation influences
- If we understand these constraints, we can understand how they affect people participating in the software process

Memory organisation



Short-term memory

- Fast access, limited capacity
- 5-7 locations
- Holds 'chunks' of information where the size of a chunk may vary depending on its familiarity
- Fast decay time

Working memory

- Larger capacity, longer access time
- Memory area used to integrate information from short-term memory and long-term memory.
- Relatively fast decay time.

Long-term memory

- Slow access, very large capacity
- Unreliable retrieval mechanism
- Slow but finite decay time - information needs reinforced
- Relatively high threshold - work has to be done to get information into long-term memory.

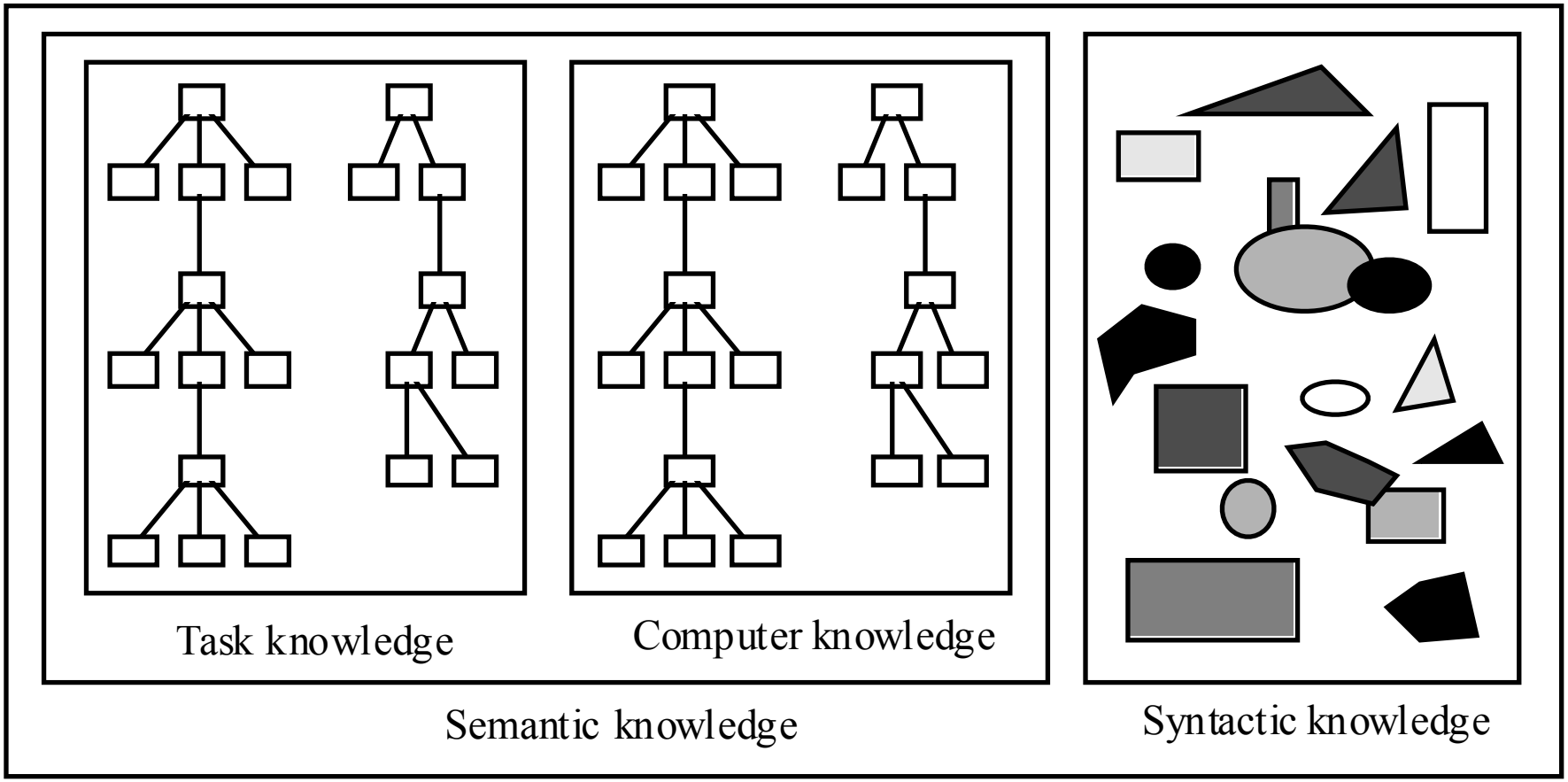
Information transfer

- Problem solving usually requires transfer between short-term memory and working memory
