



CAE

CPL Theory Human Factors (CHUF)

CHUF 6 – Decision Making



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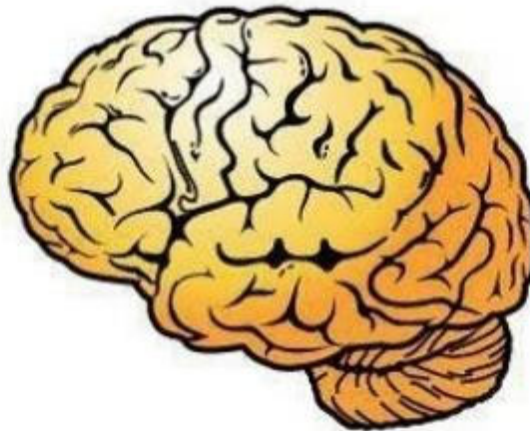
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THE DECISION MAKING PROCESS

The Decision Making Process

- The brain is an extremely complex organ – capable of processing **millions of items of information**

THE BRAIN IS THE MOST IMPORTANT
ORGAN YOU HAVE



ACCORDING TO THE BRAIN.

- However, very little is known about **how** that information is **processed** or **where** it is **stored**

The Decision Making Process

- One model of the decision making process has 4 steps:

1. Sensation

- Information is taken from the eyes, ears, vestibular and proprioceptive systems
- *E.g. Light entering the eye stimulates the rods and cones, sending impulses to the brain*

2. Perception

- Brain interprets the information from these sources leading to “situational awareness”
- *E.g. The brain perceives this image as a converging aircraft stationary in the windscreen*

3. Decision

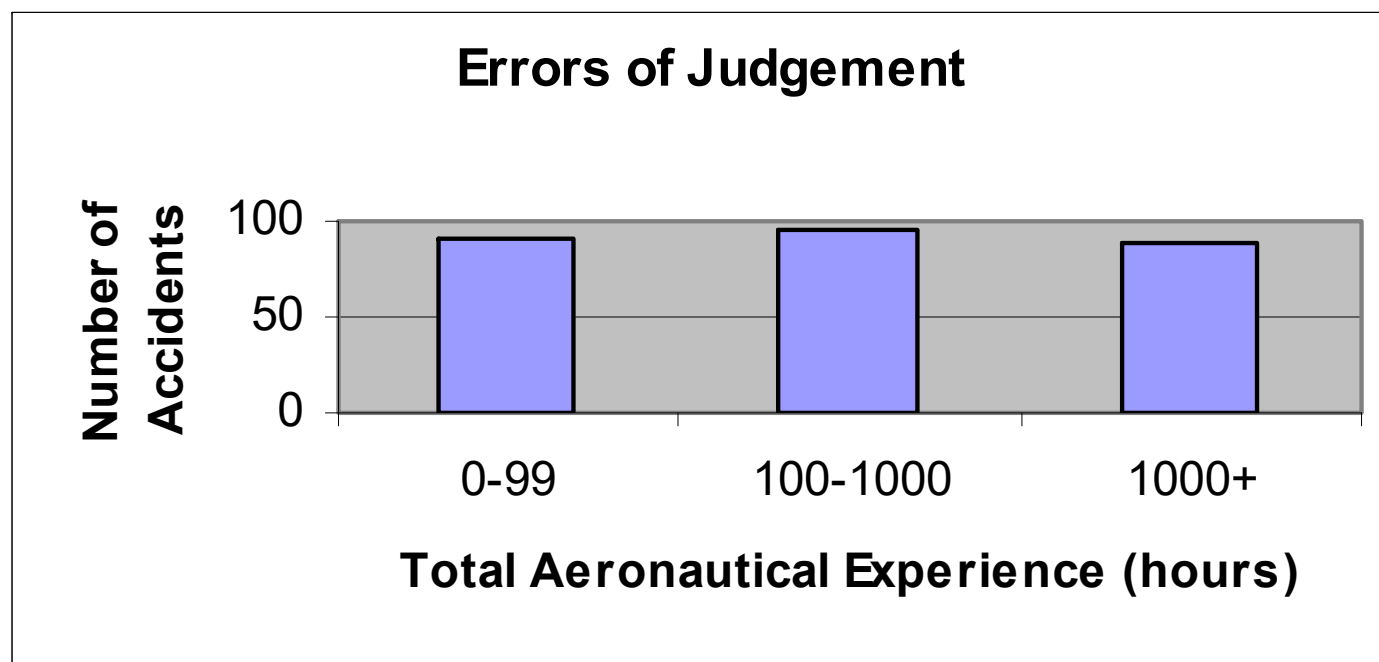
- After comparison with items in the memory, a decision is made
- *E.g. Through your long term memory, you realise this indicates danger of collision. You decide to change your cruising level and continue watching the other aircraft*

4. Response

- Acting or not acting on the decision
- *E.g. You take action to initiate the level change and advise appropriate stations of your intentions*

The Decision Making Process

- Remember that aircraft accidents caused by poor decisions do not necessarily occur with inexperienced pilots only



- Even **experienced pilots can still make errors of judgement**
- Whilst they have a greater amount of knowledge and experience stored in their long term memory, if information is misinterpreted at the sensation or perception stage then the decision making process is compromised!

The Decision Making Process – Effective Judgement

- A good pilot will not rush into a decision – the following steps should be taken:

Consider the Facts

- Do not act until you **understand the situation** – remember that misinterpretation can occur at the perception stage!

Define the Problem

- Once you have identified all the facts, **correctly identify** the problem
- Note that different problems may cause the same symptoms

Consider Solutions

- Carefully choose the **most appropriate** solution

Act

- Execute your selected solution

Consider the Result

- Did it work? Can you improve on the result in future?
- Do you need to try something else? Repeat the judgement process.

