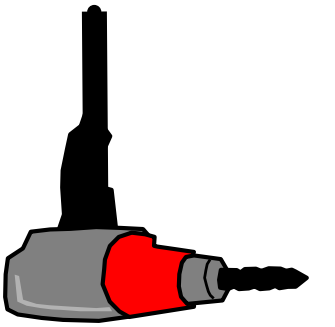

Resolving Contradictions—Quick Reference

Nov 2014 Edition

TRIZ Power Tools

Skill 1—Resolving Contradictions

Nov 2014 Edition

TRIZ Power Tools by Collaborative Coauthors

77 Pages

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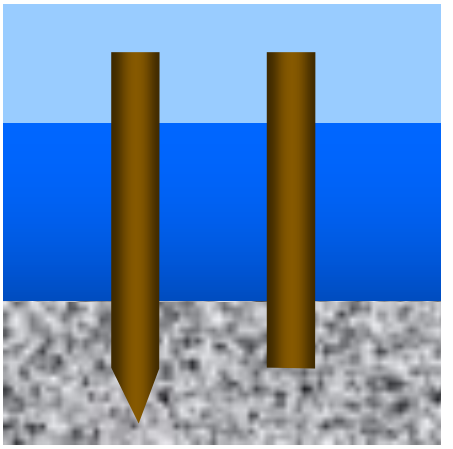
Separate in Time

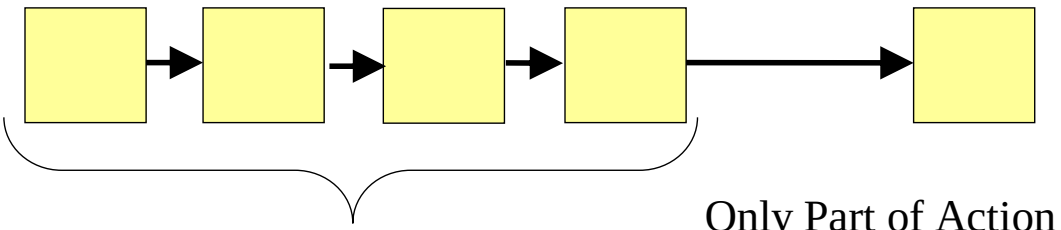
L3-Test for Separation in Time

I want the (element) to be (setting A) while (condition A). I want the (element) to be (setting B) while (condition B). Must the critical conditions overlap in time? If they must overlap then you should go to Separate Gradually.

Test: I want the (pile) to be (sharp) while (driving). I want the (pile) to be (blunt) while (supporting). Must the critical conditions overlap in time?



L3-Action—Prior Action

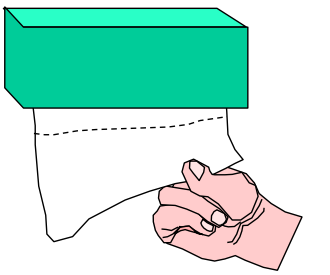


Some Stages Not Performed
(Performed in Advance)

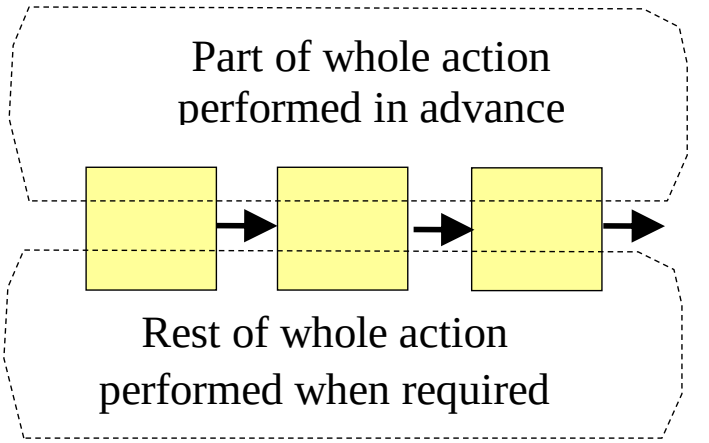
Only Part of Action
Performed When
Required

The contradiction attribute relates to an action or function. (Modification) of the (product) can be broken down into steps. The steps(s) of (actions performed during Condition A) are performed during (condition A) by (method or previously placed tool) in order to have (setting A). The remaining steps(s) of (remaining actions) are performed during (condition B) in order to have (setting B).

The contradiction attribute relates to an action or function. (Tearing) of the (towel) can be broken down into steps. The steps(s) of (holding and tearing) are performed during (any time previous to use) by (mechanical holding and tearing) in order to have (tearing). The remaining steps(s) of (pulling the towel) are performed during (towel use) in order to have (not tearing).

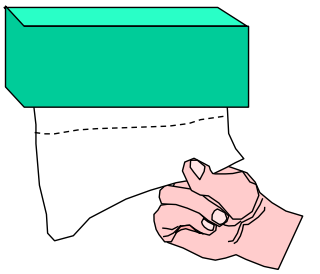


L3-Action—Partial Action

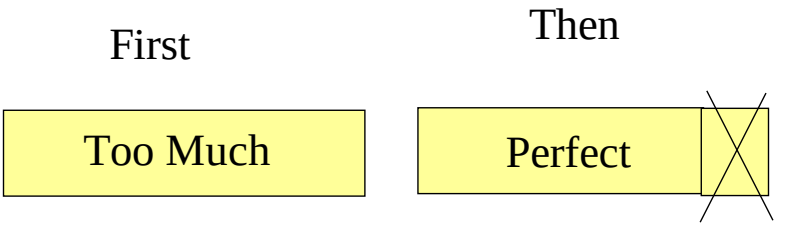


The contradiction attribute relates to an action or function. (Modification) of the (product of the function) is partially performed in its entirety during (condition A) by (method) giving (setting A). The function is completed during (condition B) by (description of final action) giving (setting B).

The contradiction attribute relates to an action or function. (Tearing) of the (towel) is partially performed in its entirety during (manufacture of the towel) by (perforating the towel) giving (not tearing). The function is completed during (towel use) by (pulling the towel) giving (tearing).

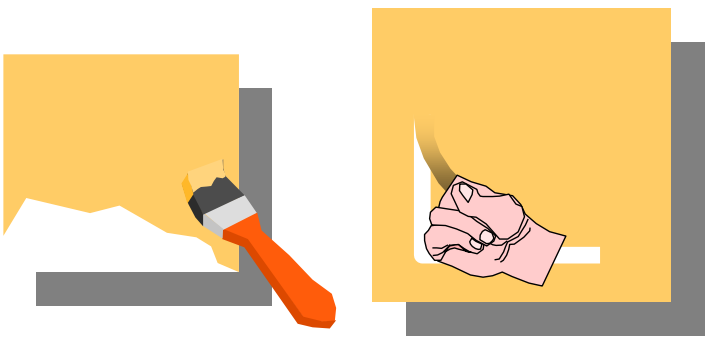


L3-Action—Excessive and Remedial Action



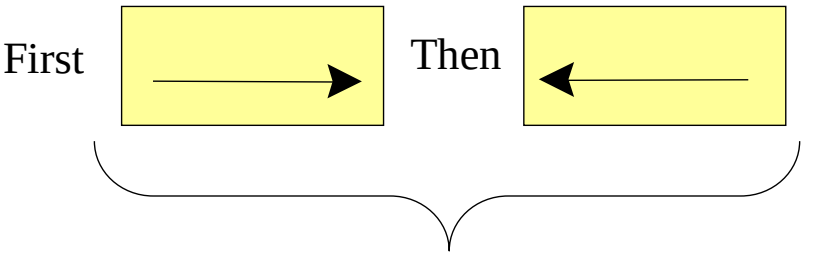
*The contradiction attribute relates to an action or function that must be performed **rapidly** and **slowly**. The function of (modifying) the (product) can be rapidly performed by the gross action of (method of performing excessively). The detailed remedial action of (remedial action) is made possible by (method) in advance or by overflowing a (threshold) threshold by (method)*

The contradiction attribute relates to an action or function. The function of (painting) the (detailed parts) can be rapidly performed by the gross action of (painting with a roller or large brush). The detailed remedial action of (removing the excess paint) is made possible by (applying masking) in advance or by overflowing a (hydrophobic) threshold by (making the unpainted areas from hydrophobic materials.)



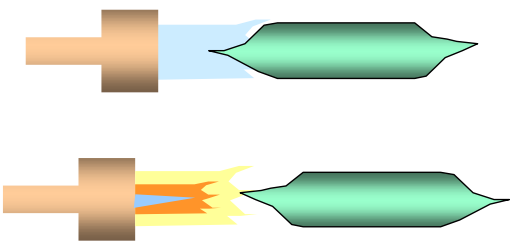
4-Separate in Time

L3-Action—Prior Counteraction



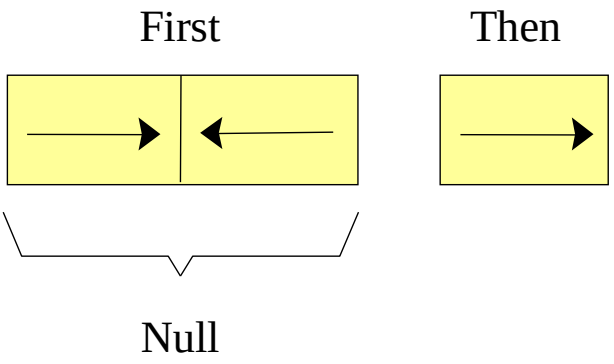
The harmful function of (harmful function) the (element) cannot be avoided. The counter action of (counter action) is performed in advance by (method of counter action) so that when the time for the harmful action of (harmful action) the (element) it is not (harmful action).

The harmful function of (heating) the (medicine) cannot be avoided. The counter action of (cooling the medicine) is performed in advance by (cooling with liquid nitrogen) so that when the time for the harmful action of (heating) the (medicine) it is not (heated).