- Information may be lost or corrupted during this transfer
- Information processing occurs in the transfer from short-term to long-term memory

Knowledge modelling

- ***Semantic knowledge*** **knowledge of concepts such as the operation of assignment, concept of parameter passing etc.**
- ***Syntactic knowledge*** **knowledge of details of a representation e.g. an Ada while loop.**
- **Semantic knowledge seems to be stored in a structured, representation independent way.**

Syntactic/semantic knowledge



Knowledge acquisition

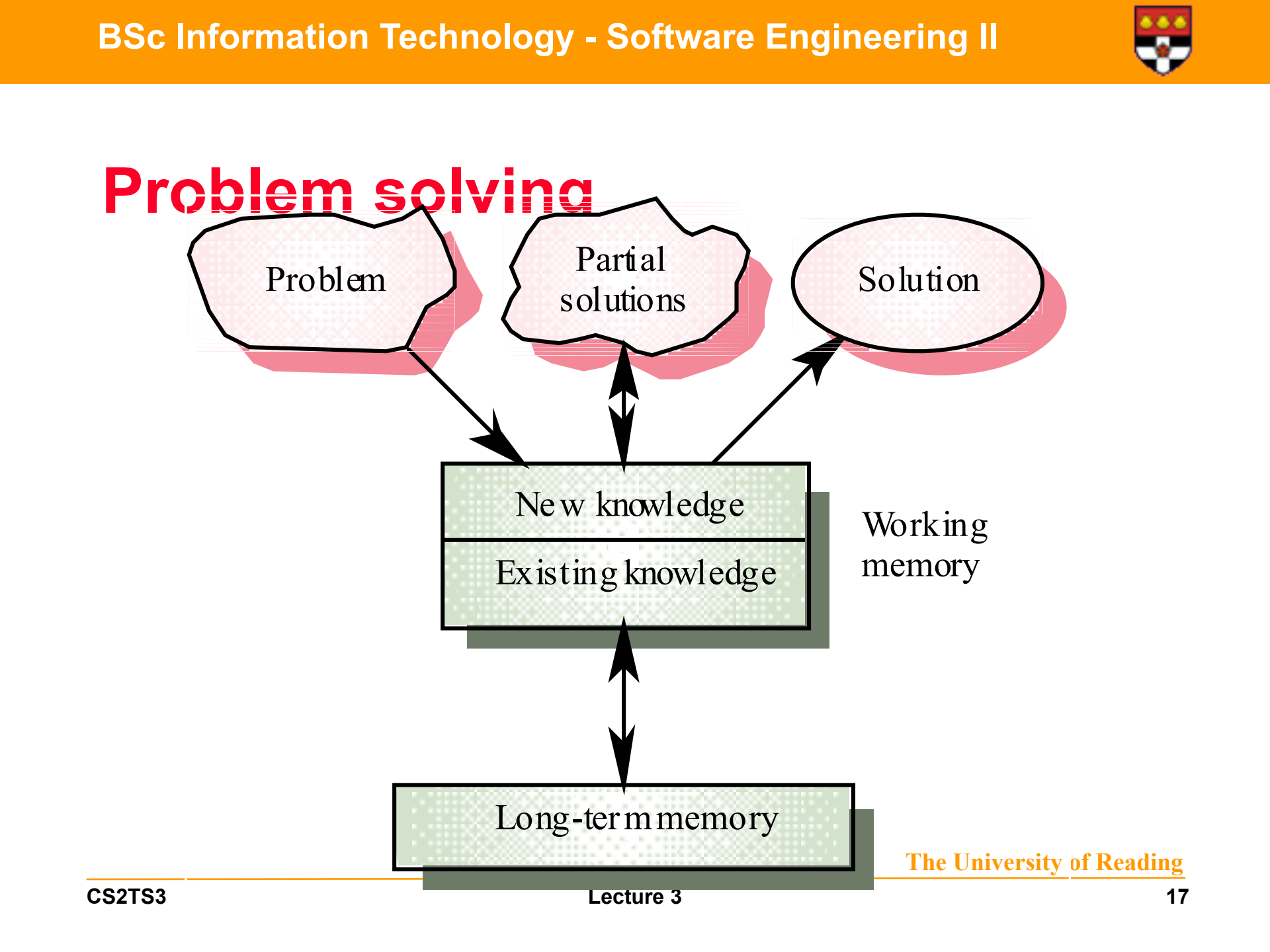
- Semantic knowledge through experience and active learning - the 'ah' factor
- Syntactic knowledge acquired by memorisation.
- New syntactic knowledge can interfere with existing syntactic knowledge.
  - Problems arise for experienced programmers in mixing up syntax of different programming languages

