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Jennifer Vail: The science of friction -- and its surprising impact on our lives | TED Talk

https://www.ted.com/talks/jennifer_vail_the_science_of_friction_and_its_surprising_impact_on_our_lives

Advanced Words Only

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Session 1: Word List

tribology

n. the study of the properties and behavior of surfaces in relative motion, including friction, lubrication, wear, and adhesion

synonym : friction, lubrication, wear

(1) **tribology** research, (2) **tribology** analysis

The **tribology** laboratory at the university is equipped with advanced machinery to study the effects of different lubricants.

lubricate

v. to apply a substance, such as oil or grease, to reduce friction or wear on a surface

synonym : grease, oil, make slippery

(1) **lubricate** the economy, (2) **lubricate** the hinges with oil

The mechanic **lubricated** the gears to prevent them from grinding.

loosen

v. to make something less tight, firm, or fixed; to free from restraint or constraint; to relax

synonym : relax, slacken, untie

(1) **loosen** grip, (2) **loosen** knot

Please **loosen** the screws on the back panel so we can access the inside of the machine.

stubborn

adj. refusing to change one's mind or behavior despite persuasion or evidence to the contrary; unyielding; difficult to move or change

synonym : persistent, obstinate, determined

(1) **stubborn** attitude, (2) **stubborn** stains

He was so **stubborn** about his beliefs that he refused to listen to any other points of view.

budge

v. to move or shift slightly, particularly with effort or resistance; to make or cause a slight change in something

synonym : move, shift, nudge

(1) **budge** an inch, (2) **budge** the shelf

No matter how hard I tried, I couldn't **budge** the heavy couch from its place in the room.

wiggle

v. to move or cause to move up and down or from side to side in short and quick movements

synonym : wiggle, jiggle, squirm

(1) **wiggle** her lips, (2) **wiggle** with excitement

Her hips **wiggle** as she walks.

squirm

v. to twist, wiggle, or contort the body uncomfortably or awkwardly, often due to embarrassment, discomfort, or nervousness

synonym : squiggle, wiggle, writhe

(1) **squirm** uncomfortably, (2) **squirm** with excitement

The child **squirmed** out of his mother's grasp and ran off.

tendon

n. a strong, fibrous cord of tissue that connects muscle to bone

synonym : tissue, sinew, ligament

(1) **tendon** grafting, (2) **tendon** collagen

Tendon injuries are common among athletes.

ballerina

n. a female ballet (= a type of performance dance that tells a dramatic story or expresses an idea with music but no

talking or singing) dancer

synonym : dancer, danseuse

(1) classical **ballerina**, (2) famous **ballerina**

The **ballerina's** graceful movements were a joy to watch.

slippery

adj. difficult to hold firmly or stand on because it is wet or smooth; not to be trusted

synonym : smooth, glistening, furtive

(1) a **slippery** customer, (2) **slippery** ice

How extraordinarily **slippery** a liar the camera is.

rosin

n. a solid form of resin that is obtained from conifers and is used to make varnishes, adhesives, and other products; a sticky substance used on the bows of stringed instruments to improve the grip on the strings

synonym : resin, sap, pitch

(1) **rosin** paper, (2) **rosin** flux

A bit of **rosin** on the bow hair helps produce a smooth and clear sound on the cello.

sap

v. to gradually weaken or drain strength, energy, or resources; to undermine or impair someone's confidence or morale

synonym : weaken, exhaust, drain

(1) **sap** flow, (2) **sap** strength

The disease has **sapped** all his energy, and he can barely get out of bed.

clumsy

adj. lacking in grace or skill; awkward; cumbersome

synonym : awkward, ungainly, inept

(1) **clumsy** at sports, (2) **clumsy** attempt

The **clumsy** waiter accidentally spilled a tray of drinks on a customer.

destine

v. to determine or set the course of something in advance, often in a way that seems predetermined or inevitable; to specify or choose someone or something for a

particular fate or outcome

synonym : ordain, doom, predestine

(1) **destine** us to meet again, (2) be **destined** to become a great artist

Some people believe that we are all **destined** for greatness.

crayon

n. a stick of colored wax, charcoal, chalk, or other material used for drawing or coloring; (verb) to draw or color with crayons, which are sticks of colored wax, chalk, or charcoal used for drawing or coloring

synonym : chalk, pastel, (verb) draw

(1) **crayon** drawing, (2) **crayon** her coloring books

The teacher handed out several different colored **crayons** to each student.