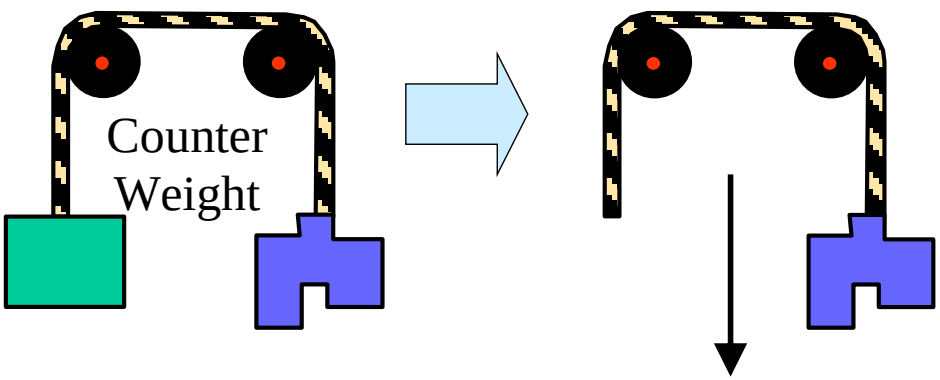


L3-Action—Countering

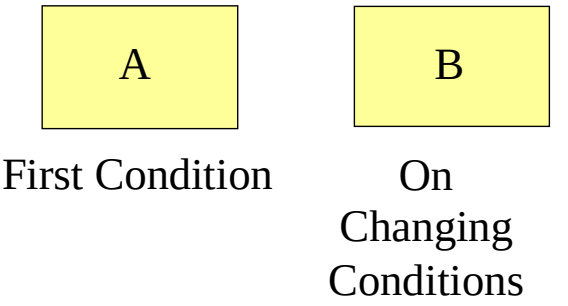
The contradiction attribute relates to an action or function. The (element) must be (null action) during (condition A). This is accomplished by applying (counteraction). The counter action is removed during (condition B) when the full action is required.



The contradiction attribute relates to an action or function. The (weight) must be (held) during (positioning). This is accomplished by applying (a counter weight or force). The counter action is removed during (dropping) when the full action is required.

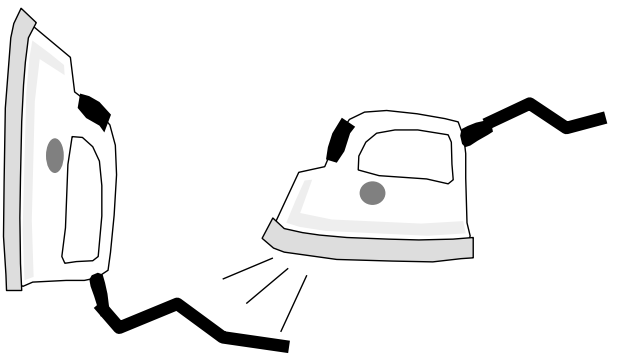


L3-Separation on Condition



The difference of (difference) between (condition A) and (condition B) will change the (element attribute) from (setting A) to (setting B). The (physical phenomenon or method) will be exploited to drive the change of parameters.

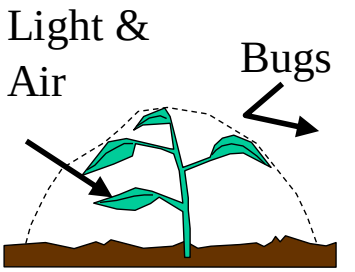
The difference of (iron orientation) between (ironing) and (iron resting) will change the (water flow) from (flowing) to (not flowing). The (water level versus flow orifice level) will be exploited to drive the change of parameters.



L3-Separation on Condition—Transparency

The difference of (difference) between (condition A) and (condition B) will change the (element) transparency from transparent to opaque. The (physical phenomenon or method) will be exploited to drive the change of parameters.

The difference of (object size) between (light and air) and (bugs) will change the (screen) transparency from transparent to opaque. The (opening size of the screen) will be exploited to drive the change of parameters.



L3-Transformation—Transformable States

Solid to Liquid to Gas
Combustible materials
Fissable
Adhesives
Explosive
Wettable
Exothermic-Endothermic
Soluble or dissolvable materials
Foams
Settable liquids--(increase of volume)
Easily breakable or abraidable
Polymerizing or de-polymerizing
Mixture decomposition --Electrolysis
Disassociation- recombination
Shape Memory Materials
Magnetic materials using Curie Effect
Molecular reorganization (diamonds)

The (element) is formed from (a transformable structure—consult the table). The (element) is (state A) during (condition A), thus making it (setting A). The (element) is (state B) during (condition B), thus making it (setting B). (The transformation) is operated near (critical point) by (method).

Critical Points
Sheer Strength
Ultimate Strength
Tip Angle
Static Friction
Adhesive Failure point
Zero Buoyancy
Triple point
Surface Tension
Resonant Frequency
Spark point
Freezing point
Boiling point
Curie temperature

The (element) is formed from (an easily broken structure). The (chopsticks) are (unbroken) during (storage in vending machine) thus making them (joined). The (chopsticks) are (broken) during (preparation for consumption) thus making them (separate). (Breaking) is operated near (yield) by (creating a high stress crack initiation).

First

Then

L3-Transformation—Using Fields

First | A | Then | B | Then | A | . . .

Elastic Stress	Gravity	Friction	Adhesion
Buoyant Force	Hydrostatic Pressure	Jet Pressure	Surface Tension
Centrifugal Force	Inertial Force	Coriolis Force	
Oder & Taste	Diffusion	Osmosis	Chemical Fields
Sound	Vibrations & Oscillations	Ultrasound	Waves
Thermal Heating or Cooling	Thermal Shocks	Information	
Corona Discharge Current	Eddie Currents	Particle Beams	Nuclear Forces
Electrostatic Fields	Magnetic Fields	Electromagnetic Fields	
Radio Waves	**Micro Waves**	**Infrared**	**Visible Light**	**Ultraviolet**	**X-Ray**	**Cosmic Rays**	

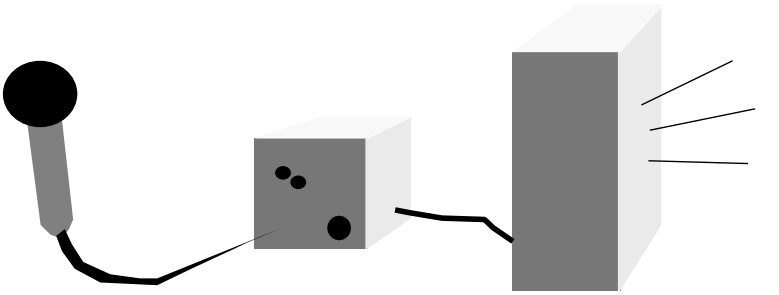
Using (physical phenomenon including pneumatic or hydraulic structures) allows us to add a (associated field from the table) to the (element) during (condition A), makes it (setting A). (Removing or reversing) the (field) during (condition B) makes it (setting B).

Using (pneumatic structures) allows us to add a (pressure field) to the (display) during (displaying), makes it (exist). (Removing) the (pressure field) during (storage) makes it (not exist).

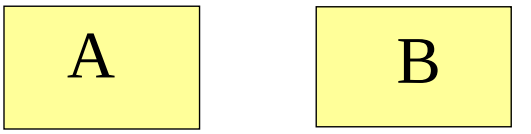
L3-Transformation—Input / Output

The (elements) to be operated upon must be (setting A) during (condition A). A transformation of (phenomena or action) changes the (elements) to (setting B) during (condition B).

The (voice) to be operated upon must be (male) during (actual story telling). A transformation of (voice modulation) changes the (voice) to (female) during (transmission of the show).



L3-Transformation—Disposable Objects



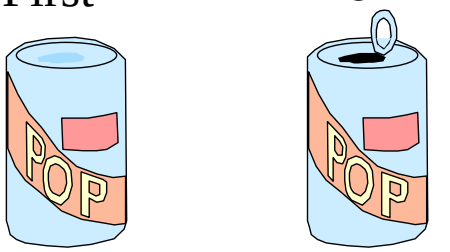
First Exists

Non-Existent or Disposed

The (element) is formed from (expendable structure—see table). The (element) is (state A) during (condition A), thus making it (existing). The (element) is (state B) during (condition B), thus making it (non- existing).

First

Then



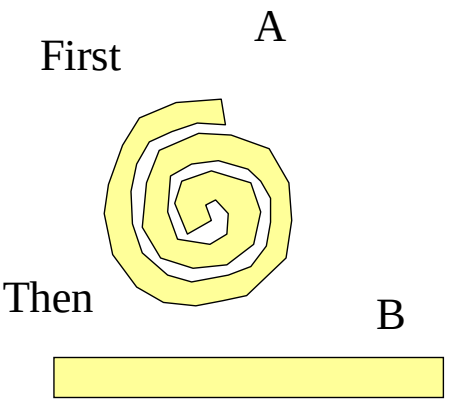
Closed

Opened

The (can seal) is formed from (an easily yielding material). The (can opening) is (open) during (consumption), thus making it (existing). The (can seal) is (closed) during (storage), thus making it (not existing).

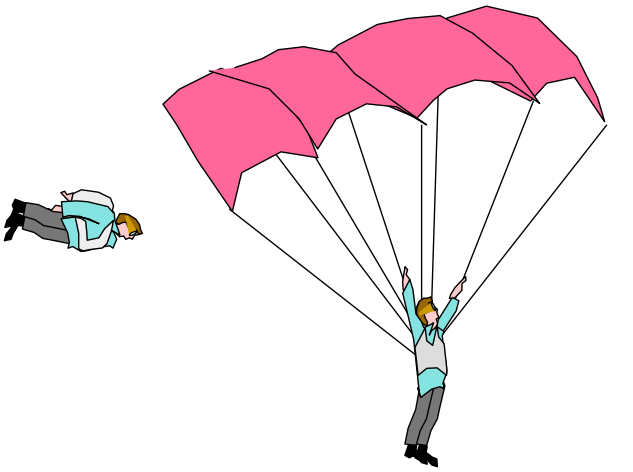
L3-Transformation—Unrolling & Stretching

- Nesting Extenders
- Fabrics
- Extension Springs
- Constant Force Springs
- Shape Changing Molecules
- Nets
- Origami
- Scissoring Expanders



The (element) is formed from (expanding structure—see table). The (element) is (state A) during (condition A), thus making it (setting A). The (element) is (state B) during (condition B), thus making it (setting B).

