Are the screen's refresh rate and FPS the same thing?



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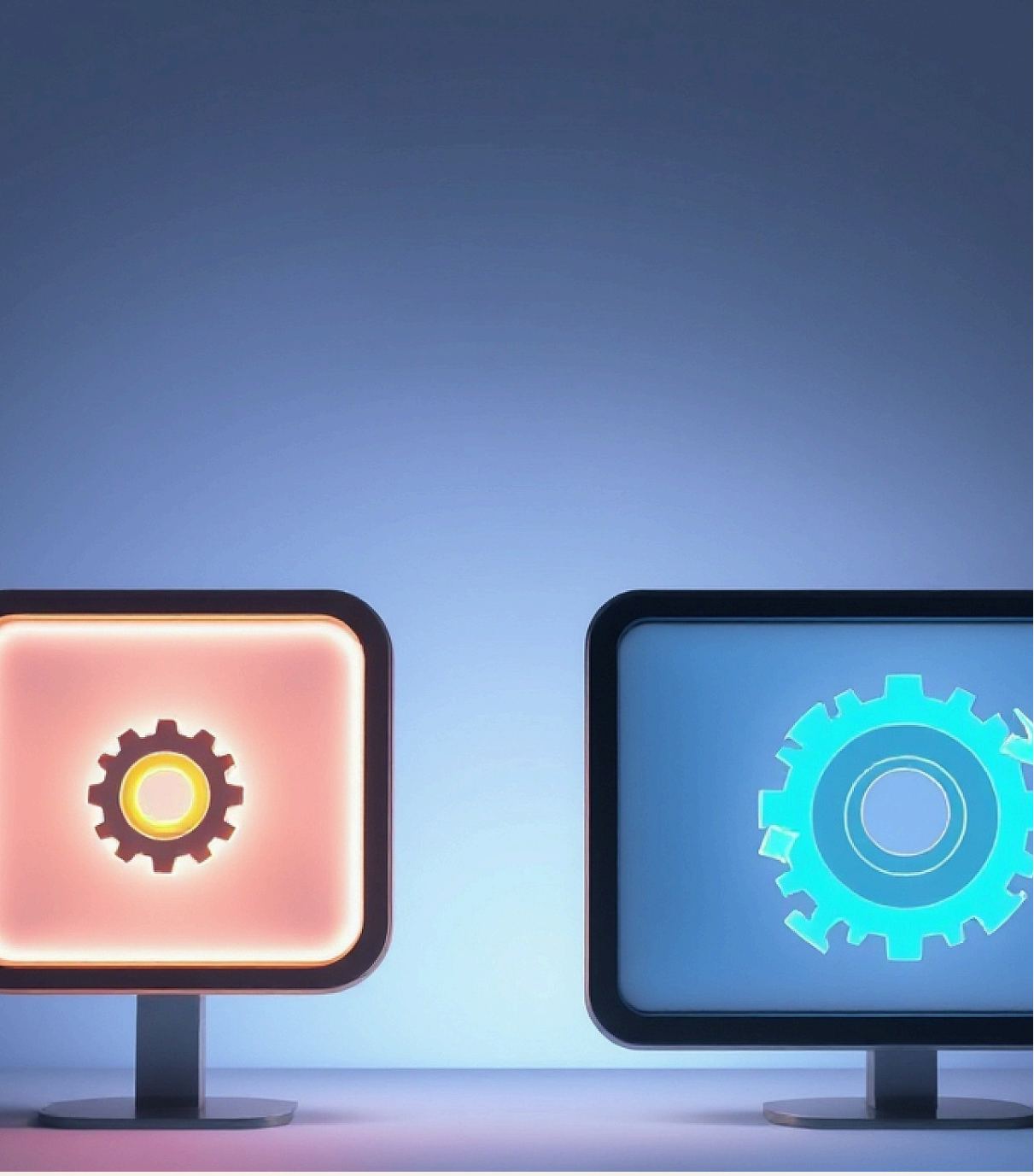
Are the screen's refresh rate and FPS the same thing? The short answer is no. Refresh rate and FPS are two different numbers that describe different parts of what you see. This book explains each one step by step, starting from zero. By the end, you will understand why they are not the same and how they work together.