Semantic knowledge

- *Computing concepts* - notion of a writable store, iteration, concept of an object, etc.
- *Task concepts* - principally algorithmic - how to tackle a particular task
- Software development ability is the ability to integrate new knowledge with existing computer and task knowledge and hence derive creative problem solutions
- Thus, problem solving is language independent

Problem solving

- Requires the integration of different types of knowledge (computer, task, domain, organisation)
- Development of a semantic model of the solution and testing of this model against the problem
- Representation of this model in an appropriate notation or programming language

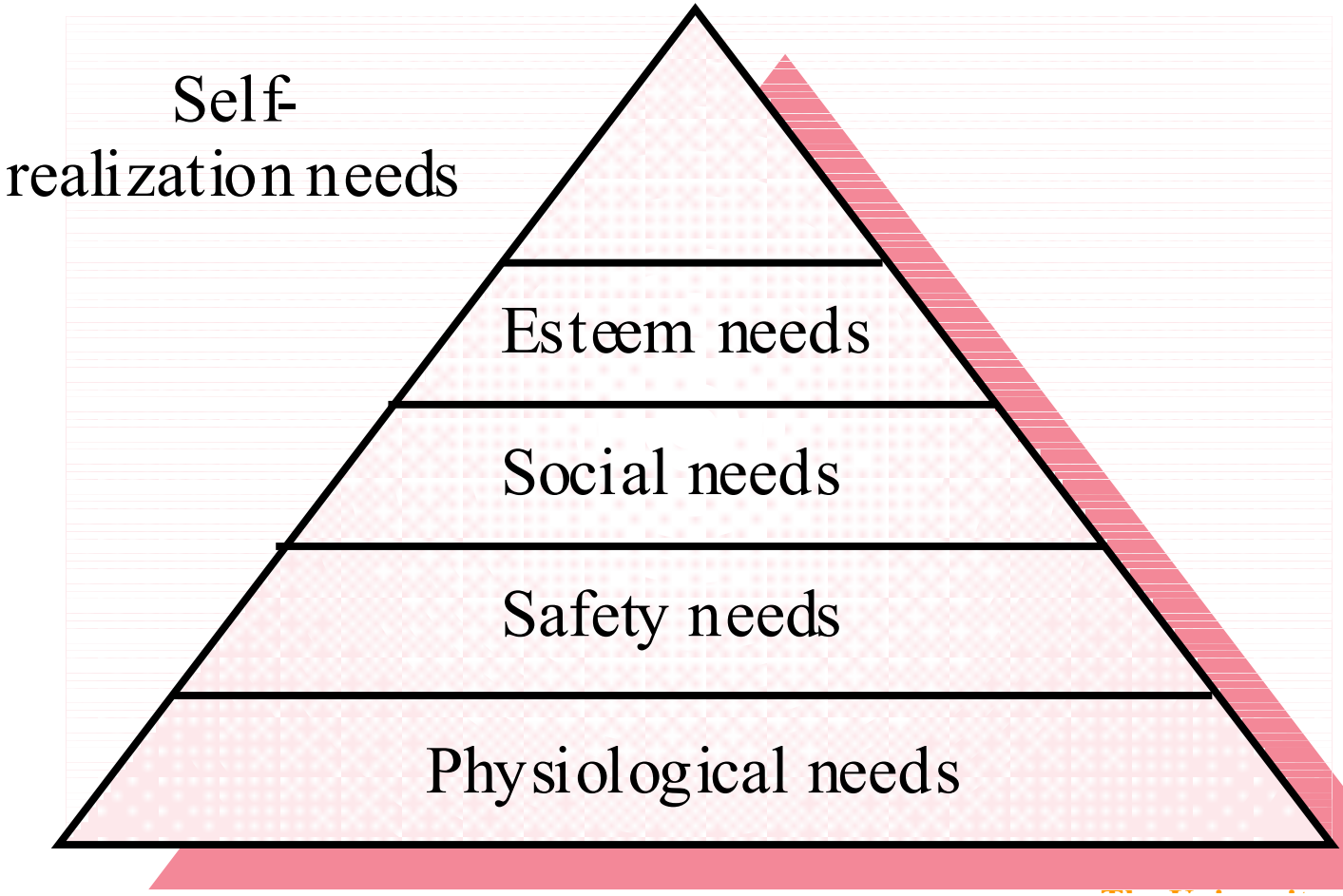


Problem solving

Motivation

- An important role of a manager is to motivate the people working on a project
- Motivation is a complex issue but it appears that their are different types of motivation based on
  - Basic needs (e.g. food, sleep, etc.)
  - Personal needs (e.g. respect, self-esteem)
  - Social needs (e.g. to be accepted as part of a group)

Human needs hierarchy



Motivating people

- Motivations depend on satisfying needs
- It can be assumed that physiological and safety needs are satisfied
- Social, esteem and self-realization needs are most significant from a managerial viewpoint

Need satisfaction

- Social
  - Provide communal facilities
  - Allow informal communications
- Esteem
  - Recognition of achievements
  - Appropriate rewards
- Self-realization
  - Training - people want to learn more
  - Responsibility

Personality types

- The needs hierarchy is almost certainly an over-simplification