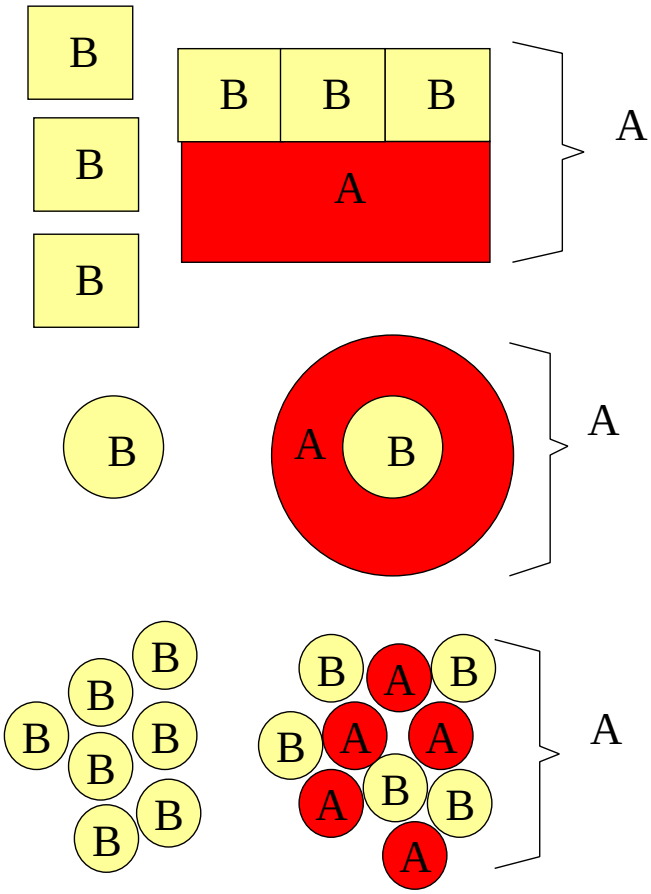
The (air brake) is formed from (fabric). The (air brake) is (compacted) during (freefall), thus making it (low drag). The (airbrake) is (expanded) during (braking), thus making it (high drag).



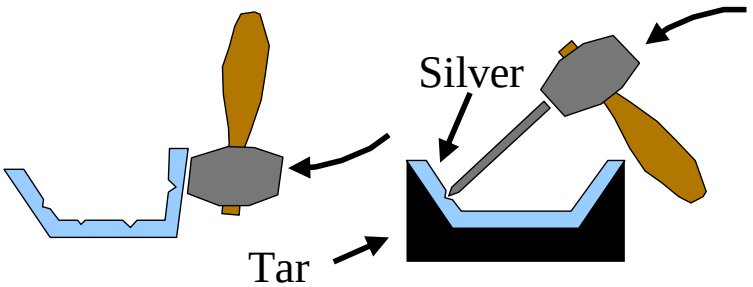
16-Separate in Time

L3-Carrier—Intermediary

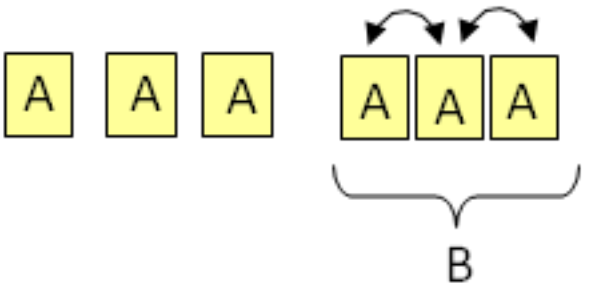
During (condition A) (an inexpensive carrier object or substance) which is (setting A) is (attached to, surrounding or mixed with) (segmented or individual) (elements) which are (setting B) thus loaning its property and making the combination (setting A). No carrier is used during (condition B) making the (element) (setting B).



During (engraving) (tar) which is (stiff) is (attached to) (individual) (plates) which are (flexible) thus loaning its property and making the combination (stiff). No carrier is used during (forming the plate) making the (plate) (flexible
).

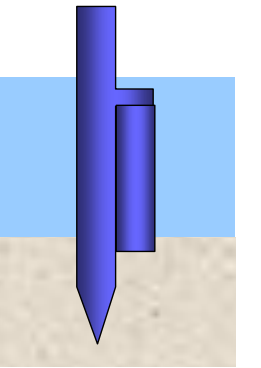


L3-Merging—Interacting

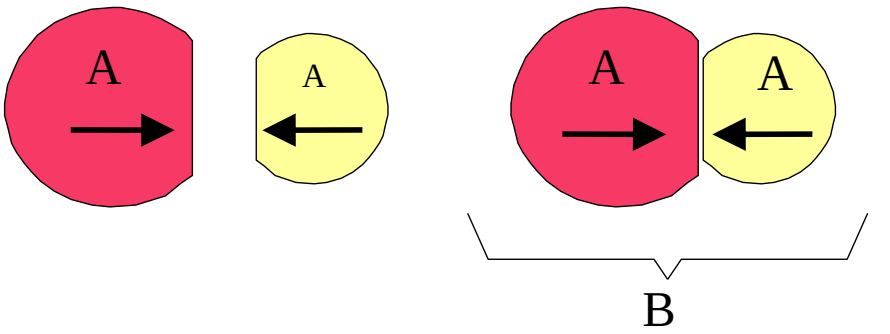


Segmentation is (allowed and accomplished by what method or not allowed). During (condition A) several (segmented or individual) (elements) have the property of being (setting A) while unified or interacting through (a field, mediator, method or unified arrangement). During (condition B) the unifying interaction is absent making them (setting B).

Segmentation is (not allowed). During (supporting) several (individual) (piles) have the property of being (blunt) while unified or interacting through (a mechanical nesting field). During (driving) the interaction is absent making them (sharp).

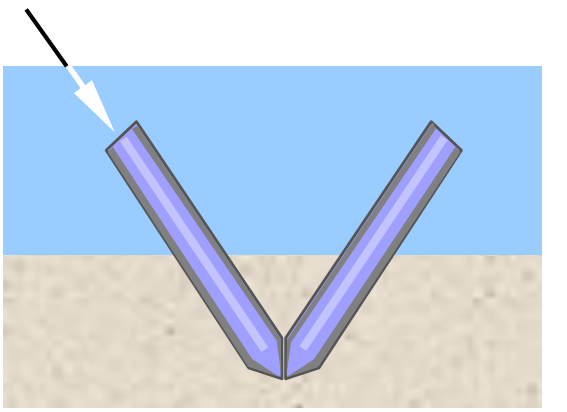


L3-Merging—Countering

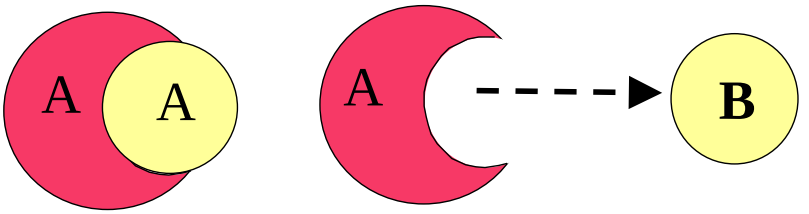


Elements are configured, oriented or designed to oppose each other by (method). Separating the (elements) during (condition A) makes them (setting A). During (condition B) the merged (elements) oppose each other making them (setting B).

Elements are configured, oriented or designed to oppose each other by (orienting them to oppose each other). Separating the (piles) during (driving) makes them (sharp). During (supporting) the merged (piles) oppose each other making them (blunt).

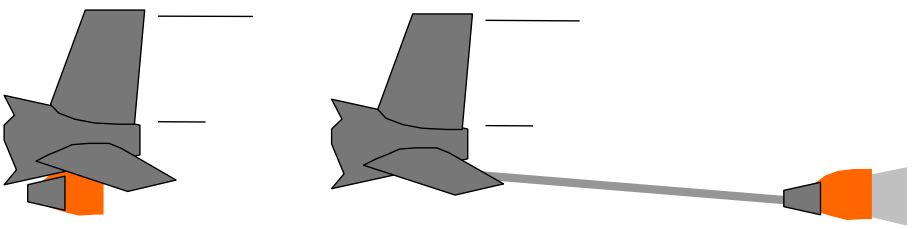


L3-Merging—Extraction



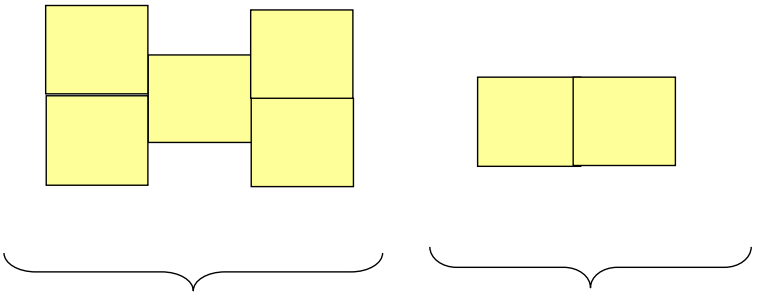
The (element) has several identifiable pieces. During (condition A) the (crucial piece) is separated making it (Setting A). During (condition B) the (crucial piece) is reunited making it (Setting B).

The (fueling system) has several identifiable pieces. During (refueling) the (intake nozzle) is separated making it (extended). During (normal flight) the (intake nozzle) is reunited making it (retracted).



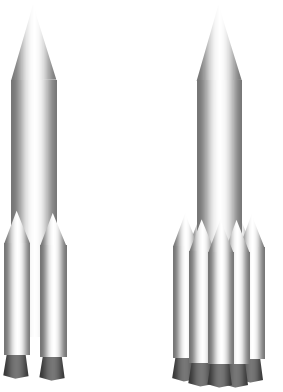
Retracted Extended

L3-Merging—Adjustable Numbers



Multiple (elements) are available for adjustable use. During (condition A) many (elements) are used to give (Setting A). During (condition B) few elements are used to give (Setting B).

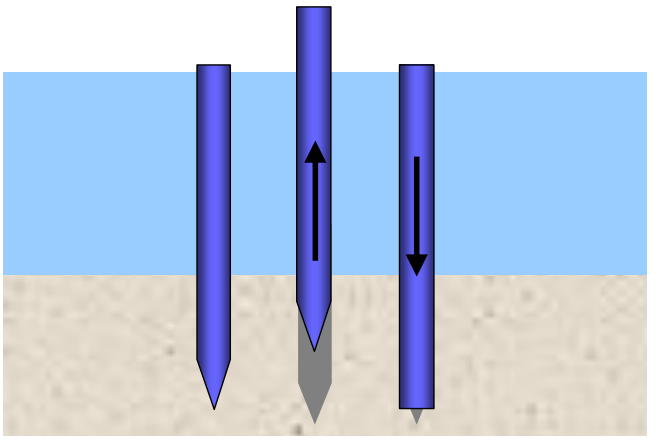
Multiple (thrusters) are available for adjustable use. During (large payloads) many (thrusters) are used to give (high thrust). During (small payloads) few elements are used to give (low thrust).