A screen shows images by drawing them again and again very fast. Each drawing is one picture, and your eye sees a series of pictures as motion. The screen does this many times every second. The speed of these redraws is what refresh rate measures. Without this constant redrawing, you would see only still pictures.



Refresh rate means how many times per second the screen can update its image. It is a property of the screen itself, not of the software. Refresh rate is measured in hertz (Hz), which means cycles per second. For example, a 60 Hz screen can update its image 60 times each second. This number tells you the screen's maximum update speed.



A 60 Hz screen can update its picture 60 times each second. A 120 Hz screen can do it 120 times, which is twice as often. Higher refresh rates allow smoother motion because the screen can show more updates. However, the screen can only update as fast as its refresh rate allows. The refresh rate is fixed for a given screen.



FPS means frames per second. It is the number of frames an application or video produces or presents each second. FPS comes from the software, such as a game or a video player, not from the screen. For example, a game might produce 60 frames every second. That number is the FPS of that game.



A game or video may produce 30, 60, or even more frames each second. That number is the FPS of that application. For instance, a video might be recorded at 30 FPS, meaning it contains 30 frames for every second of playback. A game might run at 60 FPS if your computer can handle it. FPS tells you how many frames the software creates.



Refresh rate belongs to the screen. FPS belongs to the application or video. They are two separate numbers from two separate places. The screen has its own refresh rate, like 60 Hz or 120 Hz. The software has its own FPS, like 30 or 60. You can think of them as two different measurements of speed.



Put the two values side by side: refresh rate is how often the screen can update, while FPS is how many frames are made. They measure different things. One is a capability of the screen; the other is an output of the software. Even if both numbers are 60, they are not the same thing. They just happen to have the same value in that case.