entice

v. to attract or lure someone with something desirable or tempting

synonym : lure, tempt, attract

(1) **entice** foreign investment, (2) **entice** shoppers

The salesperson tried to **entice** the customer into buying a new car.

barefoot

adj. without shoes or other foot coverings; wearing nothing on the feet

synonym : bare, shoeless, unshod

(1) **barefoot** walk, (2) **barefoot** fashion

The **barefoot** hiker enjoyed feeling the earth beneath their feet.

toothpaste

n. a paste or gel used for cleaning the teeth and freshening the breath

synonym : paste, gel, dentifrice

(1) **toothpaste** hygiene product, (2) **toothpaste** tube

I always use mint-flavored **toothpaste** to refresh my mouth in the morning and at night.

toothbrush

n. a small brush with a handle used for cleaning the teeth
synonym : brush, scrubber, cleaner

(1) **toothbrush** stand, (2) power **toothbrush**

My **toothbrush** with end-rounded bristles is excellent for gently cleaning my teeth and gums.

saliva

n. the clear liquid that is secreted into the mouth by glands in the walls of the mouth and throat, helping to lubricate food during chewing and digestion

synonym : spit, drool, slobber

(1) dog's **saliva**, (2) dry mouth with little **saliva**

The dentist asked him to spit out the excess **saliva** into the sink.

lubricity

n. the quality of being slippery, smooth, or polished; moral or ethical looseness or indulgence; sexual desire or lasciviousness

synonym : smoothness, pruriency, lasciviousness

(1) **lubricity** coefficient, (2) sexual **lubricity**

The **lubricity** of the oil made it ideal for use in engines.

periodontal

adj. relating to the supporting structures of teeth, such as the gums, bone, and connective tissue

synonym : gum, dental, oral

(1) **periodontal** disease, (2) **periodontal** surgery

The dentist recommended a **periodontal** cleaning to remove plaque buildup on my teeth.

mimic

v. to imitate someone's speech, movement, or behavior, especially to make others laugh

synonym : mirror, imitate, ape

(1) **mimic** a human voice, (2) **mimic** numerous instruments

He is very popular at school because he can **mimic** all the teachers' accents.

tread

v. to step or walk on something

synonym : step, walk, pace

(1) **tread** water, (2) **tread** a similar path
He **treads** carefully on the slippery ice.

decelerate

v. to slow down or reduce the speed of something; to decrease in speed

synonym: slow down, slacken, brake

(1) **decelerate** slowly, (2) **decelerate** approach

The driver had to **decelerate** quickly to avoid hitting the red light.

instinctively

adv. as a matter of nature or intuition rather than thought or training

synonym: inherently, intuitively, naturally

(1) **instinctively** grabbed the knife, (2) **instinctively** bad with children

Some researchers claim that even humans can **instinctively** sense earthquakes.

opportune

adj. suitable or happening at a time that is suitable or convenient for a particular purpose

synonym: suitable, timely, practical

(1) **opportune** occasion, (2) an **opportune** remark

The phone rang at the most **opportune** time.

quad

n. (short for quadrangle) a square or rectangular open area or courtyard, often surrounded by buildings or used for recreational or social purposes

synonym: quadrangle, square, block

(1) **quad** room, (2) **quad** biking

We met at the campus **quad** to study for our upcoming exams.

rev

n. a measure of the rate at which an engine or motor rotates, often expressed in revolutions per minute (RPM); (verb) to increase the number of rotations per minute

synonym: revolution, RPM, speed

(1) low- **rev** engine, (2) **rev** up the crowd

He stepped on the gas pedal, and the engine released a loud **rev**.

actuate

v. to cause a machine or equipment to start to work
synonym: motivate, spark, drive

(1) **actuate** the circuits, (2) **actuate** a parking brake

A desire for success **actuated** her.