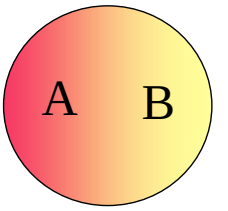
L3-Rearranging—Two Objects

Two distinct (elements) are used. During (condition A) the (setting A) one is used. During (condition B) the (setting B) one is used.

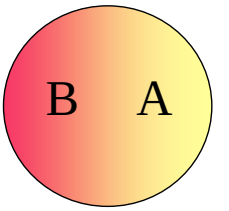
Following driving, the sharp pile which is specifically designed for driving is extracted and the blunt one is driven into the resulting hole. Additionally, the sharp pile can have other features for driving such as strength, low mass and high stiffness which make the pile driving more rapid.



L3-Rearranging—Reorienting Non-Uniform



One Orientation



The Other

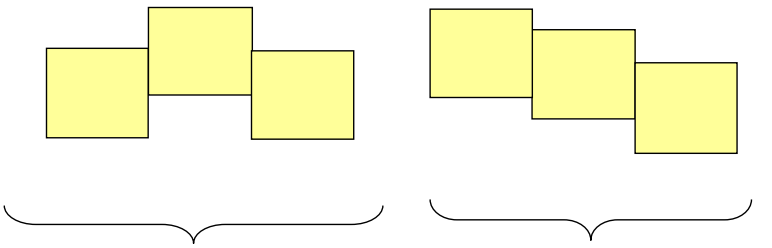
Part of a single (element) is (Setting A) while another part is (Setting B). During (condition A) the non-uniform (element) is oriented so that (Setting A) is emphasized. During (condition B) the (element) is reoriented so that (Setting B) is emphasized.

Part of a single (uniform) is (red) while another part is (blue). During (playing on one team) the non-uniform (uniform) is oriented so that (red) is emphasized. During (playing on another team) the (uniform) is reoriented so that (blue) is emphasized.

Blue

Red

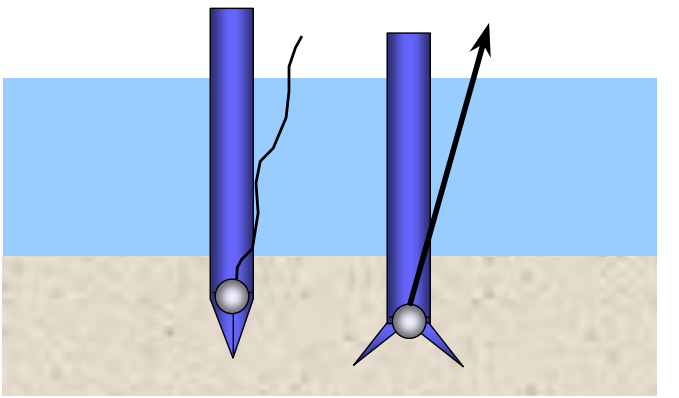
L3-Rearranging—Rearranging & Unfolding Parts



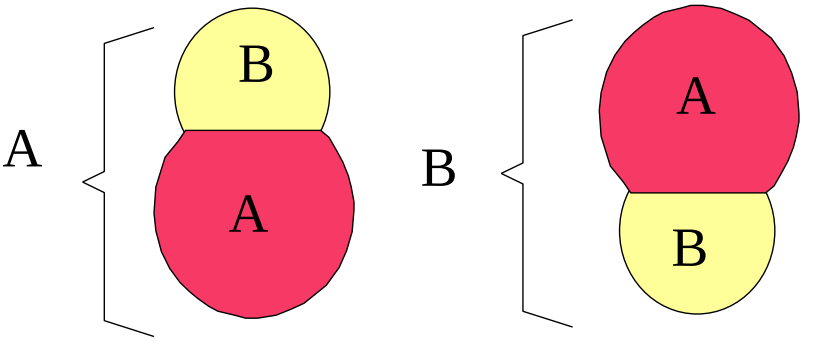
Hinged
Unfolding
Origami
Nesting

(Multiple or segmented elements) are coordinated together. During (condition A) the pieces are oriented so that they are collectively (Setting A). During (condition B) the pieces are oriented so that they are collectively (Setting B).

(Segmented Piles) are coordinated together. During (driving) the pieces are oriented so that they are collectively (sharp). During (supporting) the pieces are oriented so that they are collectively (blunt).

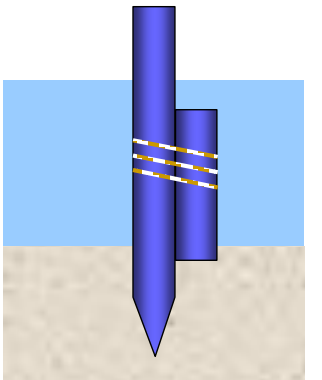


L3-Rearranging—Reorienting Attachments

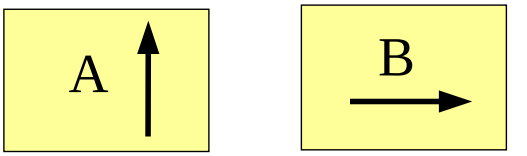


Two (objects) which are (Setting A) and (Setting B) are attached to each other. During (condition A) the pieces are oriented so that (Setting A) comes into play. During (condition B) the pieces are oriented so that (Setting B) comes into play.

Two (piles) which are (sharp) and (blunt) are attached to each other. During (driving) the pieces are oriented so that (sharp) comes into play. During (supporting) the pieces are oriented so that (blunt) comes into play.

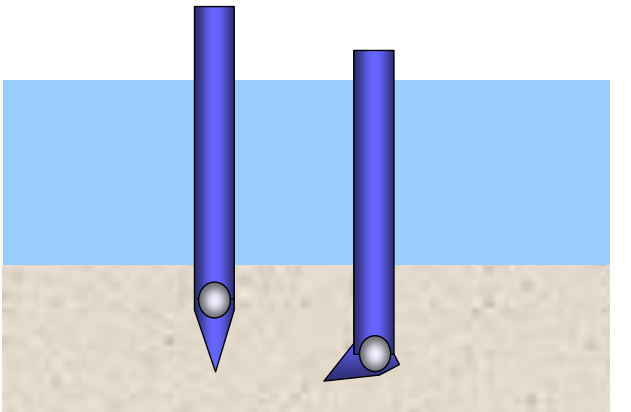


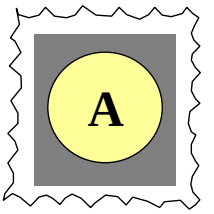
L3-Rearranging—Changing Direction



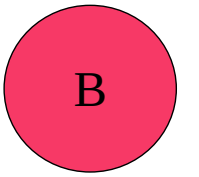
Changing directions of (crucial feature) allows the setting to be changed. During (condition A) the (crucial feature) is oriented so that (Setting A) comes into play. During (condition B) the (crucial feature) changes direction so that (Setting B) comes into play.

Changing directions of (the pile point) allows the setting to be changed. During (driving) the (pile point) is oriented so that (sharp) comes into play. During (supporting) the (pile point) changes direction so that (blunt) comes into play.





Then

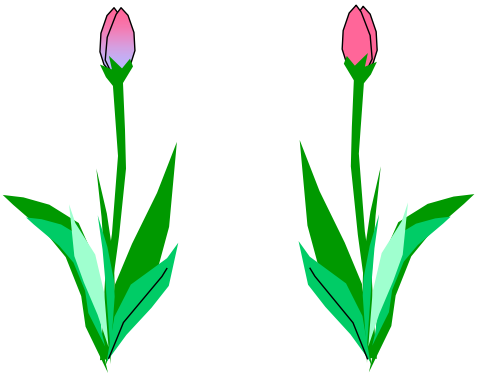


Copy / Facsimile Original

L3-Copy or Facsimile

The (essential part) of the (element) can be copied into a (copy name—consider the above list). During (condition A) the (copy name) is (Setting A). During (condition B) the (original) is (Setting B).

Photographs Movies Paint Coverings Molds Time lapse photos Impressions	Silhouettes Castings Resists Projections Computer Model Dummies



27-Separate in Time

Real Silk

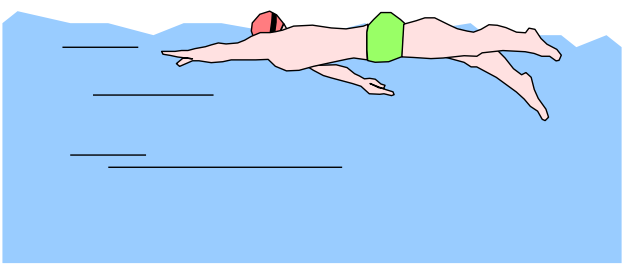
The (look) of the (flower) can be copied into a (silk flower). During (winter) the (silk flower) is (cold tolerant). During (summer) the (real flower) is (not cold tolerant).

Separate Gradually

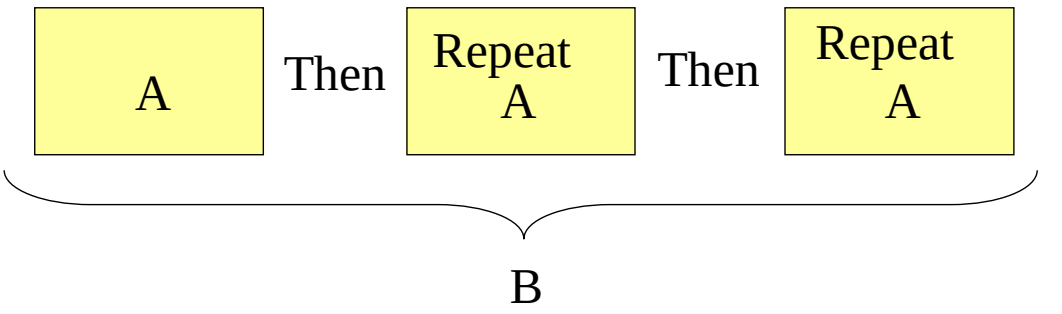
L3-Test for Separate Gradually

Will a complete resolution of the contradiction allow starting with (setting A) and ending with (setting B) or its equivalent? If "yes" then try to Separate Gradually. Otherwise, go to Separate in Space.

Will a complete resolution of the contradiction allow starting with (little) (water) and ending with (much) (water) or its equivalent? This would be allowable so we will try to separate gradually.