The Decision Making Process – Effective Judgement

- One hazard of rushing into a decision is **confirmation bias**
- This is the tendency of pilots to “**jump to a conclusion**” and then disregard any other information that may indicate that conclusion is incorrect

Example: Air Florida Flight 90 – Washington 1982

- The B737 was delayed on the ground in snowy conditions – allowing amounts of ice to accumulate on the airframe
- The captain was aware of this, but did not want to delay further
- Take-off was initiated and the aircraft appeared to be producing less power than the instruments were indicating
- The FO raised this but was dismissed by the captain – who has decided that everything was normal seeing as though the instrument indications were showing normal engine



The Decision Making Process – Effective Judgement

- Another hazard is known as the **false hypothesis**
- This is a **mistaken assumption** and is hazardous as the pilot is so **set in their belief** that they will reject the suggestions of other crew members
- A false hypothesis is likely to occur with (Bob Tait pp 91):

High Expectancy

- If we expect one thing to occur, but another happens, we act on what we expected

Diverted Attention

- When we become pre-occupied with one problem, we assume all other items are OK

Following a period of High Concentration

- Tendency to relax and think there are no more hazards after an intense period

Motor Memory/Environmental Capture

- A particular action or motor skills is usually associated with a particular phase of flight
- This makes it easy for us to assume a particular action has been completed when we reach a certain stage

MEMORY

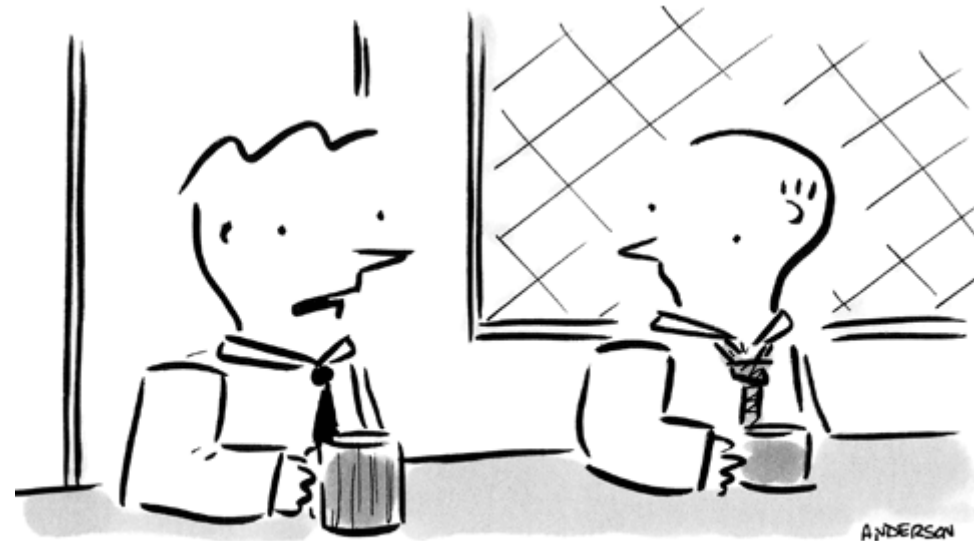
Memory

- Memory plays an important part in the decision making process
- Our memory can be divided into three components:

1. Sensory Memory

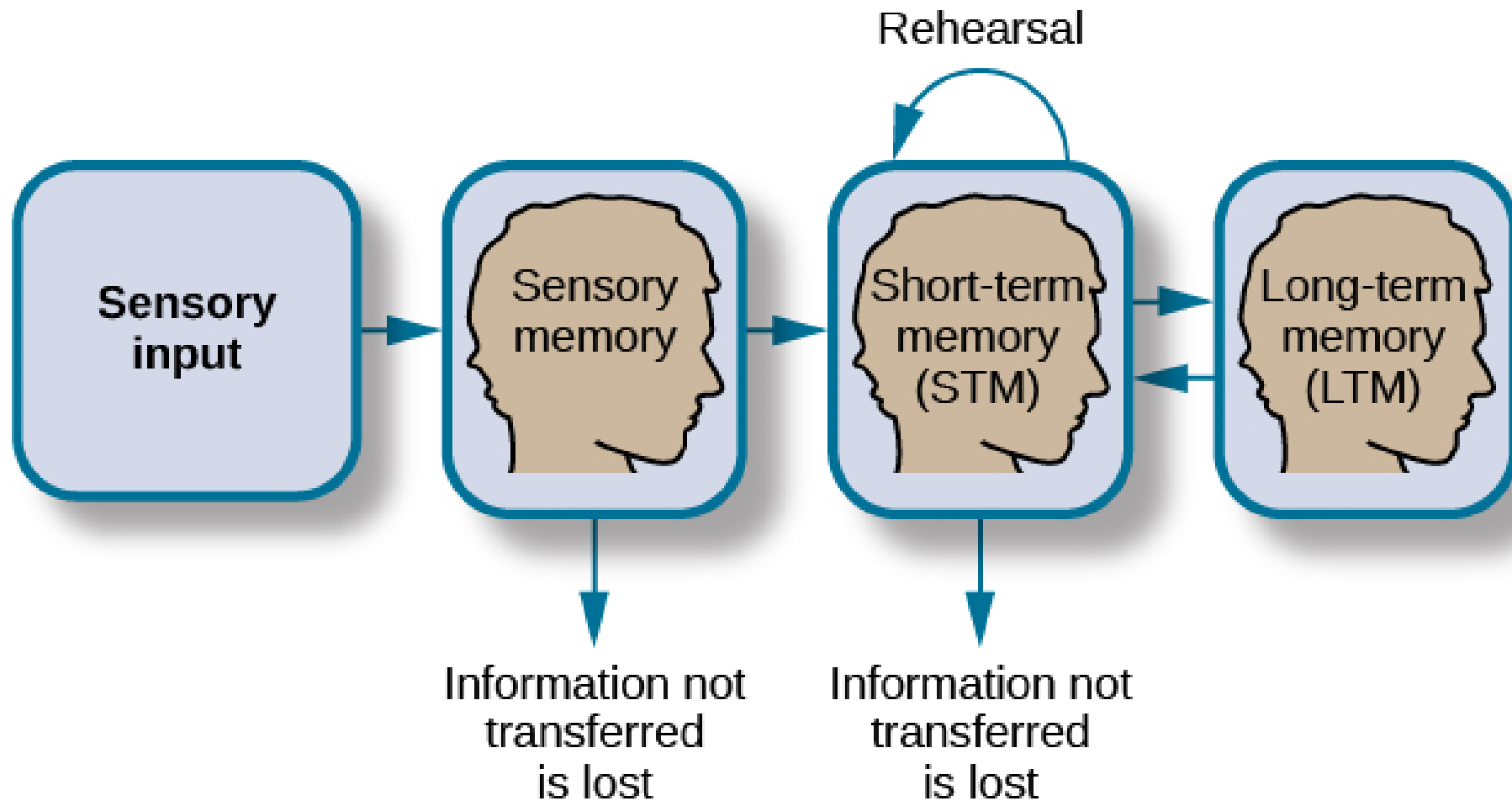
2. Short Term Memory

3. Long Term Memory



"I've got a photographic memory, but everything's out of focus."

Memory



Memory – Sensory Memory

- Information from our senses is first directed to the sensory memory
- Here, the information is sorted and:
 1. Is used to trigger reflexes
 2. Is directed to subconscious actions
 3. Passed on to the short term memory for further attention
 4. Discarded
- The sensory memory is constantly being used and can only hold any one item for a very short time
- **Visual** information is held for about **0.5 to 1 second**
- **Auditory** information is held for about **4 to 8 seconds**

Memory – Short Term Memory

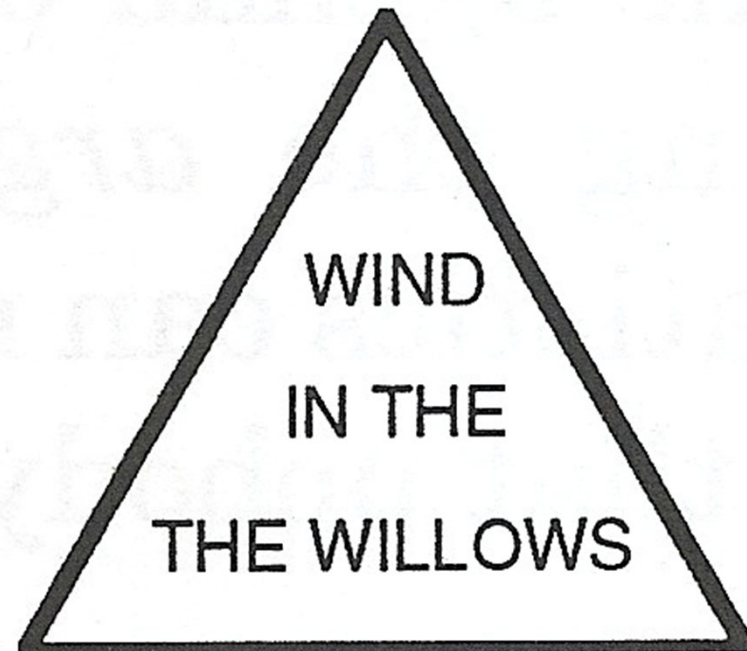
- The short term memory can hold about **7 items** of information for about **30 seconds**
- Recalling items may be easier if the “**chunking**” method is used
- This means we **group pieces of information together** so there are less total items to recall

E.g. The number 98824881

- If you were to recall this as “9 – 8 – 8 – 2 – 4 – 8 – 8 – 1” there are 8 items
- If you chunk the 8s together: “9 – 88 – 2 – 4 – 88 – 1” there are only 6 items
- The short term memory is almost entirely **acoustic**
- This means that **information is stored as sounds** rather than mental pictures
- Despite its short duration, **the short term memory is almost error free**

Memory – Long Term Memory

- The long term memory can hold an **unlimited number** of items for a time ranging from **minutes to an entire life**
- Unlike the short term memory, long term memory can have significant **error**
- When new information enters the brain, it may try to associate or “match” this information with that already stored in the long term memory
- Sometimes, **the brain may assume** the two pieces of information are the same, even though there are slight differences
- This tendency is called **mind-set** – the brain **believes what it wants to believe**



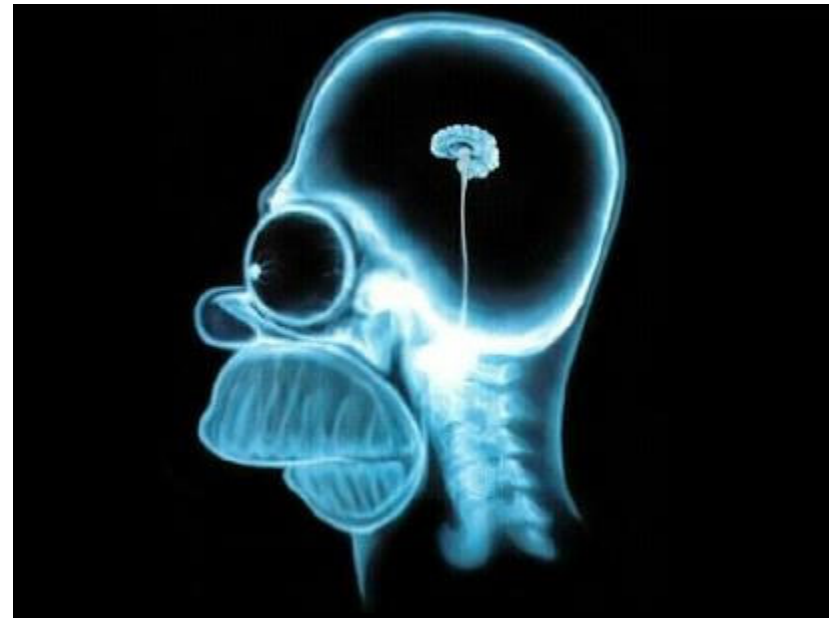
Memory – Long Term Memory

- The long term memory organises items by **association** – it associates new information with information already stored
- This is why we find it easier to learn when we “**proceed from the known to the unknown**”
- The long term memory can be divided into several categories:

1. Semantic Memory

2. Episodic Memory

3. Motor Skills Memory



Memory – Long Term Memory (Semantic Memory)

➤ Assigns meaning to:

1. Symbols

2. Codes

3. Words

➤ Allows us to take in information in an **abbreviated** and often **visual format**



E.g. When we see this sign in a public place, our semantic memory instantly associates this symbol with a bathrooms/toilets

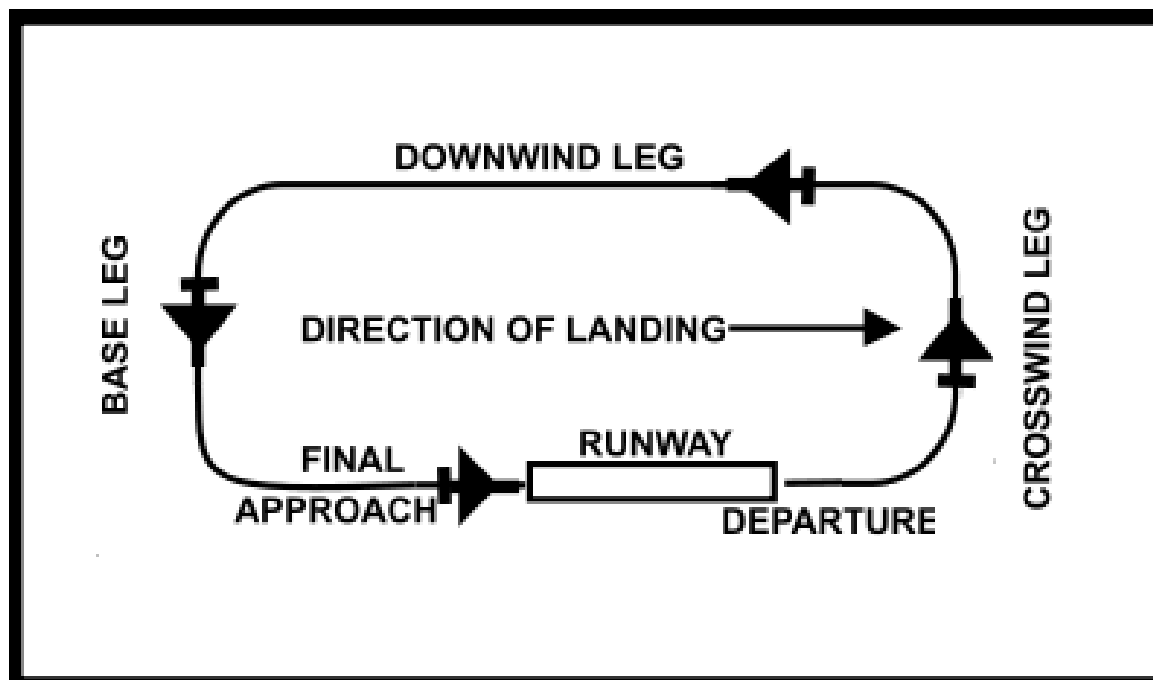
Memory – Long Term Memory (Episodic Memory)

- Contains past events which have occurred along with their outcomes
- “The last time I did this, that happened”
- Episodic memory allows us to **learn from our experiences**



Memory – Long Term Memory (Motor Skills Memory)

- Through **training and practice**, complex tasks can be linked together to form **skills**
- Although these tasks may initially require large amounts of concentration, once they have been learnt, very little conscious effort is required to perform these **motor skills** and the brain is free to concentrate on other items
- **Motor skills** are also called **motor programs** and can be performed **subconsciously**
- Because they are stored as a set of automatic actions, **errors are rare**
- The **most likely error** to occur is that you will **initiate the incorrect motor skill** rather than incorrectly perform the correct motor skill



LIMITATIONS OF INFORMATION PROCESSING

Limitations of Information Processing

- Even though it is possible to do two things at once, we will usually focus more on one task while we give the other less attention
- This indicates that humans have a **limited attention range** or attention span
- As stress on the pilot increases:
 1. **The rate of information processing increases**
 2. **The range of attention decreases – we can focus on less items!**
- Alternatively, if the pilot is bored:
 1. **The rate of information processing decreases**
 2. **The range of attention increases – our minds wander to think about things other than the task at hand**

Limitations of Information Processing

- Our attention can be either **selective** or **divided**

Selective

- When **all of our attention is focused on a specific task** at hand
- All irrelevant data is excluded
- When under stress, we tend to adopt this mode and deal with one specific task before moving onto the next – known as “**selective sequential**” attention