Session 2: Spelling

1. lu_____te the economy
v. to apply a substance, such as oil or grease, to reduce friction or wear on a surface
2. per_____al surgery
adj. relating to the supporting structures of teeth, such as the gums, bone, and connective tissue
3. cr___n her coloring books
n. a stick of colored wax, charcoal, chalk, or other material used for drawing or coloring; (verb) to draw or color with crayons, which are sticks of colored wax, chalk, or charcoal used for drawing or coloring
4. an op_____ne remark
adj. suitable or happening at a time that is suitable or convenient for a particular purpose
5. mi__c a human voice
v. to imitate someone's speech, movement, or behavior, especially to make others laugh
6. te___n collagen
n. a strong, fibrous cord of tissue that connects muscle to bone
7. tr__d water
v. to step or walk on something
8. ro__n flux
n. a solid form of resin that is obtained from conifers and is used to make varnishes, adhesives, and other products; a sticky substance used on the bows of stringed instruments to improve the grip on the strings

ANSWERS: 1. lubricate, 2. periodontal, 3. crayon, 4. opportune, 5. mimic, 6. tendon, 7. tread, 8. rosin

9. ins_____ely bad with children *adv.* as a matter of nature or intuition rather than thought or training
10. te___n grafting *n.* a strong, fibrous cord of tissue that connects muscle to bone
11. ba_____ot fashion *adj.* without shoes or other foot coverings; wearing nothing on the feet
12. sq___m uncomfortably *v.* to twist, wiggle, or contort the body uncomfortably or awkwardly, often due to embarrassment, discomfort, or nervousness
13. ins_____ely grabbed the knife *adv.* as a matter of nature or intuition rather than thought or training
14. cr___n drawing *n.* a stick of colored wax, charcoal, chalk, or other material used for drawing or coloring; (verb) to draw or color with crayons, which are sticks of colored wax, chalk, or charcoal used for drawing or coloring
15. mi__c numerous instruments *v.* to imitate someone's speech, movement, or behavior, especially to make others laugh
16. lu_____te the hinges with oil *v.* to apply a substance, such as oil or grease, to reduce friction or wear on a surface
17. en___e shoppers *v.* to attract or lure someone with something desirable or tempting
18. wi___e with excitement *v.* to move or cause to move up and down or from side to side in short and quick movements

ANSWERS: 9. instinctively, 10. tendon, 11. barefoot, 12. squirm, 13. instinctively, 14. crayon, 15. mimic, 16. lubricate, 17. entice, 18. wiggle

19. too_____sh stand *n.* a small brush with a handle used for cleaning the teeth
20. low-r_v engine *n.* a measure of the rate at which an engine or motor rotates, often expressed in revolutions per minute (RPM); (verb) to increase the number of rotations per minute
21. st_____rn attitude *adj.* refusing to change one's mind or behavior despite persuasion or evidence to the contrary; unyielding; difficult to move or change
22. ro__n paper *n.* a solid form of resin that is obtained from conifers and is used to make varnishes, adhesives, and other products; a sticky substance used on the bows of stringed instruments to improve the grip on the strings
23. sq___m with excitement *v.* to twist, wiggle, or contort the body uncomfortably or awkwardly, often due to embarrassment, discomfort, or nervousness
24. s_p strength *v.* to gradually weaken or drain strength, energy, or resources; to undermine or impair someone's confidence or morale
25. too_____te tube *n.* a paste or gel used for cleaning the teeth and freshening the breath
26. cl___y attempt *adj.* lacking in grace or skill; awkward; cumbersome
27. dry mouth with little sa___a *n.* the clear liquid that is secreted into the mouth by glands in the walls of the mouth and throat, helping to lubricate food during chewing and digestion

ANSWERS: 19. toothbrush, 20. rev, 21. stubborn, 22. rosin, 23. squirm, 24. sap, 25. toothpaste, 26. clumsy, 27. saliva

28. q__d biking *n.* (short for quadrangle) a square or rectangular open area or courtyard, often surrounded by buildings or used for recreational or social purposes
29. st____rn stains *adj.* refusing to change one's mind or behavior despite persuasion or evidence to the contrary; unyielding; difficult to move or change
30. de____e us to meet again *v.* to determine or set the course of something in advance, often in a way that seems predetermined or inevitable; to specify or choose someone or something for a particular fate or outcome
31. lo___n grip *v.* to make something less tight, firm, or fixed; to free from restraint or constraint; to relax
32. cl___y at sports *adj.* lacking in grace or skill; awkward; cumbersome
33. tr____gy analysis *n.* the study of the properties and behavior of surfaces in relative motion, including friction, lubrication, wear, and adhesion
34. s_p flow *v.* to gradually weaken or drain strength, energy, or resources; to undermine or impair someone's confidence or morale
35. dec____te approach *v.* to slow down or reduce the speed of something; to decrease in speed
36. sexual lu____ty *n.* the quality of being slippery, smooth, or polished; moral or ethical looseness or indulgence; sexual desire or lasciviousness