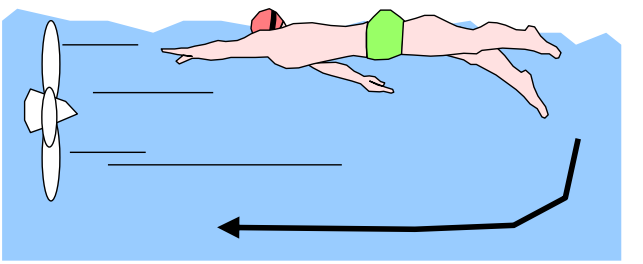


L3-Repeated Use

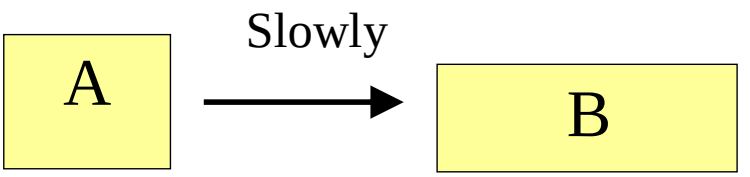


(Setting A) (element) is used over and over which is equivalent to (setting B) (element). (Method of reconditioning) is used to make this happen.

(Little) (water) is used over and over which is equivalent to (much) (water). (Recirculation of the water) is used to make this happen.

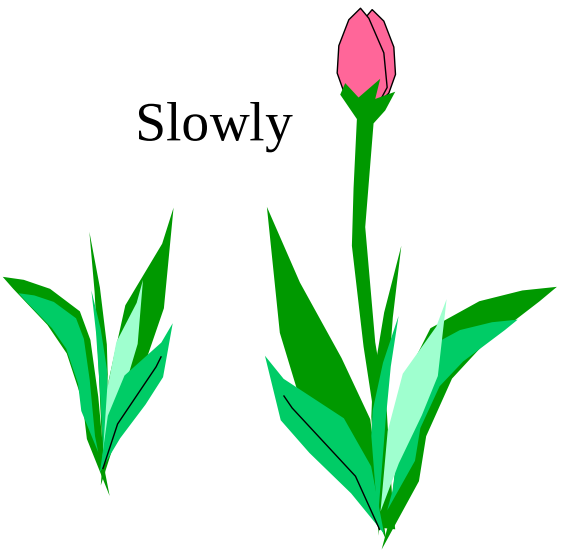


L3-Maturing / Proliferation

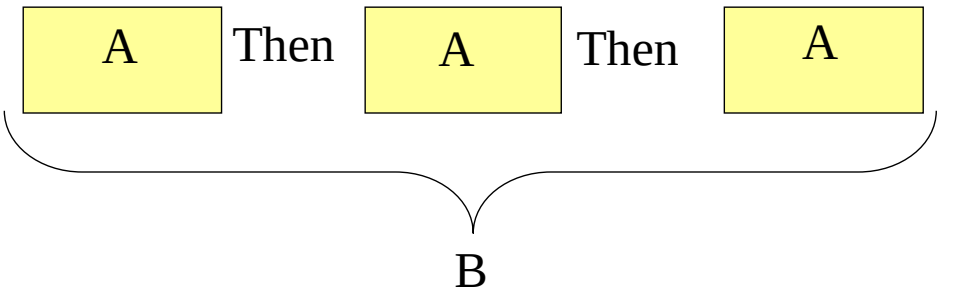


The (element) is capable of self organization through (method). During (condition A) the (element) starts as (setting A). Over time the (element) matures or proliferates to become (setting B) during (condition B).

The (shade producer) is capable of self organization through (biological growth). During (the time that the plant is small) the (shade producer) starts as (small). Over time the (shade producer) matures or proliferates to become (large) during (the time that the plant needs a lot of shade).



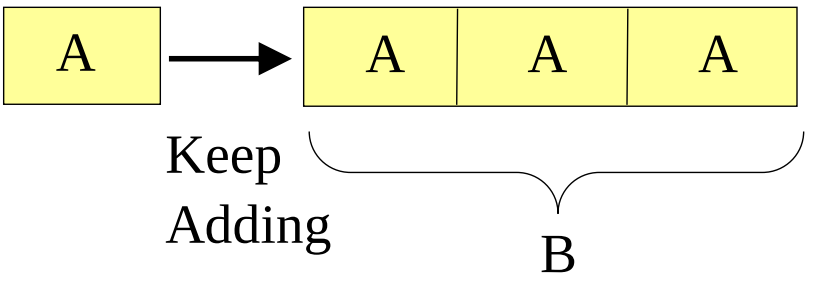
L3-Separate Use



Individual (elements) which are (setting A) come into play gradually during (condition A). In the end, the sum effect is (setting B).

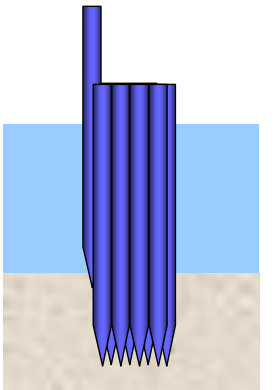
Individual (explosions) which are (small) come into play gradually during (excavation). In the end, the sum effect is a (large) (explosion).

L3-Gradually Merged

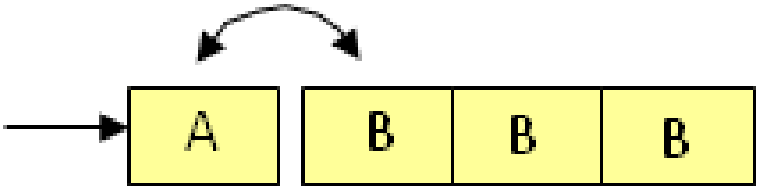


Multiple or segmented (elements) are available. Gradually merging the (setting A) (elements) during (condition A) results in the equivalent of (setting B) (elements).

Multiple or segmented (piles) are available. Gradually merging the (thin) (piles) during (driving) results in the equivalent of (thick) (piles).

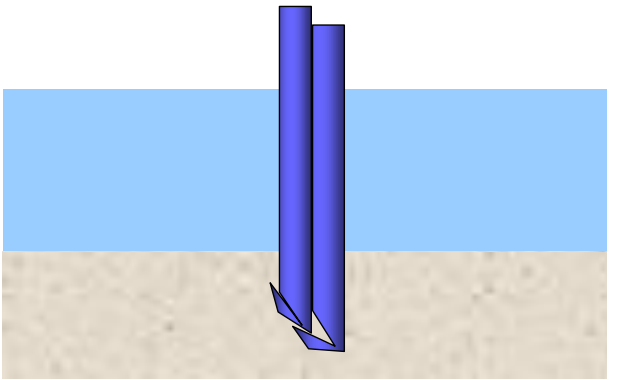


L3-Merging—Merged Interaction

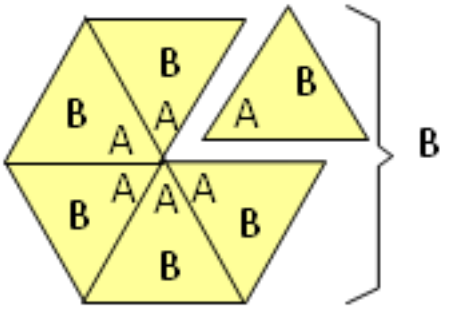


Multiple or segmented (elements) are available. Each (setting A) (element) that is merged during (condition A) with the already merged (elements) become (setting B) by (method).

Multiple or segmented (piles) are available. Each (sharp) (pile) that is merged during (driving) with the already merged (piles) become (blunt) by (pushing down on a ledge protruding with a lip).

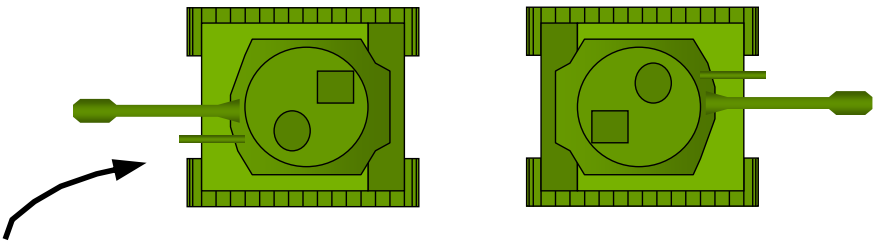


L3-Gradually Hidden / Exposed

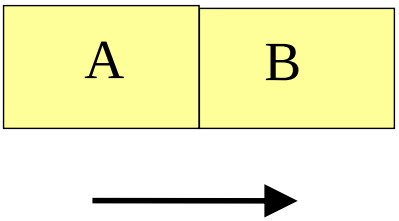


The (element) already has both properties. (Setting A) is desirable and (setting B) is undesirable. The (elements) are gradually merged in a way that hides (setting B) until the whole is (setting A).

The (tank) already has both properties. (protected) is desirable and (vulnerable) is undesirable. The (tanks) are gradually merged in a way that hides (vulnerable) until the whole is (protected).

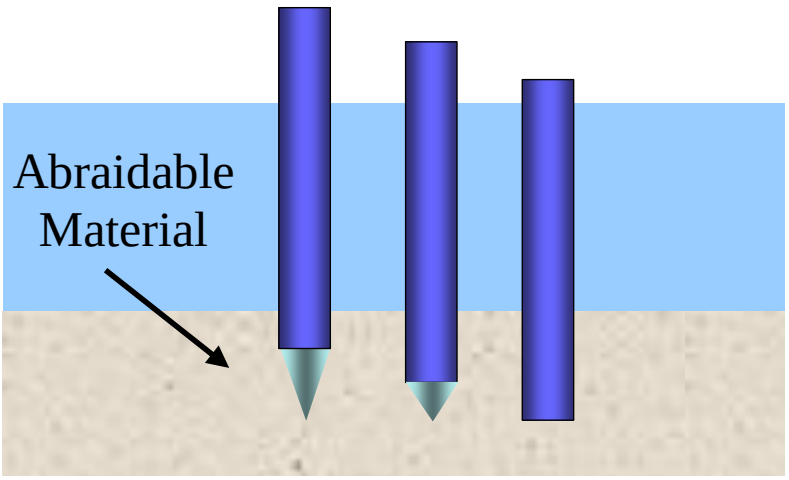


L3-Gradually Transformed

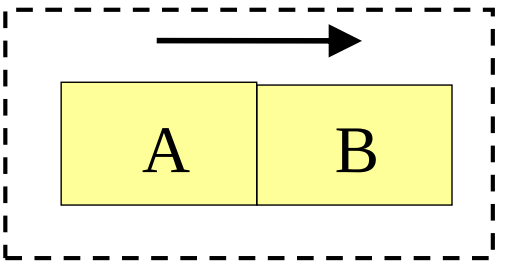


The (element) (critical region) is made from (transformable material). During (condition A) the (element) transforms from (setting A) to (setting B).