- Motivation should also take into account different personality types:
  - Task-oriented
  - Self-oriented
  - Interaction-oriented

Personality types

- **Task-oriented.**
  - **The motivation for doing the work is the work itself**
- **Self-oriented.**
  - **The work is a means to an end which is the achievement of individual goals - e.g. to get rich, to play tennis, to travel etc.**
- **Interaction-oriented**
  - **The principal motivation is the presence and actions of co-workers. People go to work because they like to go to work**

Motivation balance

- Individual motivations are made up of elements of each class
- Balance can change depending on personal circumstances and external events
- However, people are not just motivated by personal factors but also by being part of a group and culture.
- People go to work because they are motivated by the people that they work with

Group working

- Most software engineering is a group activity
  - The development schedule for most non-trivial software projects is such that they cannot be completed by one person working alone
- Group interaction is a key determinant of group performance
- Flexibility in group composition is limited
  - Managers must do the best they can with available people

Group composition

- Group composed of members who share the same motivation can be problematic
  - Task-oriented - everyone wants to do their own thing
  - Self-oriented - everyone wants to be the boss
  - Interaction-oriented - too much chatting, not enough work
- An effective group has a balance of all types
- Can be difficult to achieve because most engineers are task-oriented
- Need for all members to be involved in decisions which affect the group