ANSWERS: 28. quad, 29. stubborn, 30. destine, 31. loosen, 32. clumsy, 33. tribology, 34. sap, 35. decelerate, 36. lubricity

37. wi___e her lips *v.* to move or cause to move up and down or from side to side in short and quick movements
38. tr__d a similar path *v.* to step or walk on something
39. tr_____gy research *n.* the study of the properties and behavior of surfaces in relative motion, including friction, lubrication, wear, and adhesion
40. ba_____ot walk *adj.* without shoes or other foot coverings; wearing nothing on the feet
41. en___e foreign investment *v.* to attract or lure someone with something desirable or tempting
42. lu_____ty coefficient *n.* the quality of being slippery, smooth, or polished; moral or ethical looseness or indulgence; sexual desire or lasciviousness
43. q__d room *n.* (short for quadrangle) a square or rectangular open area or courtyard, often surrounded by buildings or used for recreational or social purposes
44. a sl_____ry customer *adj.* difficult to hold firmly or stand on because it is wet or smooth; not to be trusted
45. dec_____te slowly *v.* to slow down or reduce the speed of something; to decrease in speed
46. ac_____e the circuits *v.* to cause a machine or equipment to start to work
47. bu__e an inch *v.* to move or shift slightly, particularly with effort or resistance; to make or cause a slight change in something

ANSWERS: 37. wiggle, 38. tread, 39. tribology, 40. barefoot, 41. entice, 42. lubricity, 43. quad, 44. slippery, 45. decelerate, 46. actuate, 47. budge

48. lo___n knot *v.* to make something less tight, firm, or fixed; to free from restraint or constraint; to relax
49. famous ba_____na *n.* a female ballet (= a type of performance dance that tells a dramatic story or expresses an idea with music but no talking or singing) dancer
50. bu__e the shelf *v.* to move or shift slightly, particularly with effort or resistance; to make or cause a slight change in something
51. op_____ne occasion *adj.* suitable or happening at a time that is suitable or convenient for a particular purpose
52. classical ba_____na *n.* a female ballet (= a type of performance dance that tells a dramatic story or expresses an idea with music but no talking or singing) dancer
53. too_____te hygiene product *n.* a paste or gel used for cleaning the teeth and freshening the breath
54. power too_____sh *n.* a small brush with a handle used for cleaning the teeth
55. sl_____ry ice *adj.* difficult to hold firmly or stand on because it is wet or smooth; not to be trusted
56. dog's sa___a *n.* the clear liquid that is secreted into the mouth by glands in the walls of the mouth and throat, helping to lubricate food during chewing and digestion
57. r_v up the crowd *n.* a measure of the rate at which an engine or motor rotates, often expressed in revolutions per minute (RPM); (verb) to increase the number of rotations per minute

ANSWERS: 48. loosen, 49. ballerina, 50. budge, 51. opportune, 52. ballerina, 53. toothpaste, 54. toothbrush, 55. slippery, 56. saliva, 57. rev

58. ac____e a parking brake

v. to cause a machine or equipment to start to work

59. per____al disease

adj. relating to the supporting structures of teeth, such as the gums, bone, and connective tissue

60. be de____ed to become a great artist

v. to determine or set the course of something in advance, often in a way that seems predetermined or inevitable; to specify or choose someone or something for a particular fate or outcome

ANSWERS: 58. actuate, 59. periodontal, 60. destine

Session 3: Fill in the Blanks

1. The _____ of the oil made it ideal for use in engines.
n. the quality of being slippery, smooth, or polished; moral or ethical looseness or indulgence; sexual desire or lasciviousness

2. How extraordinarily _____ a liar the camera is.
adj. difficult to hold firmly or stand on because it is wet or smooth; not to be trusted

3. _____ injuries are common among athletes.
n. a strong, fibrous cord of tissue that connects muscle to bone

4. The _____ laboratory at the university is equipped with advanced machinery to study the effects of different lubricants.
n. the study of the properties and behavior of surfaces in relative motion, including friction, lubrication, wear, and adhesion

5. Some people believe that we are all _____ for greatness.
v. to determine or set the course of something in advance, often in a way that seems predetermined or inevitable; to specify or choose someone or something for a particular fate or outcome