The (pile) (tip) is made from (abraidable material). During (driving) the (pile) transforms from (sharp) to (blunt).



L3-Gradually Added Fields



The (element) (critical region) can be changed from (setting A) to (setting B) by gradually adding a (field type) field. During (condition A) the (element) transforms from (setting A) to (setting B).

Separate in Space

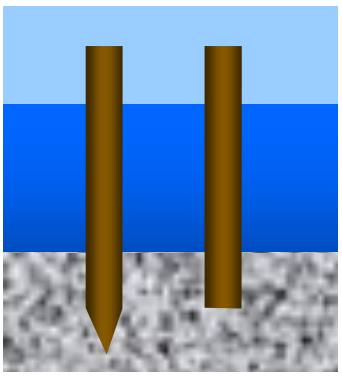
L3-Test for Separation in Space

During (critical time) (setting A) is essential (where condition A exists). (Setting B) is essential (where condition B exists). Must these conditions (and settings) overlap in space? If yes then go to Separate between the Parts and the Whole.

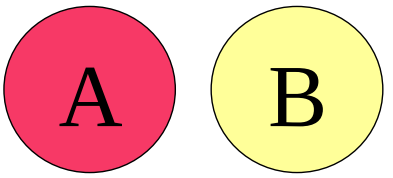
If one of the conditions is never essential (useful and necessary) then the condition where this applies is any place that it is allowable. Note that some of the methods will only weakly apply when one of the conditions is not essential.

During (supporting) (bluntness) is essential (where a supporting structure exists to keep it from falling over). (Sharpness) is essential where (nowhere) exists.

These conditions do not overlap in space. However, since sharpness is essential nowhere we need to determine where it is allowable. It is allowable anywhere the vertical support is sufficient to carry the vertical load that the sharp pile cannot carry. The sharp pile is mostly carrying the lateral loads.

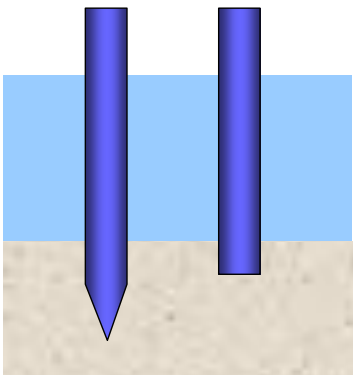


L3-Two Objects

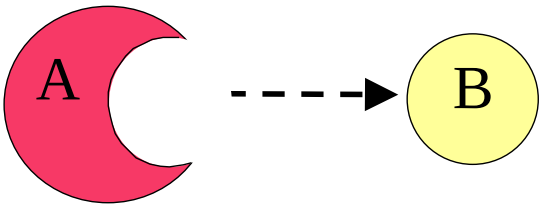


If more than one type of (element) is allowed, one (element) is (setting A) and a nearby (element) is (setting B).

If more than one type of (pile) is allowed, one (pile) is (sharp) and a nearby (pile) is (blunt).

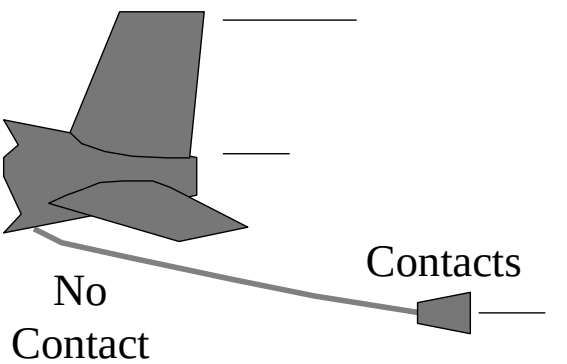


L3-Extraction



If the (element) can be separated into functional parts: The separated (element part) is (setting A). The (rest of the element parts) are (setting B). The separated parts interact through (means).

If the (tanker) can be separated into functional parts: The separated (fueling nozzle) is (in contact with the refueled craft). The (rest of the aircraft) is (not in contact). The separated parts interact through (a long refueling line).

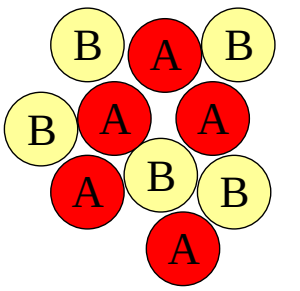


L3-Mixture

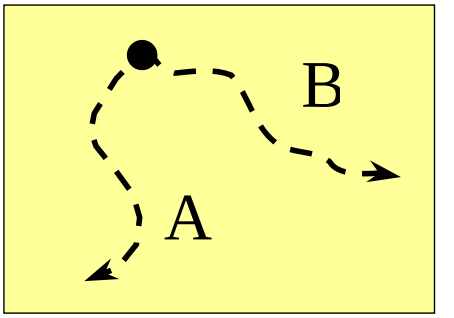
Mixture

- Partially Mixed
- Mixture
- Interweave
- Fabrics and Matrix
- Multi Fiber Fabrics
- Multi Property Laminates
- Mixtures of Different Molecules
- Gels (Liquids + Solids)
- Pastes (Liquids + Solids)
- Foams (solid or liquid)
- Capillary Structures (Solid + Liquid)
- Components of Solids or Liquid
- Porous Materials
- Foams

(Inexpensive particles or segmented elements) which are (setting A) are (mixed with) (particles or segmented elements) which are (setting B).

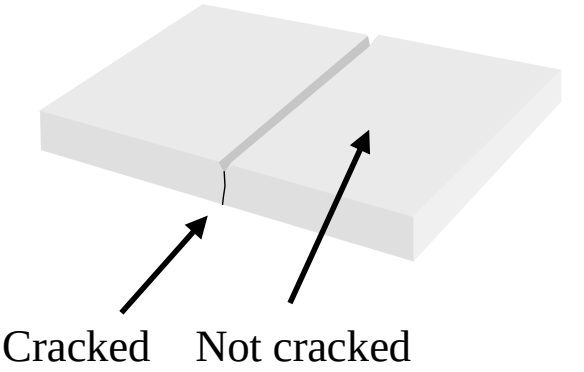


L3-Path

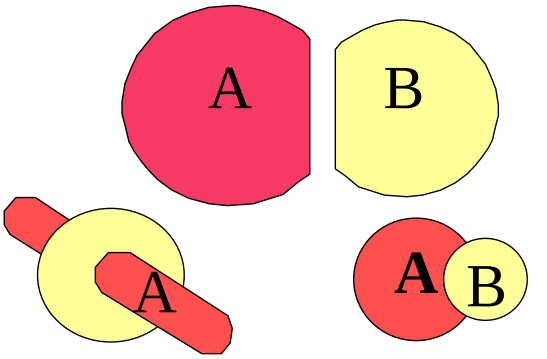


On a path (path location A) the (element knob) is (setting A). On a path (path location B) the (element knob) is (setting B).

On a path (along a notch) the (existence of crack) is (existing). On a path (in all other locations) the (existence of the crack) does (not exist).

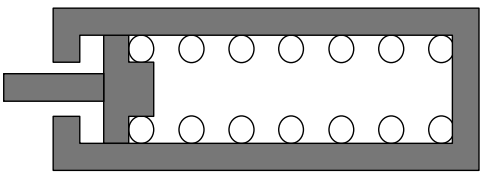


L3-Interact / Guide / Nestle / Penetrate

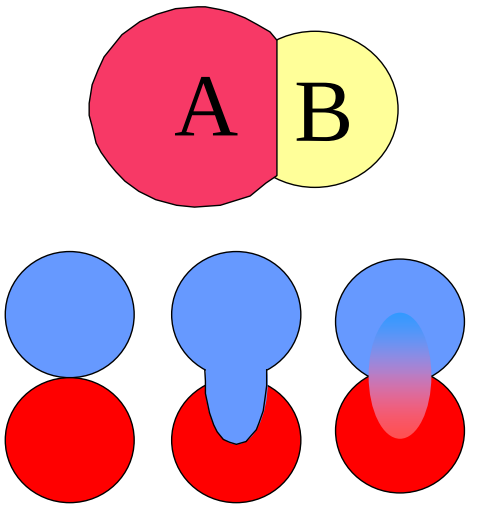


The (element) is (setting A). The interacting (object) is (setting B). The objects (interact / guide / nestle or go through each other).

The (spring) is (flexible). The interacting (spring housing) is (stiff). The objects (go through each other).



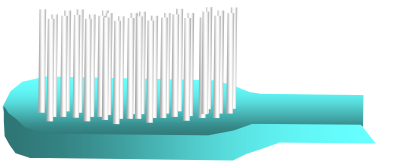
L3-Attached Objects



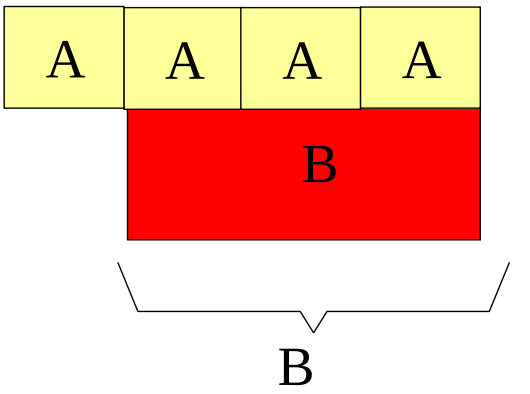
- Inert carriers
- Dual states-same material
- Dual phase substances
- Thin Films
- Paint
- Nested parts
- Attached parts
- Mixed somewhat

The (element or element part) is (setting A). The attached (object) is (setting B).

The (handle) is (rigid).
The attached (bristles) are (flexible).

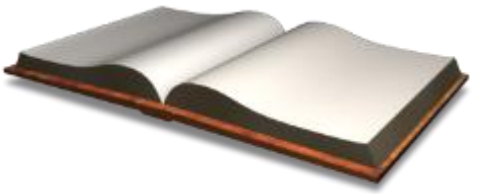


L3-Partly Carried

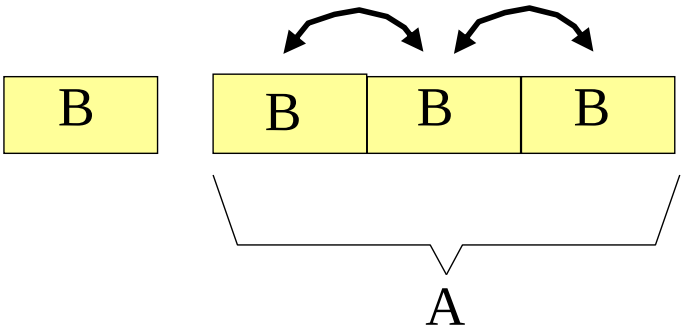


Several (elements) can be used. Some of the (elements) which are (setting A) are attached to a (carrier) which is (setting B). The (carrier) and attached (elements) are collectively (setting B). The (elements or element parts) which are not carried are still (setting A).