Divided

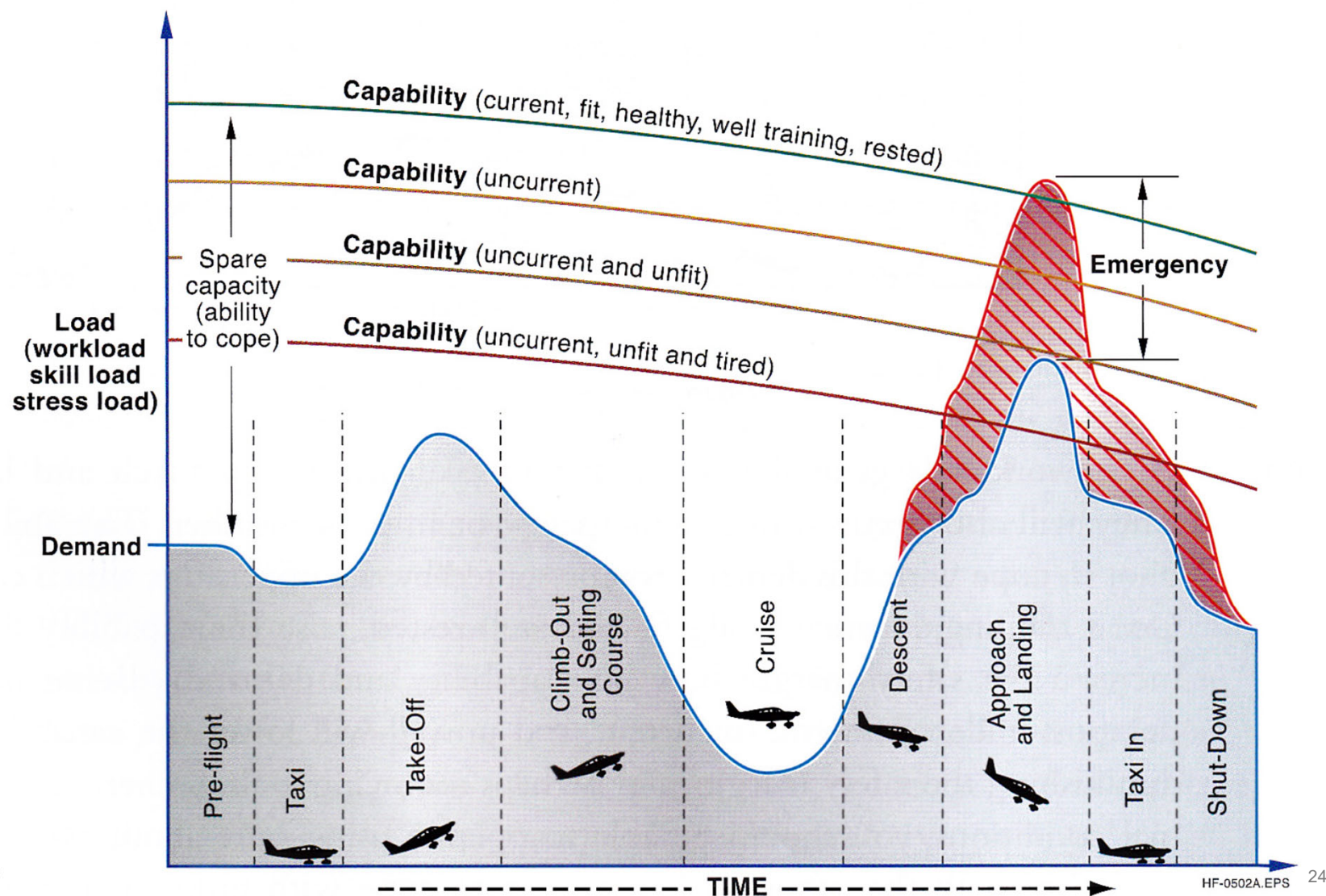
- When our **attention is focused on separate tasks simultaneously**
- We use this mode when **scanning** e.g. visual scanning or scan of flight instruments
- This is usually accomplished by rapidly moving on from one item to the next – known as “**divided sequential**” attention

Limitations of Information Processing

- Our ability to concentrate on tasks is limited by our **mental capacity**
- In the aviation environment, we must have sufficient **spare mental capacity** to deal with emergencies
- If there is too much demand, the brain will begin “load shedding” and begin removing items from the cycle of attention