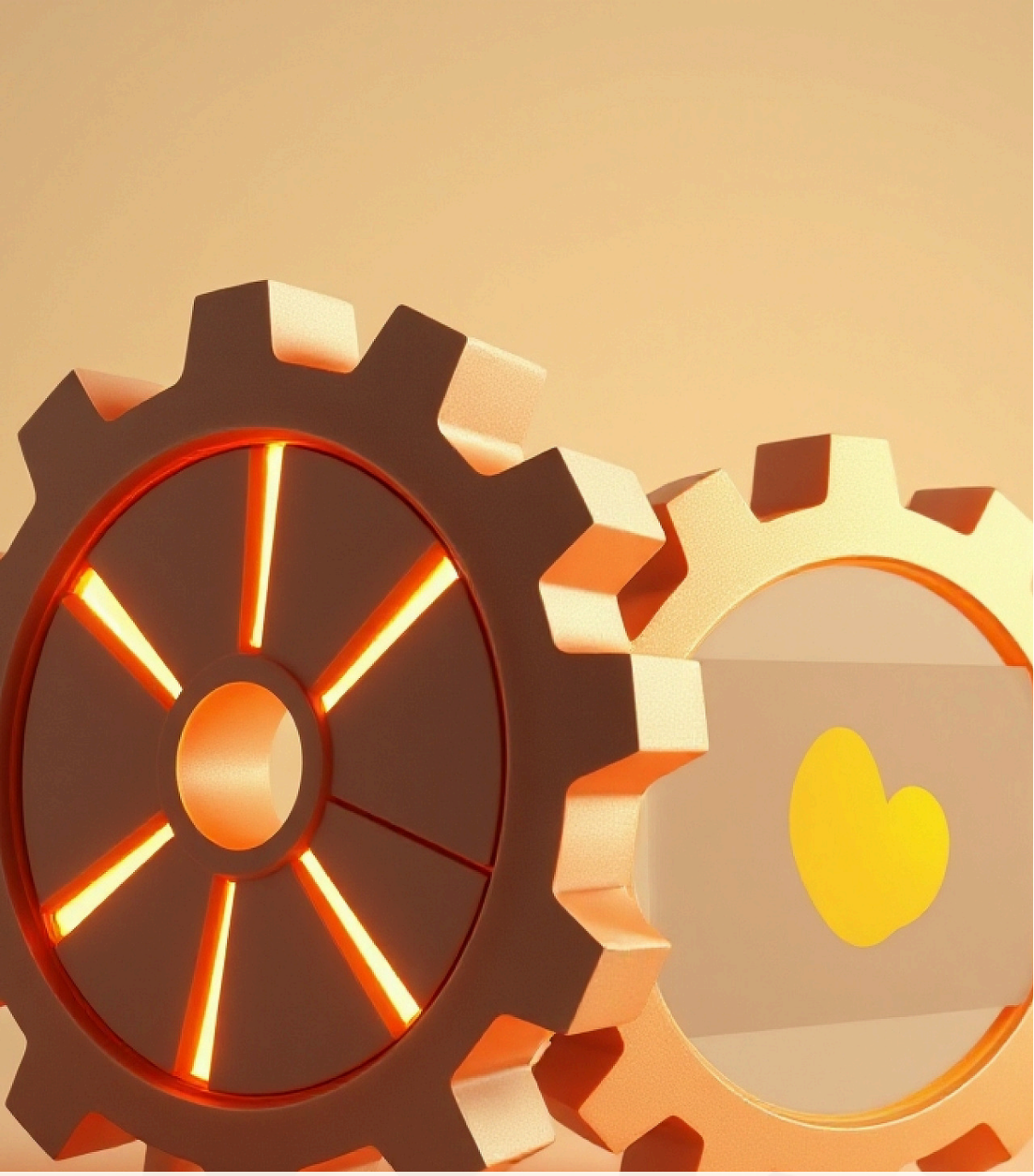
A screen can only display as many updates as its refresh rate allows. If the refresh rate is 60 Hz, the screen can show at most 60 updates per second. Any extra frames beyond that limit cannot all be shown. The screen simply cannot update faster than its refresh rate. This is a hard limit built into the screen.



