Theories of arousal

**Walter Cannon** was an American biologist who had a big influence on psychology. He studied the stress response in lab animals and noticed that creatures (including humans) tend to behave in a similar way when they are stressed. He called this the FIGHT-OR-FLIGHT RESPONSE (1927). When creatures face an emergency of any sort, the body goes into a heightened state, ready to go into battle or run away. These biological changes make up the body's SYMPATHETIC RESPONSE to stress and they include:

- Increase in **heart rate** and **blood pressure**
- Faster, shallower **breathing**
- **Blood** flows to muscles, away from stomach and skin
- **Pupils dilate** (get bigger)

This led researchers like **Clark Hull (1951)** to propose DRIVE THEORY. Drive Theory states that, if creatures are using a well-learned skill, their performance gets better and better the more aroused they are (there is a positive correlation between arousal and performance at a task). However, sometimes even top athletes “choke” and how good do you have to be at a skill before you get the benefits of “drive”? Critics of Drive Theory seized upon much earlier research by Yerkes & Dodson to explain arousal and performance better.

Robert Yerkes and John Dodson were very famous American psychologists in the early 20th century. They carried out a 1908 lab experiment on 40 lab mice to see how they learned a simple maze. For some reason, this is nicknamed the **Dancing Mice study**. In order to get back to their nesting area, the mice had to go through either a black tunnel or a white tunnel. If they went through the black tunnel, they got an electric shock and had to go back and choose again. The mice were tested 10 times every morning and over a few days they learned to pick the white tunnel and avoid the painful black tunnel.

However, Yerkes & Dodson changed the size of the shock, either mild (7-9 volts), medium (15 volts) or strong (20+ volts). Mice given the mild shock or the strong shock were quite slow to learn they had to take the white tunnel – it took them about 175 tests, on average. Mice given the medium shock learned the route the fastest – they learned in about 80 tests, on average. Too much or too little arousal is bad for learning but there seems to be an **OPTIMAL POINT** (just the right amount of pain for the mice) which produces the best performance.

This experiment was originally just a study into mice learning mazes, but the conclusions have “drifted” into other areas of psychology and become very influential. The **YERKES-DODSON LAW** suggests that for any task, there is an optimal level of arousal that will produce the best performance. This is often shown using a type of curve on a graph called an INVERTED-U (so sometimes this law is called the “inverted-u law”). The Yerkes-Dodson Law has been very influential, especially in sport psychology. Athletes perform better when they are “hyped up” with excitement, confidence and practice and no one performs well from a cold start. However, players who are too “hyped up” start making mistakes, getting frustrated and their performance suffers.
The trick is to identify every player’s “optimal point” and try and maintain arousal at that level. Often, training is done using biofeedback – machines that keep the athlete and the coach updated about the athlete’s heart rate, skin conductance, etc. The athlete can learn in training to recognize their optimal level and how to keep themselves there.

**Types of arousal**

The theories of arousal addressed so far tend to assume that there is such a thing as “general arousal” and that everyone experiences it in the same way. You already know one theory that suggests this isn’t true: Hans Eysenck’s personality trait theory (1965). Eysenck suggests that everyone has varying amounts of the Neurotic personality trait. High-N individuals cope with arousal badly (low optimal level) while low-N individuals do not easily become over-aroused (high optimal level).

Cognitive psychology also started to question the simplistic idea of “general arousal”. When we are aware of getting aroused (heart beat, sweaty palms, difficulty breathing, butterflies in the stomach) we have a cognitive reaction to these sensations – maybe we decide they are exciting and fun or else frightening and nauseous. Not everyone perceives arousal in quite the same way.

Husband-and-wife team John & Bea Lacey studied arousal (then termed “activation”) throughout the ‘60s. They carried out hundreds of tests on volunteers, measuring heart rate, skin conductivity and brain voltage, while giving the participant different challenges, including cognitive challenges (like puzzles) and physical challenges (tests of strength or agility). The Laceys expected to find that people belonged to different “types” who experienced arousal differently. This turned out to be somewhat true – some people became aroused quickly, other slowly; some experienced raised heart rate, others increased brain activity. However, they also found that it mattered how the arousal was stimulated – the sort of challenge that was given and the situation the participant was put in. Some participants would respond to a cognitive puzzle with rising heart rate, others with increasing brain activity. The Laceys called this variation in arousal SOMATIC RESPONSE PATTERNING.