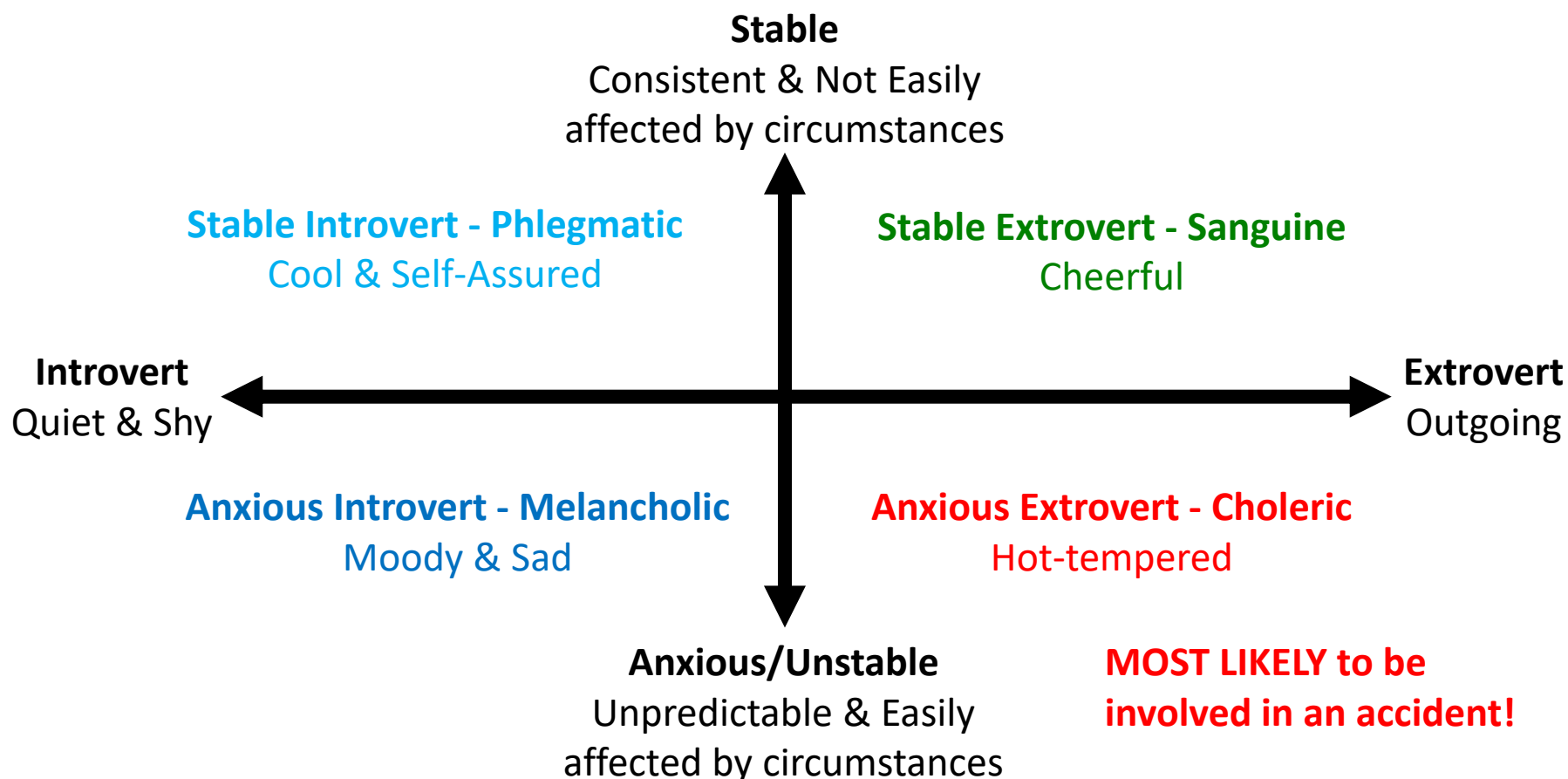
Limitations of Information Processing



PERSONALITY & DECISION MAKING

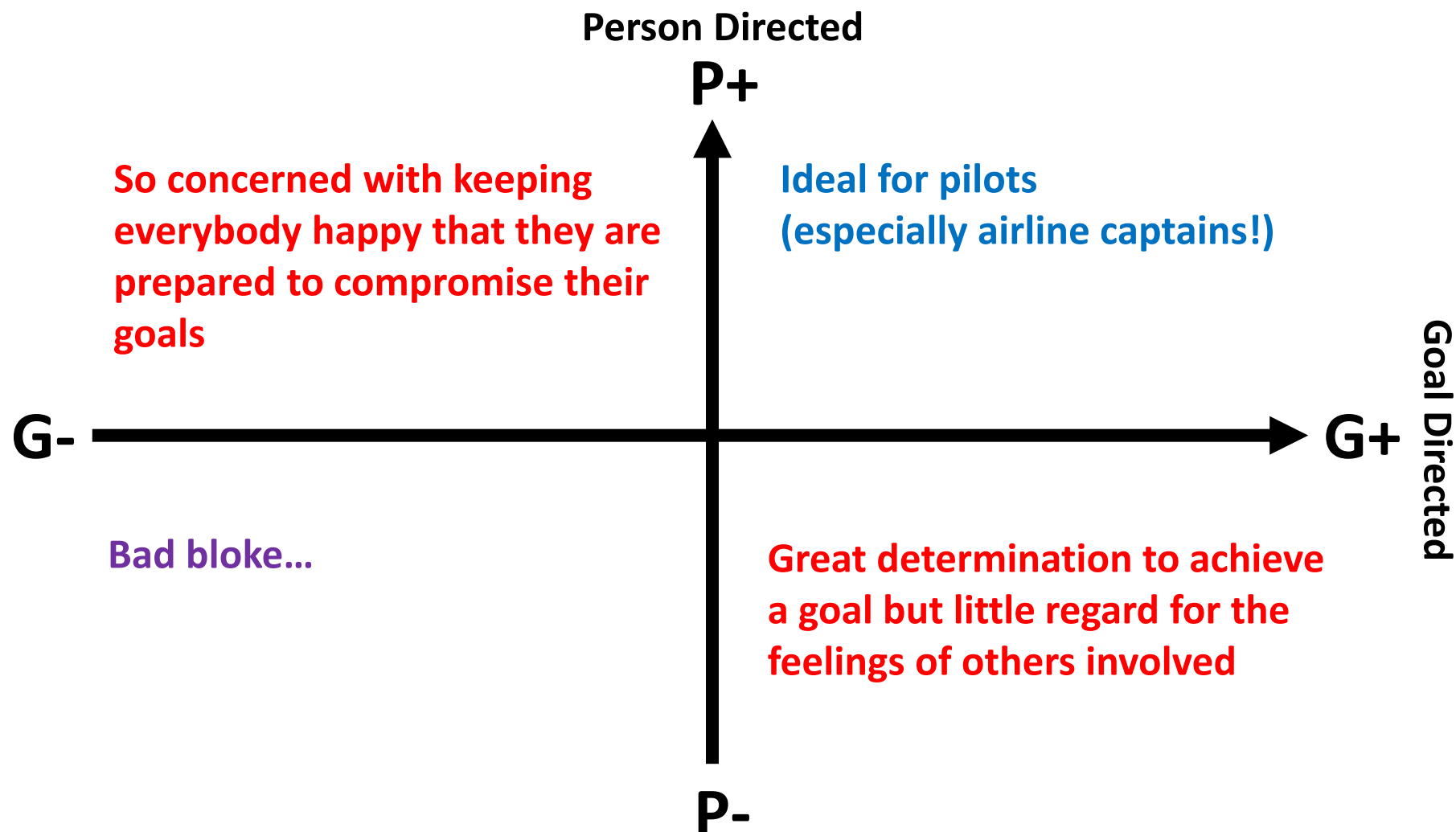
Personality & Decision Making

- A large factor affecting our decision making capability is our **personality**
- One model of personality is as follows:



Personality & Decision Making

➤ Another model of personality looks like this:



Personality & Decision Making

- Psychologists have identified the following hazardous attitudes that are created by a person's personality
- These attitudes can affect human behaviour and decision making and include:

1. Anti-Authority

2. Deference

3. Impulsiveness

4. Invulnerability

5. Macho

6. Resignation

Hazardous Attitudes – Anti-Authority

- **Refuses to listen** to the advice or suggestions of others
- **Contempt for all regulation** – even those which are reasonable and necessary
- Thinks **their way is the best way**



Hazardous Attitudes – Deference

- Anything that goes wrong is always the fault of somebody else or some other circumstance
- **It is never their fault!**
- This is a particularly dangerous attitude for a first officer on an airline flight