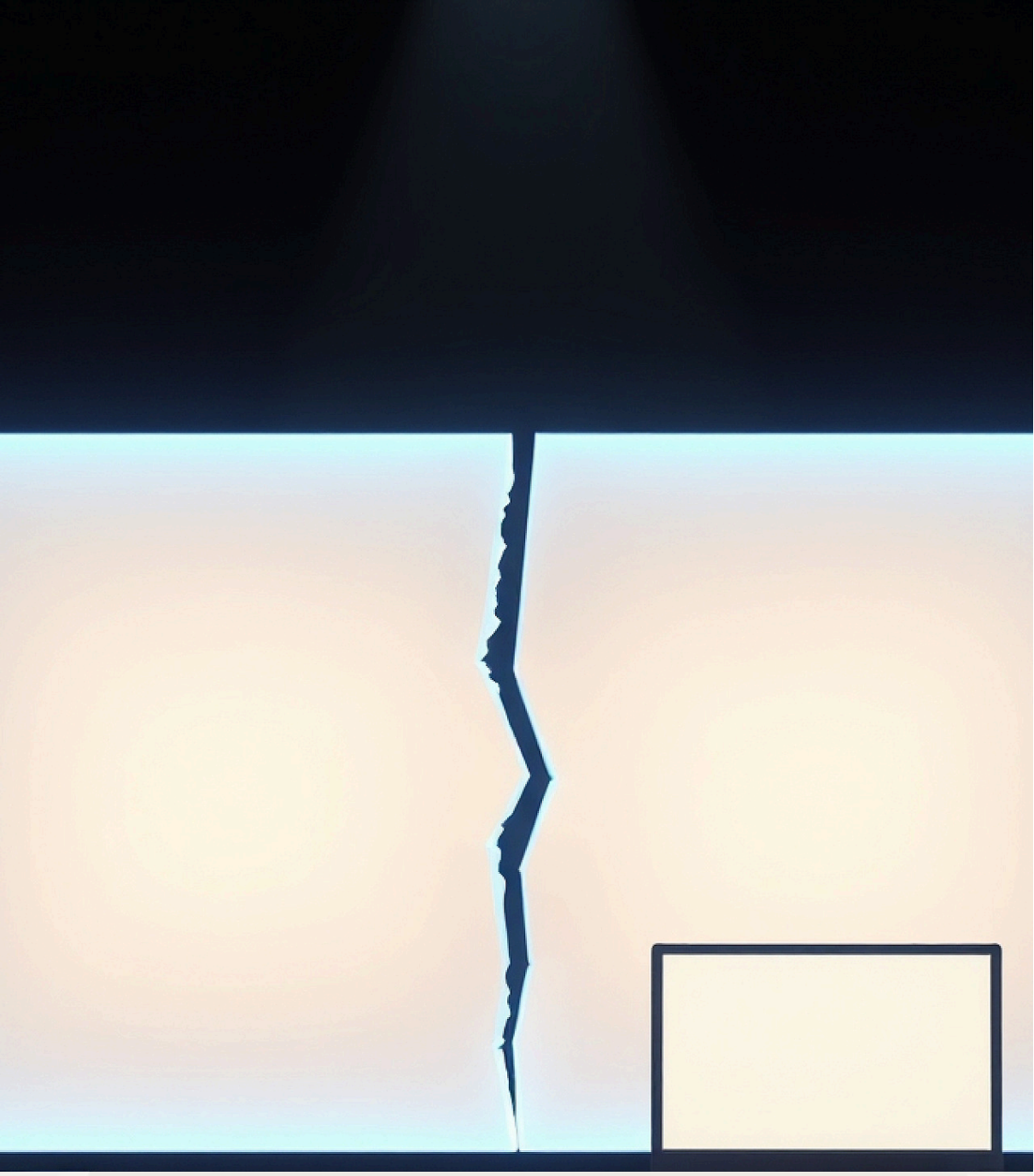
When the application makes more frames than the screen can show, some frames are skipped or not fully displayed. For example, if a game runs at 120 FPS but the screen is 60 Hz, the screen can only show 60 of those frames each second. The extra frames are wasted because the screen cannot keep up. You might not see all the detail the game produces.