Group leadership

- Leadership depends on respect not titular status
- There may be both a technical and an administrative leader
- Democratic leadership is more effective that autocratic leadership
- A career path based on technical competence should be supported

Group cohesiveness

- In a cohesive group, members consider the group to be more important than any individual in it
- Advantages of a cohesive group are:
  - Group quality standards can be developed
  - Group members work closely together so inhibitions caused by ignorance are reduced
  - Team members learn from each other and get to know each other's work
  - Egoless programming where members strive to improve each other's programs can be practised

Developing cohesiveness

- Cohesiveness is influenced by factors such as the organisational culture and the personalities in the group
- Cohesiveness can be encouraged through
  - Social events
  - Developing a group identity and territory
  - Explicit team-building activities
- Openness with information is a simple way of ensuring all group members feel part of the group

Group loyalties

- Group members tend to be loyal to cohesive groups
- 'Groupthink' is preservation of group irrespective of technical or organizational considerations
- Management should act positively to avoid groupthink by forcing external involvement with each group

Group communications

- Good communications are essential for effective group working
- Information must be exchanged on the status of work, design decisions and changes to previous decisions
- Good communications also strengthens group cohesion as it promotes understanding

Group communications

- Status of group members
  - Higher status members tend to dominate conversations
- Personalities in groups
  - Too many people of the same personality type can be a problem
- Sexual composition of group
  - Mixed-sex groups tend to communicate better
- Communication channels
  - Communications channelled though a central coordinator tend to be ineffective