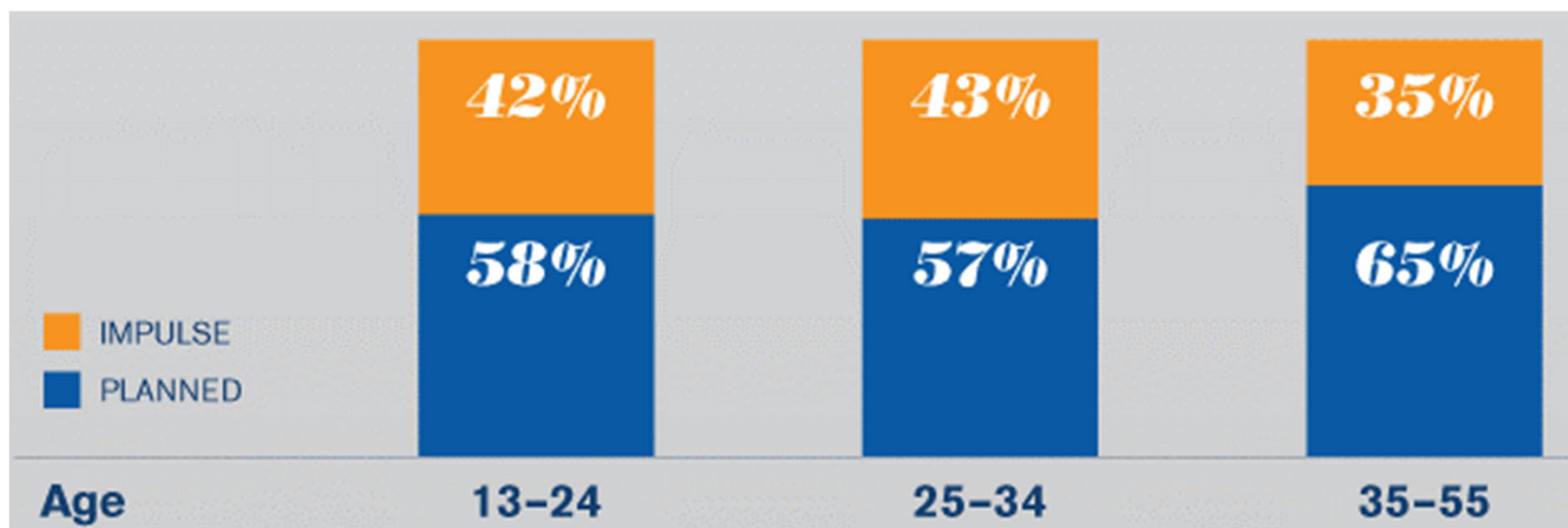
Example:

- *The captain makes an incorrect decision and the FO informs them of this threat*
- *The captain replies that he/she knows what they are doing and the FO is wrong*
- *The FO accepts this and doesn't raise the issue any further*



Hazardous Attitudes – Impulsiveness

- Acts **without thinking**
- **Motivated by emotion** rather than thought
- Doesn't give thought to the possible consequences
- Particularly dangerous when pilots try to **“show off”** to impress someone
- Impulsiveness also affects people's everyday lives, such as when shopping:



Hazardous Attitudes – Invulnerability

- “It won’t happen to me!”
- “It can’t happen to me!”
- “It’ll be fine!”
- “She’ll be right!”



Hazardous Attitudes – Macho

- No situation or condition is too tough
- Overconfidence and ego increases risk taking with regard to items such as:

1. Marginal weather
2. Weight & Balance limitations
3. Fuel Reserves



"This will be interesting, let's show them who's the chicken here."

Hazardous Attitudes – Resignation

- Unwilling to take control of the situation
- Unwilling to try different things to fix an emergency



Personality & Decision Making

- There can also be several personality-related factors that can affect our judgement:

Pride:

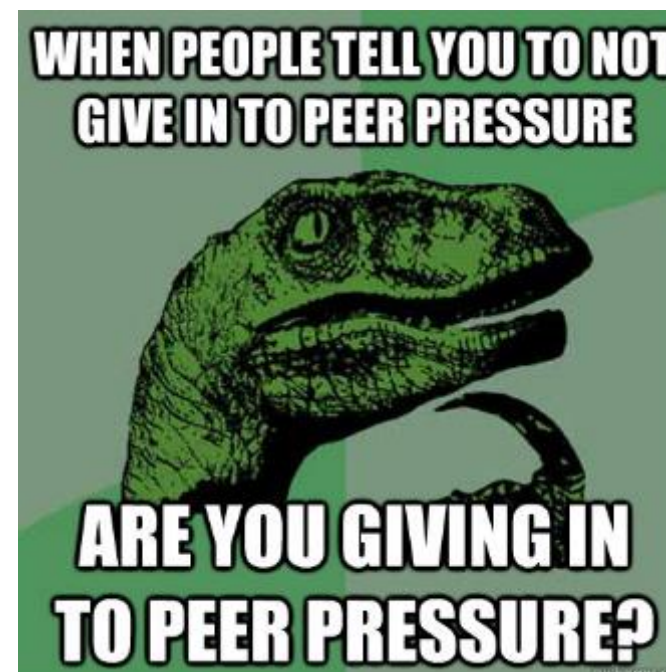
- Pilots often like to compare their skills and ability
- However, this must not restrict them from learning from the experience and wisdom of others

Peer Pressure:

- Similar to pride – the desire to “fit in” and be as good as everyone else
- Inexperienced pilots must realise their own limitations

Employer Pressure:

- On one hand, a desire to impress their boss
- On the other hand, a fear of the consequences of failure!