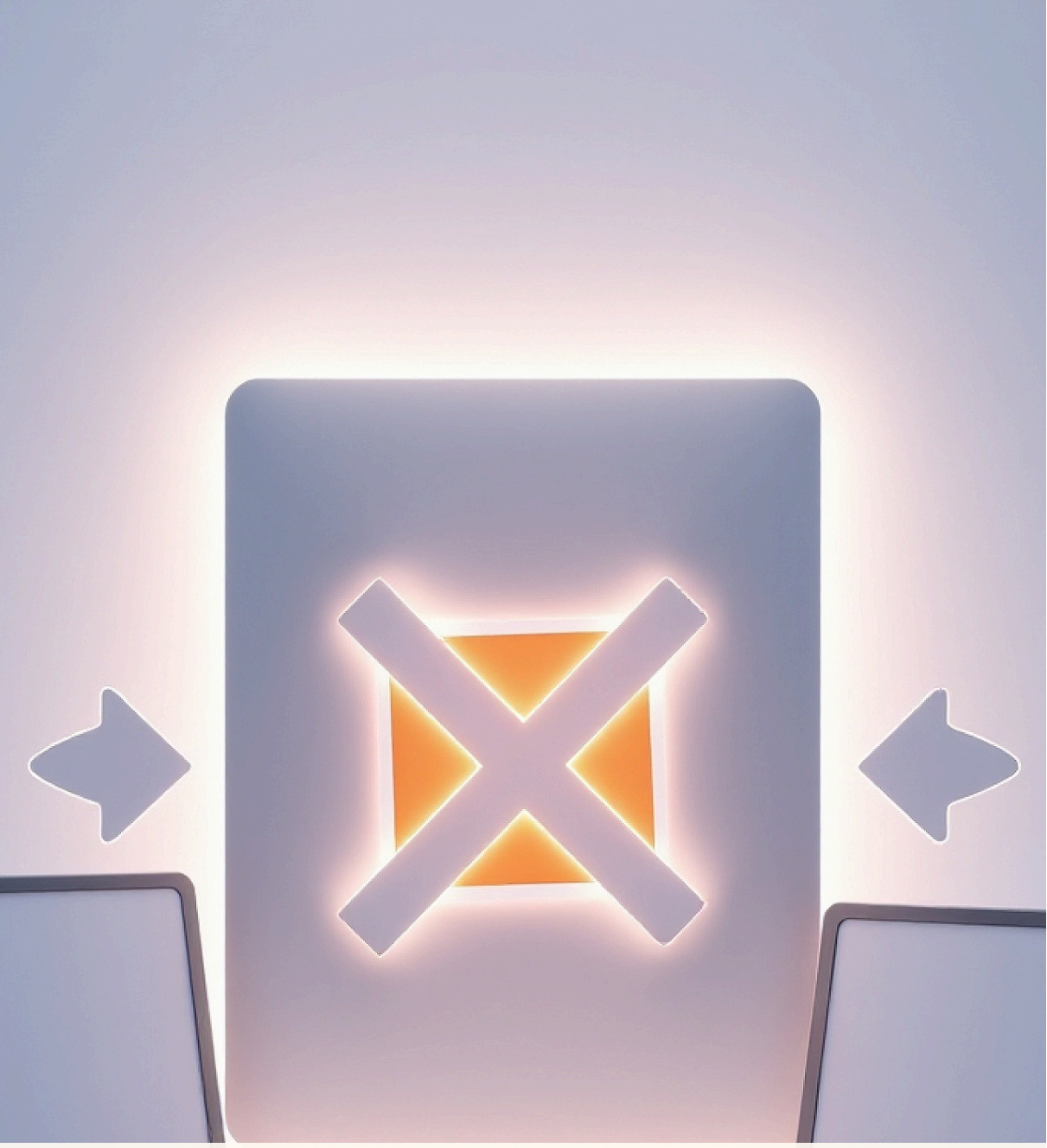
When the application makes fewer frames than the screen can refresh, the screen may show the same frame more than once. For example, if a game runs at 30 FPS on a 60 Hz screen, the screen updates 60 times but only gets 30 new frames. So it shows each frame twice. The motion may look less smooth because there are fewer unique frames.