6. I always use mint-flavored _____ to refresh my mouth in the morning and at night.
n. a paste or gel used for cleaning the teeth and freshening the breath

7. The disease has _____ all his energy, and he can barely get out of bed.
v. to gradually weaken or drain strength, energy, or resources; to undermine or impair someone's confidence or morale

ANSWERS: 1. lubricity, 2. slippery, 3. Tendon, 4. tribology, 5. destined, 6. toothpaste, 7. sapped

8. Please _____ the screws on the back panel so we can access the inside of the machine.
- v.* to make something less tight, firm, or fixed; to free from restraint or constraint; to relax
9. We met at the campus _____ to study for our upcoming exams.
- n.* (short for quadrangle) a square or rectangular open area or courtyard, often surrounded by buildings or used for recreational or social purposes
10. A bit of _____ on the bow hair helps produce a smooth and clear sound on the cello.
- n.* a solid form of resin that is obtained from conifers and is used to make varnishes, adhesives, and other products; a sticky substance used on the bows of stringed instruments to improve the grip on the strings
11. The dentist recommended a _____ cleaning to remove plaque buildup on my teeth.
- adj.* relating to the supporting structures of teeth, such as the gums, bone, and connective tissue
12. The salesperson tried to _____ the customer into buying a new car.
- v.* to attract or lure someone with something desirable or tempting
13. The _____ waiter accidentally spilled a tray of drinks on a customer.
- adj.* lacking in grace or skill; awkward; cumbersome
14. The driver had to _____ quickly to avoid hitting the red light.
- v.* to slow down or reduce the speed of something; to decrease in speed
15. My _____ with end-rounded bristles is excellent for gently cleaning my teeth and gums.
- n.* a small brush with a handle used for cleaning the teeth

ANSWERS: 8. loosen, 9. quad, 10. rosin, 11. periodontal, 12. entice, 13. clumsy, 14. decelerate, 15. toothbrush

16. Some researchers claim that even humans can _____ sense earthquakes.

adv. as a matter of nature or intuition rather than thought or training

17. The phone rang at the most _____ time.

adj. suitable or happening at a time that is suitable or convenient for a particular purpose

18. He is very popular at school because he can _____ all the teachers' accents.

v. to imitate someone's speech, movement, or behavior, especially to make others laugh

19. He was so _____ about his beliefs that he refused to listen to any other points of view.

adj. refusing to change one's mind or behavior despite persuasion or evidence to the contrary; unyielding; difficult to move or change

20. The child _____ out of his mother's grasp and ran off.

v. to twist, wiggle, or contort the body uncomfortably or awkwardly, often due to embarrassment, discomfort, or nervousness

21. He _____ carefully on the slippery ice.

v. to step or walk on something

22. The teacher handed out several different colored _____ to each student.

n. a stick of colored wax, charcoal, chalk, or other material used for drawing or coloring; (verb) to draw or color with crayons, which are sticks of colored wax, chalk, or charcoal used for drawing or coloring

23. Her hips _____ as she walks.

v. to move or cause to move up and down or from side to side in short and quick movements

ANSWERS: 16. instinctively, 17. opportune, 18. mimic, 19. stubborn, 20. squirmed, 21. treads, 22. crayons, 23. wiggle

24. The dentist asked him to spit out the excess _____ into the sink.
n. the clear liquid that is secreted into the mouth by glands in the walls of the mouth and throat, helping to lubricate food during chewing and digestion
25. The _____ hiker enjoyed feeling the earth beneath their feet.
adj. without shoes or other foot coverings; wearing nothing on the feet
26. No matter how hard I tried, I couldn't _____ the heavy couch from its place in the room.
v. to move or shift slightly, particularly with effort or resistance; to make or cause a slight change in something
27. The _____ graceful movements were a joy to watch.
n. a female ballet (= a type of performance dance that tells a dramatic story or expresses an idea with music but no talking or singing) dancer
28. He stepped on the gas pedal, and the engine released a loud _____.
n. a measure of the rate at which an engine or motor rotates, often expressed in revolutions per minute (RPM); (verb) to increase the number of rotations per minute
29. The mechanic _____ the gears to prevent them from grinding.
v. to apply a substance, such as oil or grease, to reduce friction or wear on a surface
30. A desire for success _____ her.
v. to cause a machine or equipment to start to work

ANSWERS: 24. saliva, 25. barefoot, 26. budge, 27. ballerina's, 28. rev, 29. lubricated, 30. actuated