ATTITUDES

Attitudes

- Aside from our **personality**, our **attitude** may also affect our decision making
- Our attitude can be defined as the way we are **conditioned to react** or respond to a certain situation or person
- Attitude incorporates 3 separate components:
 1. **Beliefs**
 2. **Feelings**
 3. **Actions**
- In other words, we will **act** or **react** to certain people or situations according to our **attitude** towards those people or situations
- Our attitudes are based on our **beliefs** and our **feelings**

Attitudes

Belief – The Cognitive Aspect

- Our beliefs are our beliefs – whether or not they are justified!
- *E.g. I believe that aliens exist*

Feeling – The Affective Aspect

- Our beliefs may cause us to feel certain emotions
- *E.g. When I see a light in the sky, I feel excited because it may be a UFO*



Action – The Behavioural Aspect

- Our feelings, based on our beliefs, may cause us to act or react in certain ways
- *E.g. I take a video of the light on my phone and send it to everybody I know, telling them that I have discovered evidence of aliens*

MOTIVATION

Motivation

➤ To make effective command decisions, pilots require:

- 1. Sufficient Intelligence – information stored in the memory**
- 2. The Right Personality – no previously mentioned hazardous attitudes**
- 3. Sufficient Motivation – the desire to achieve a task or goal**

➤ Intelligence and personality alone do not guarantee a successful result – we must also have the desire to succeed!

➤ People can be motivated by either:

Extrinsic Factors – Motivation comes from possibility of reward or punishment

➤ *E.g. The approval of others, an increase in salary etc.*

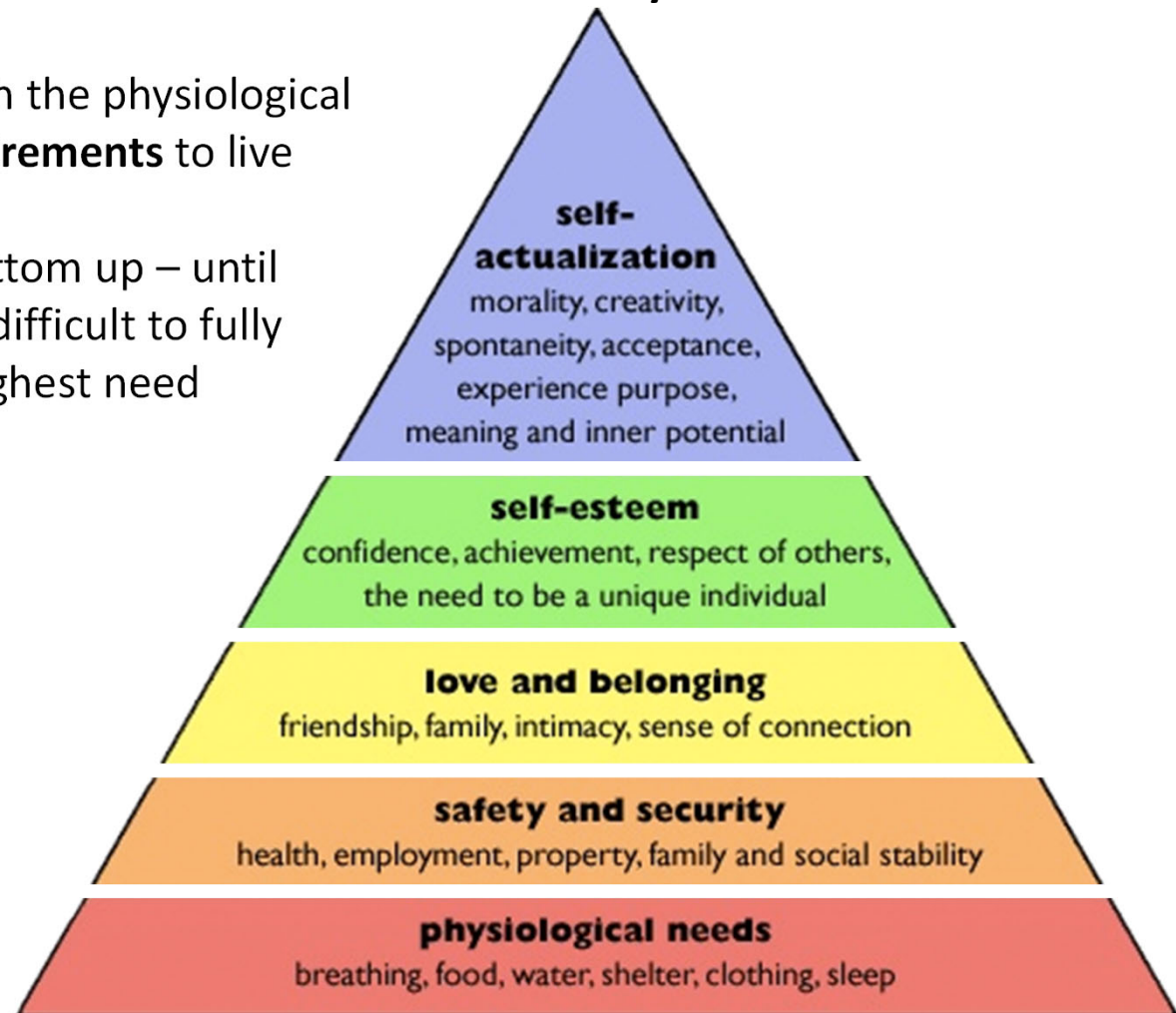
Intrinsic Factors – Motivation comes from personal fulfilment

➤ *E.g. Solving a puzzle because you find it challenging and exciting*

➤ *E.g. Participating in a sport because you find it enjoyable*

Motivation

- Factors that motivate human beings can be further categorised
- In 1943, psychologist Abraham Maslow created the **Hierarchy of Human Needs**
- We start at the bottom with the physiological needs – the **essential requirements** to live
- We then work from the bottom up – until each need is satisfied, it is difficult to fully concentrate on the next highest need



Motivation

- Another model for motivation is Frederick Herzberg's **Two-Factor Theory**, proposed in 1959. This model is based around motivation and job satisfaction/dissatisfaction
- This implies that there are not only **motivation factors** but also **hygiene factors**

Motivation Factors

- Involve job **content** – lead to job **satisfaction**
- *Personal Growth*
- *Work Content*
- *Responsibility*
- *Achievement*
- *Advancement*
- *Recognition*

Hygiene Factors

- Involve job **context** – lead to job **dissatisfaction**
- *Company Policies & Administration*
- *Supervision*
- *Interpersonal Relations*
- *Status*
- *Working Conditions*
- *Job Security*
- *Salary*