Several (pages) can be used. Some of the (pages) which are (flexible) are attached to a (binding) which is (stiff). The (binding) and attached (pages) are collectively (stiff). The (parts of the pages) which are not carried are still (flexible).

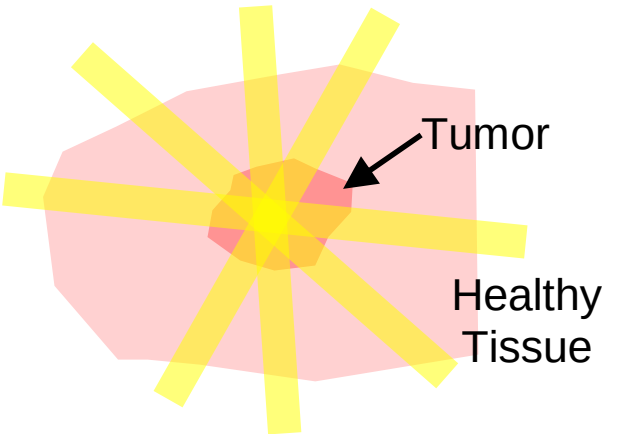


L3-Partly Merged or Interacting

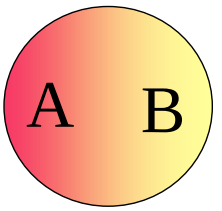


Several (elements) can be used. They partially merge or interact by (method of merging or interaction). The partly merged (elements or part of the elements) are (setting A). All that are unmerged are (setting B).

Several (beams) can be used. They partially merge or interact with each other by (crossing the beams). The partly merged (section of the beams) is (high intensity). All that are unmerged are (low intensity).



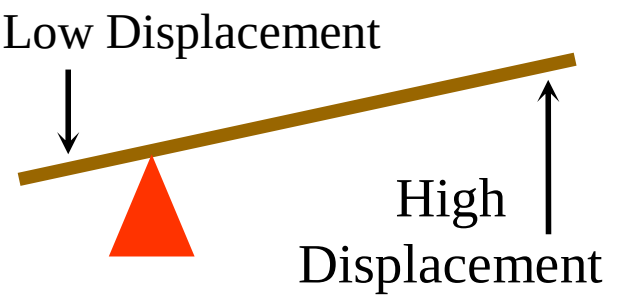
L3-Non-Uniform



- Transformers (electric, levers, etc.)
- Standing Waves
- Concentrated Additives
- Especially active Additives

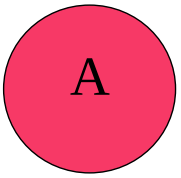
Only one (element) is allowed. One part of the (element) is (setting A). Another part of the same (element) is (setting B).

Only one (beam) is allowed. One part of the (beam) is (slow). Another part of the same (beam) is (fast).

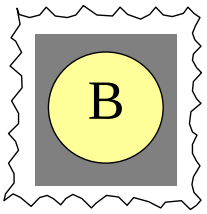


L3-Facsimile

- Photographs
- Movies
- Paint Coverings
- Molds
- Time lapse photos
- Impressions
- Silhouettes
- Castings
- Resists
- Projections
- Computer Models



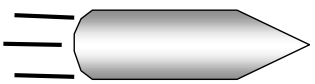
Original

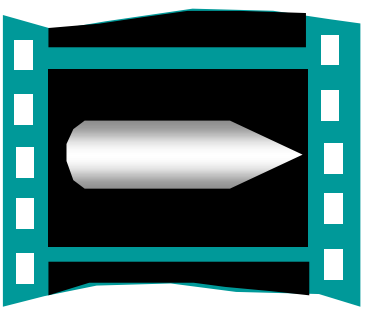


Facsimile

The (element) is unfortunately (setting A). But we can change its (appearance, sound, feel, smell or effect) to seem like it is (setting B) when using (a type of facsimile that represents the important attributes).

The (bullet) is unfortunately (fast). But we can change its (appearance) to seem like it is (slow) when using (a movie of the bullet).

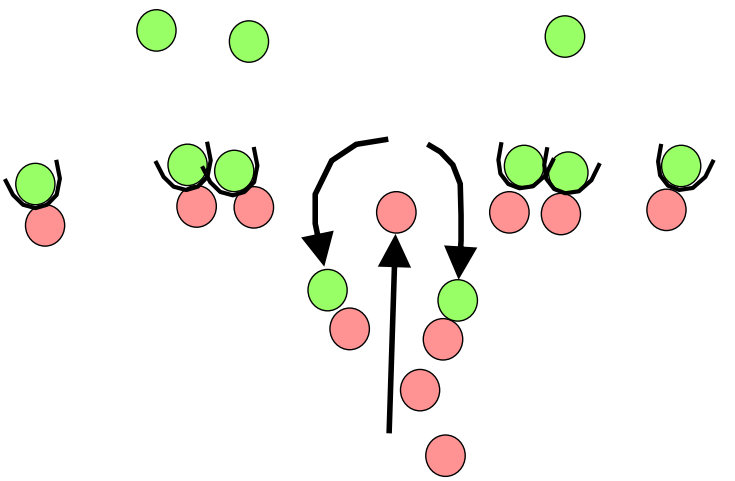




L3-Selective Countering

For actions, forces or extrinsic attributes that depend upon interactions such as beauty. Part of the (element) has (countering forces, fields or actions) in one location. In another location of the (element) the counter (counter forces, fields or actions) do not exist.

For actions, forces or extrinsic attributes that depend upon interactions such as beauty. Part of the (offensive line) has (blocking) in one location. In another location of the (offensive line) the (blocking actions) do not exist.



L3-On Condition

One (element) is (location creating condition A) rendering it (setting A). Another (element) is (location creating condition B) rendering it (setting B)

One (boat) is (in the water) rendering it (mobile). Another (boat) is (on the land) rendering it (immobile).

Separate Between the Parts and the Whole

L3-Test for Separation between the Parts and the Whole

Step 1: At a critical moment in time, should either (setting A) or (setting B) be hidden or minimized to solve the problem?

Step 2: At a critical moment in time, do I want (setting A) and (setting B) to be expressed at different scales?

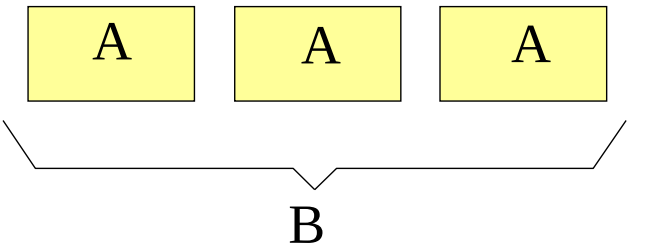
Step 3: If the answer to 1 and 2 is "no", go to separation by direction. Otherwise, separate between the parts and the whole.

Step 1: At a critical moment in time, should either (failed) or (not failed) be hidden or minimized to solve the problem? Yes, if bulb failure was minimized during any time after failure of a light bulb that would solve the problem and it would be sufficient.

Step 2: At a critical moment in time, do I want (sharp) and (blunt) to be expressed at different scales? No, there is no critical time that both properties are essential

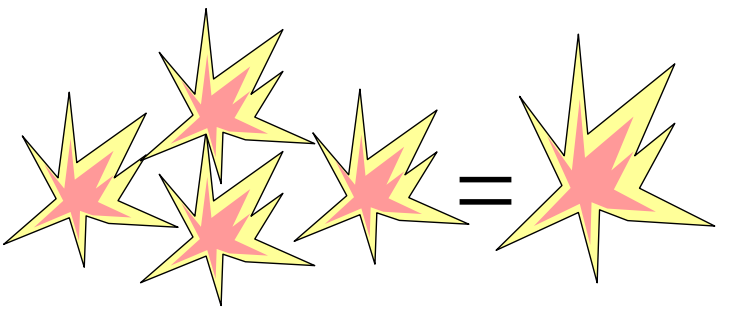
Step 3: If the answer to 1 and 2 is “no”, go to separation by direction. Otherwise, separate between the parts and the whole. The answer to 1 is “yes” so we will try to separate between the parts and the whole.

L3-Formation

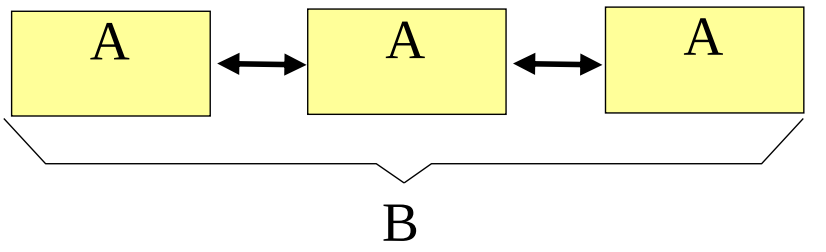


(Segmented or individual) (elements) are (setting A). The (elements) are arranged into a formation which (describe working formation). This formation has the macro effect of being (setting B). (Setting A) is (expressed or hidden).

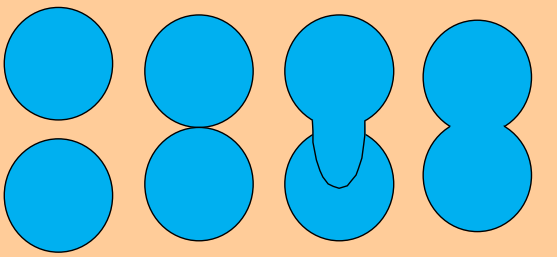
(Individual) (explosions) are (small). The (explosions) are arranged into a formation which (is sufficiently close to have the required effect). This formation has the macro effect of being (large). (Smallness) is (hidden).