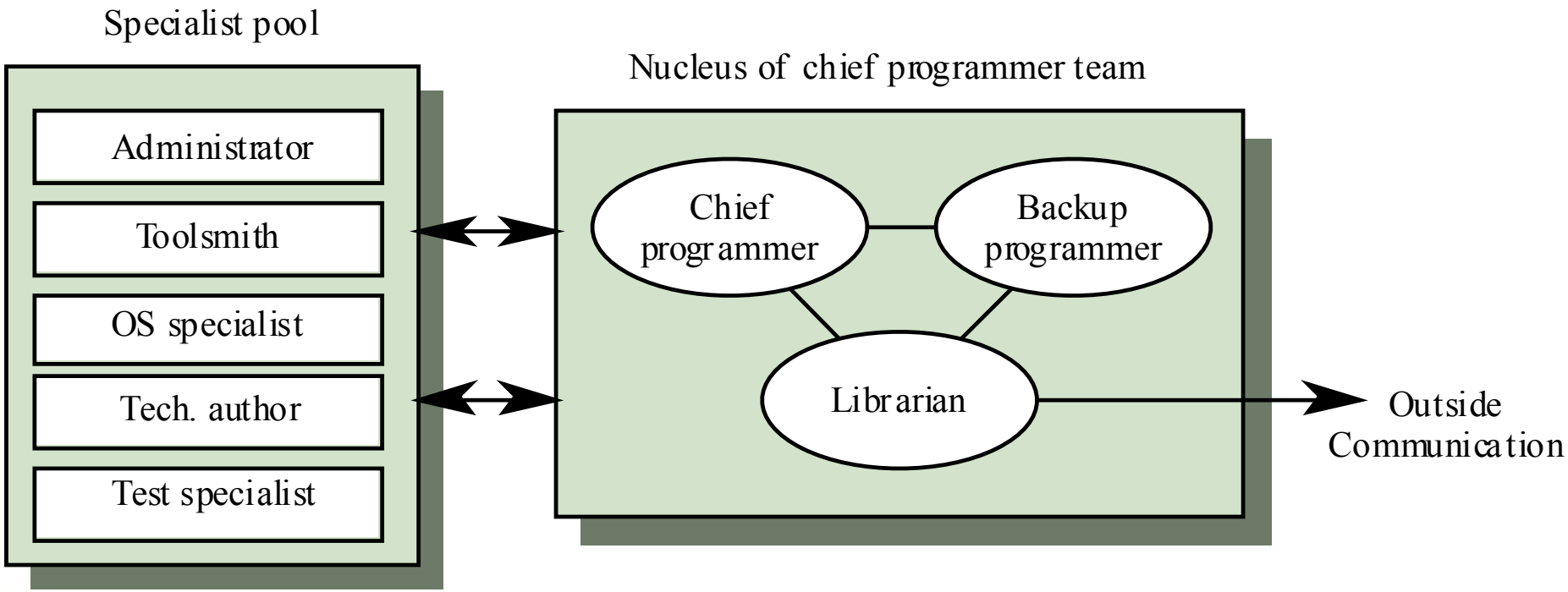
Group organisation

- Software engineering group sizes should be relatively small (< 8 members)
- Break big projects down into multiple smaller projects
- Small teams may be organised in an informal, democratic way
- Chief programmer teams try to make the most effective use of skills and experience

Democratic team organisation

- The group acts as a whole and comes to a consensus on decisions affecting the system
- The group leader serves as the external interface of the group but does not allocate specific work items
- Rather, work is discussed by the group as a whole and tasks are allocated according to ability and experience
- This approach is successful for groups where all members are experienced and competent

Chief programmer teams



Chief programmer teams

- Consist of a kernel of specialists helped by others added to the project as required
- The motivation behind their development is the wide difference in ability in different programmers
- Chief programmer teams provide a supporting environment for very able programmers to be responsible for most of the system development

Problems

- This chief programmer approach, in different forms, has undoubtedly been successful
- However, it suffers from a number of problems
  - Talented designers and programmers are hard to find. Without exception people in these roles, the approach will fail
  - Other group members may resent the chief programmer taking the credit for success so may deliberately undermine his/her role
  - High project risk as the project will fail if both the chief and deputy programmer are unavailable
  - Organisational structures and grades may be unable to accommodate this type of group

Choosing and keeping people

- Choosing people to work on a project is a major managerial responsibility
- Appointment decisions are usually based on
  - information provided by the candidate (their resumé or CV)
  - information gained at an interview
  - recommendations from other people who know the candidate
- Some companies use psychological or aptitude tests
  - There is no agreement on whether or not these tests are actually useful

Working environments

- Physical workplace provision has an important effect on individual productivity and satisfaction
  - Comfort
  - Privacy
  - Facilities
- Health and safety considerations must be taken into account
  - Lighting
  - Heating
  - Furniture