John Lacey presented his findings at a 1967 conference in Toronto organized by the US Office of Naval Research (the same people who commissioned Zimbardo’s Prison Simulation). Lacey argued that arousal is not a simple response to all situations, the way Cannon’s “Fight-or-Flight” response suggests. He identified three types of arousal:

- **Autonomic arousal**: this is a biological response triggered by the nervous system, including raised heart rate, pupil dilation, changes in breathing, etc (the sympathetic response)
- **Electrocortical arousal**: this is a change in brain functioning, with brain waves changing frequency, speeding up or slowing down (probably linked to Eysenck’s Reticular Activating System)
- **Behavioural arousal**: this is a change in observable behaviour, including restlessness, fidgeting, trembling or tension
Lacey argued that some types of arousal are separate ("dissociated"), so someone could experience autonomic arousal without showing behavioural arousal. Even with biological processes, a person can experience one arousal-response (eg raised heart rate) without getting the others (eg pupil dilation). Lacey also pointed out that people’s type of arousal can be “individual response stereotypy” (dispositional – a feature of how they personally react to stress) or “situational stereotypy” (situational – affected by the type of challenge or stimulus given to them). Finally, Lacey showed how the brain reacts to signals from autonomic arousal in the body, normally by inhibiting the amount of arousal rather than adding to it. Effectively, the brain is a “calming influence”.

John & Bea Lacey were hugely influential biopsychologists who invented new techniques, measuring devices and statistical approaches. For example, they pioneered the measurement of galvanic skin response (GSR). John Lacey’s theories also moved the study of arousal away from a simplistic idea of “general arousal” towards a more sophisticated picture. Modern athletes and coaches will try to identify their own unique Somatic Response Pattern – their own personal way of responding to arousal. They will also take into account what Lacey called “situational stereotypy” – how you own response pattern changes for different types of stimuli, such as physical challenges or tactical problems.

### Factors influencing arousal

John & Bea Lacey identified several factors affecting arousal in their groundbreaking research, most notably situation stereotypy, which is the effect of the type of challenge or stimulus on the stress response. The Lacey’s mostly concentrated on the difference between situations that posed mental challenges (like puzzles) and situations posing physical challenges (balancing, aiming, lifting, etc). These ideas were taken further by Joseph B Oxendine (1980). Joe Oxendine is a Native American who was a professional baseball player before he completed his doctorate at Boston University, so he perhaps has more first-hand experience than most sport psychologists. He based his theory on the Yerkes-Dodson Law, taking into account situation stereotypy.

Oxendine starts off considering the Yerkes-Dodson Law, but points out that different tasks require different optimum levels of arousal to produce the best performance. For example, complex tasks are performed better when arousal is low, but simple tasks benefit from high arousal. He proposes three additions to the Yerkes-Dodson Law:

- High arousal produces optimal performance in “gross motor activities” (meaning acts of strength, endurance and speed)
- High arousal interferes with complex skills and fine muscle movements (coordination, precision, concentration)
- Slightly above-average arousal is better than normal or below-average for all motor tasks

To back up his ideas, Oxendine cites studies by the great biologist Walter Cannon (1929). Cannon injected fatigued and rested animals with adrenalin. This had a huge effect on the fatigued animals, improving their response times in tasks, but didn’t benefit the rested animals. This shows the benefit of above-average arousal in fighting fatigue.

He goes on to suggest that the inverted-u curve has a different optimal level for different sports and cites several earlier studies in support of this. Carron (1965)
investigated balance and found that while highly-aroused players did better at easy tasks, low-arousal was best for complex tasks. This leads Oxendine to argue that golf, gymnastics and diving all require low arousal and players will need firmer control to maintain optimal performance. Bergstrom (1967) found that experience helps reduce the effect of stress, so Oxendine argues that more experienced players should have higher optimal levels than beginners.

Finally, Oxendine suggests different levels of optimal arousal for different sports:

1. **[Slight arousal]** Archery, bowling, basketball free throw, golf (putting)
2. Baseball (pitching & batting), fencing, tennis, golf (driving)
3. Basketball, boxing, high jump, gymnastics, soccer
4. Running long jump, middle/long-distance running, swimming, judo
5. **[Extreme excitation]** Rugby tackle & scrum, sprint, weight-lifting

Joseph Oxendine drew together various strands of research into arousal and produced a very persuasive theory of how these fit together in sporting situations. Unfortunately, his theories have not been validated by research. There are several reasons for this. Firstly, Oxendine is discussing “general arousal”, but after Lacey’s theory of Somatic Response Patterning, researchers were more interested in studying and measuring specific types of arousal. Secondly, Oxendine is rather vague about what he means by “complex skills” and “simple skills”, making it hard to operationalise his ideas for future research hypotheses. Finally, the “Cognitive Revolution” meant that by the 1980s Cognitive Psychology became the dominant perspective and researchers became more interested in looking at how players’ attitudes and expectations of a game affect their arousal, rather than situation stereotypye.