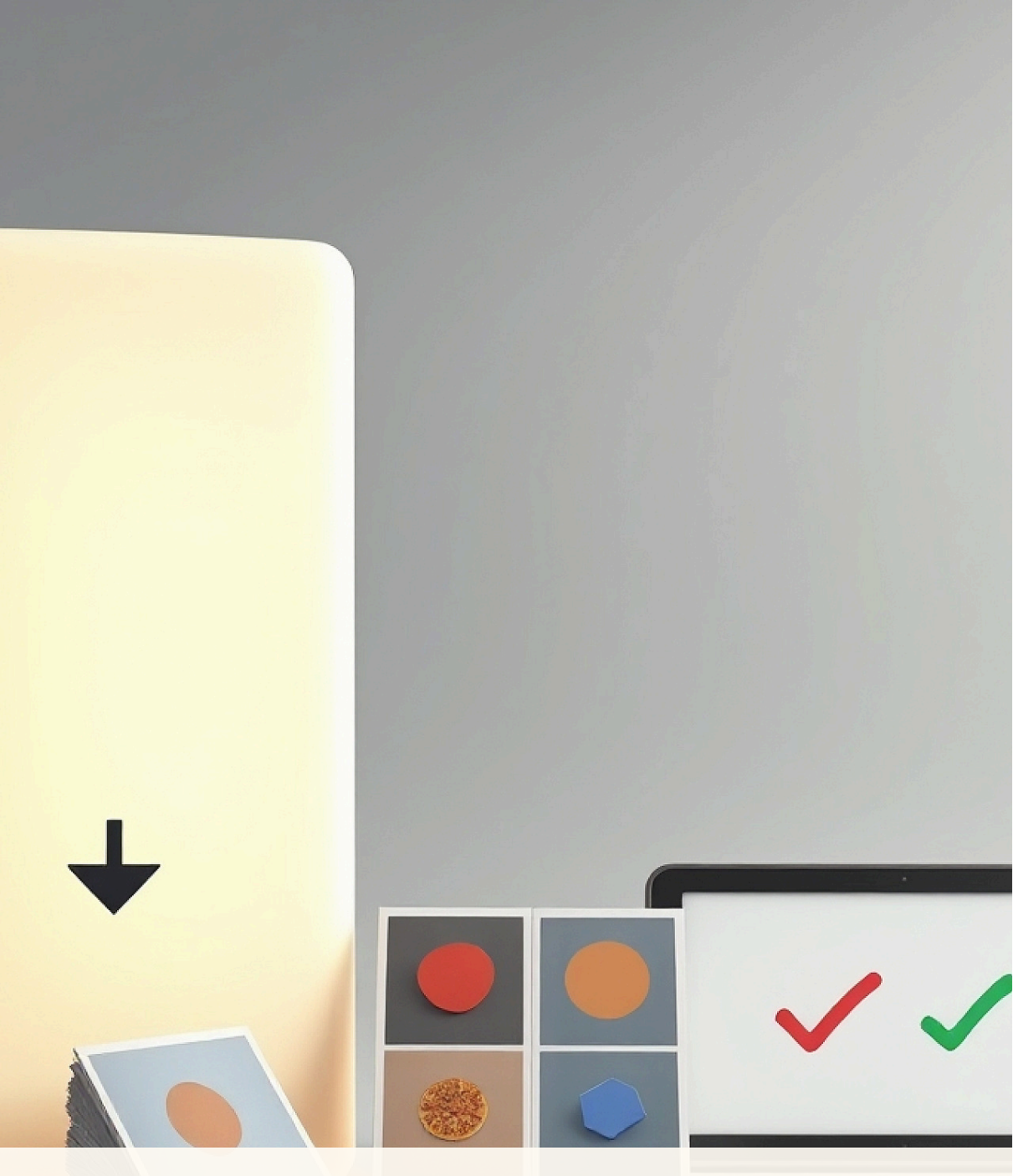
The two values affect each other even though they are different. What you see on the screen depends on both the refresh rate and the FPS. If both are high and matched, motion looks smooth. If one is much lower than the other, you may notice stutter or skipped frames. They work together to create the final picture.



When frames and screen updates do not match, the picture can split or tear. This is called screen tearing. It happens when the screen updates while a new frame is being drawn, so you see parts of two different frames at once. For example, a fast-moving scene might show a horizontal line where the image breaks. Screen tearing is a common sign of mismatch.



A common mistake is to treat refresh rate and FPS as one number. For example, someone might think a 60 Hz screen always shows 60 FPS, or that buying a 144 Hz monitor automatically gives 144 FPS. That mix-up leads to wrong conclusions. They are separate: the screen's refresh rate does not create frames, and the software's FPS does not change the screen's limit.



Another mistake is assuming a higher number alone fixes everything. A higher refresh rate helps only if the software can produce enough frames. A higher FPS helps only if the screen can show them. Both values must work together for a smooth picture. For example, a 144 Hz screen with a game running at 30 FPS will still look choppy.



Refresh rate is the screen's update speed, measured in hertz. FPS is the frames made by the software, measured in frames per second. They are not the same. Remember that they affect each other, and mismatches can cause screen tearing. To get smooth motion, you want both to be high and well matched. Now you know the difference.