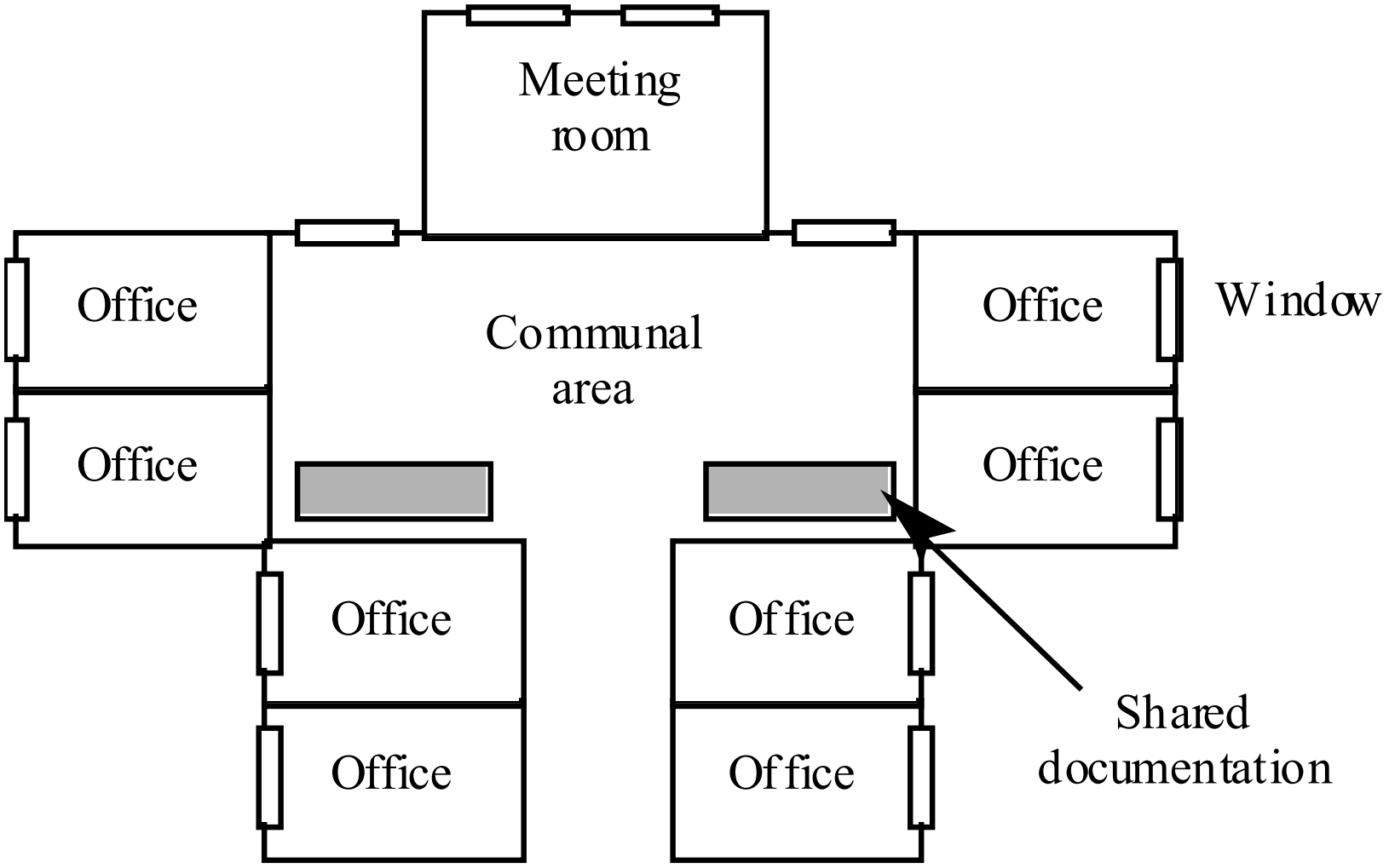
Environmental factors

- Privacy - each engineer requires an area for uninterrupted work
- Outside awareness - people prefer to work in natural light
- Personalization - individuals adopt different working practices and like to organize their environment in different ways

Workspace organisation

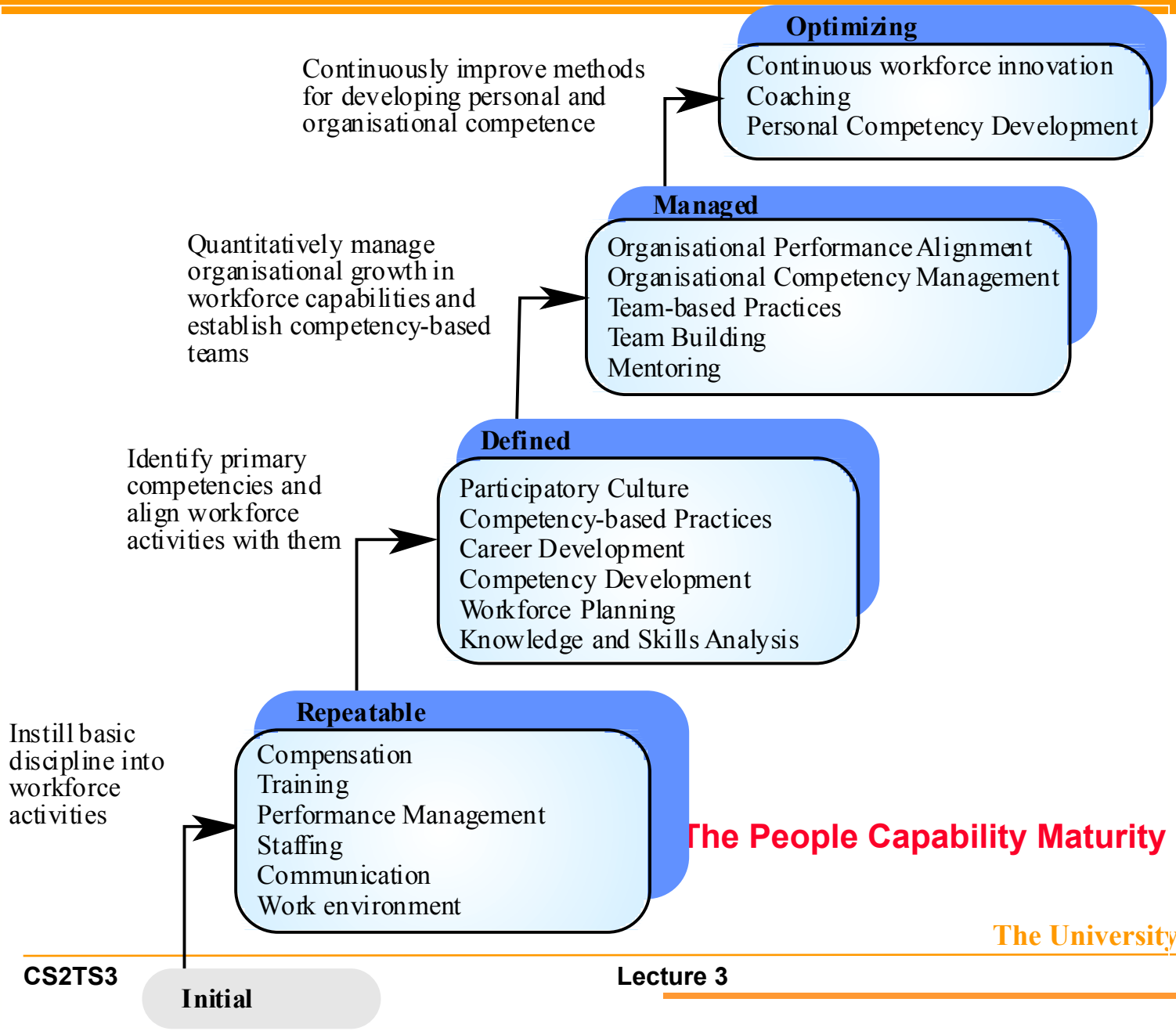
- Workspaces should provide private spaces where people can work without interruption
  - Providing individual offices for staff has been shown to increase productivity
- However, teams working together also require spaces where formal and informal meetings can be held

Office layout



The People Capability Maturity Model

- Intended as a framework for managing the development of people involved in software development
- Five stage model
  - Initial. Ad-hoc people management
  - Repeatable. Policies developed for capability improvement
  - Defined. Standardised people management across the organisation
  - Managed. Quantitative goals for people management in place
  - Optimizing. Continuous focus on improving individual competence and workforce motivation



The People Capability Maturity Model

P-CMM Objectives

- To improve organisational capability by improving workforce capability
- To ensure that software development capability is not reliant on a small number of individuals
- To align the motivation of individuals with that of the organisation
- To help retain people with critical knowledge and skills

Key points

- Managers must have some understanding of human factors to avoid making unrealistic demands on people
- Problem solving involves integrating information from long-term memory with new information from short-term memory
- Staff selection factors include education, domain experience, adaptability and personality

Key points

- Software development groups should be small and cohesive
- Group communications are affected by status, group size, group organisation and the sexual composition of the group
- The working environment has a significant effect on productivity
- The People Capability Maturity Model is a framework for improving the capabilities of staff in an organisation