L3-Merging

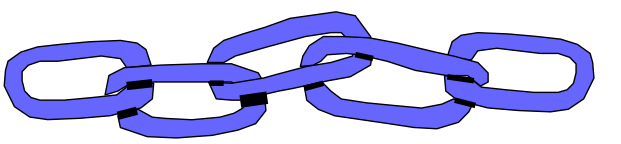


Interact through a field at a distance
Interact through a "mediator" substance
Linked by Transmission
Touch
Interweave
Nest
Nestle
Interlink
Clamped
Hinged
Interfused
Fractal Constructions



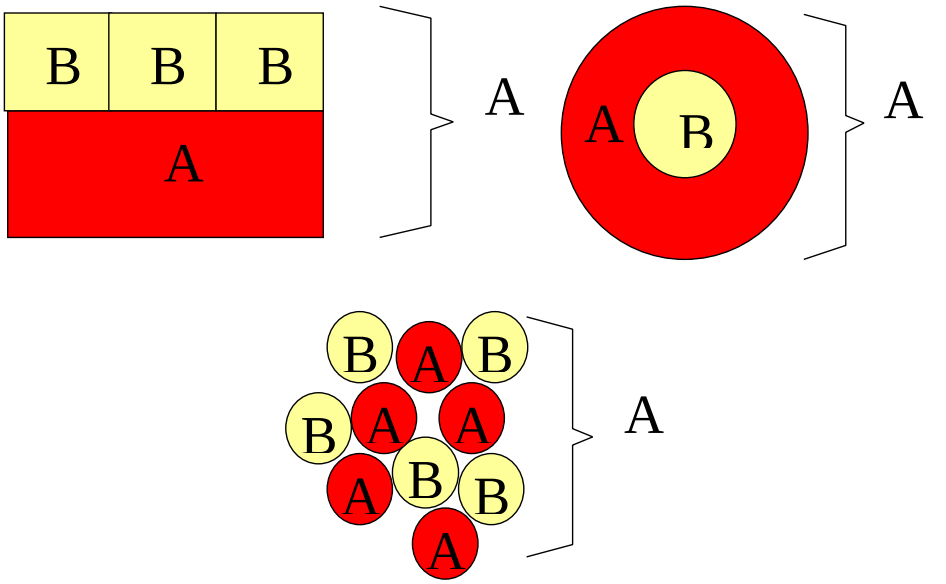
(Segmented or individual) (elements) have the property of being (setting A). When made to interact with each other by (field, mediator, method or arrangement), the overall effect is (setting B). (Setting A) is (expressed or hidden).

(Segmented) (anti-slip devices) have the property of being (stiff). When made to interact with each other by (interlocking), the overall system is (flexible). (Stiffness) is (expressed).



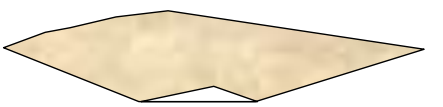
L3-Carrier

(An inexpensive carrier object or substance) which is

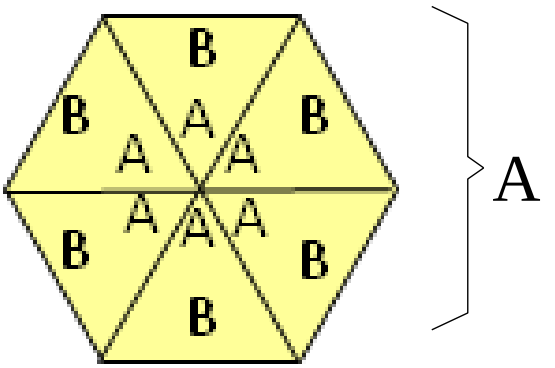


(setting A) is (attached to, surrounding or mixed with) (segmented or individual) (elements) which are (setting B) thus loaning its property and making the combination (setting A) at the macro scale. (Setting B) is (hidden or expressed at the micro scale).

(Paper) which is (flexible) is (attached to) (segmented) (abrasive particles) which are (rigid) thus loaning its property and making the combination (flexible) at the macro scale. (Rigidness) is (expressed at the micro scale).

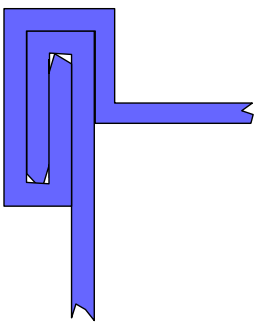


L3-Hiding Part

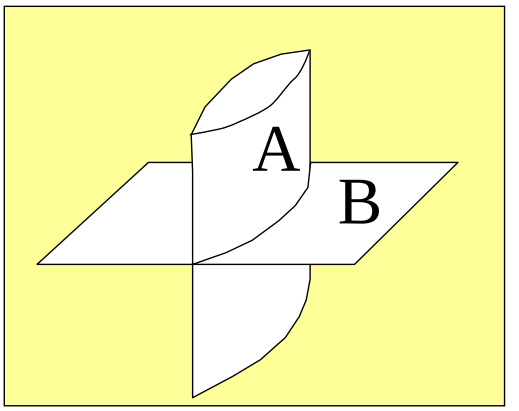


Each individual (elements) already has the undesirable property of (setting A) and the desirable property of (setting B), even in the slightest degree. The (elements) are merged (into a configuration that hides setting A—try different orientations) thus giving the general property of (setting B).

Each individual (can part) already has the undesirable property of (being sharp) and the desirable property of (not being sharp), even in the slightest degree. The (can parts) are merged (by rolling the edges up in a seam) thus giving the general property of (being not sharp).

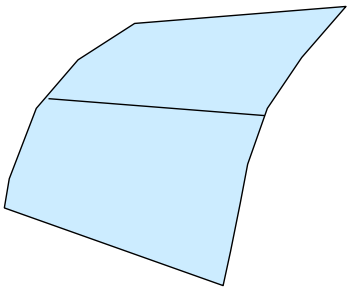


L3-New Dimension

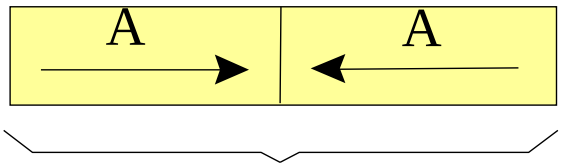


The (element) has the property of being (setting A). Going (up or down) in dimension gives the (element) the property of being (setting B) since (explanation).

The (panel) has the property of being (curved). Going (down) in dimension gives the (panel) the property of being (straight) since (a section through the panel is a straight line which is sufficient in the direction of air flow).



L3-Countering

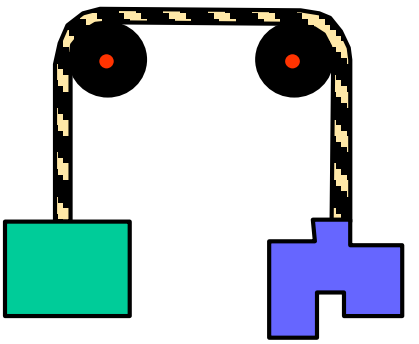


Low or Null

- Opposing Element
- Counter Weight with Transmission means
- Negative Spring Rate
- Negative rate of change of lever arm
- Counter Field Gradient

The (element) (force, field, field gradient or action) has a direction with the undesirable property of (setting A). Countering the (force, field, field gradient or action) with (a counter measure) gives the desirable (setting B--Low or Null).

The (transmission) (weight) has a direction with the undesirable property of (heavy). Countering the (weight) with (a counter weight with transmission cable) gives the desirable (null weight).

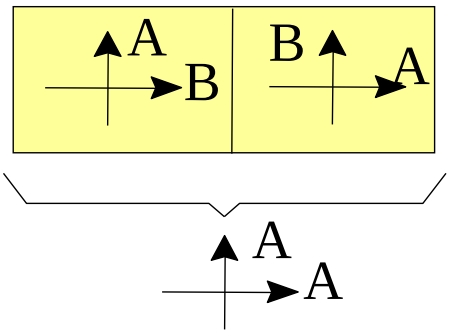


Counter Weight

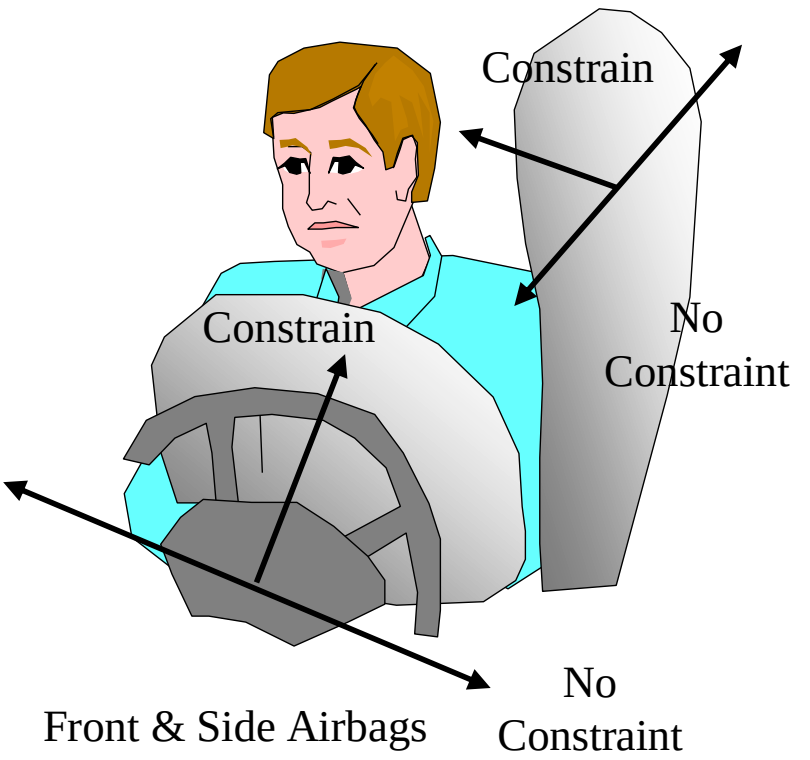
Heavy Object

L3-Complementary Directions

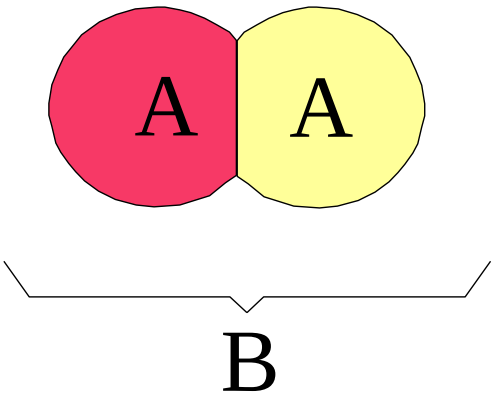
Each (element) is (setting A) which is desirable in one direction and (setting B) which is undesirable in another direction. Combining two or more (elements) and orienting them in a complementary fashion makes the combination (setting A) in both directions.



Each (airbag) is (constraining) which is desirable in one direction and (not constraining) which is undesirable in another direction. Combining two or more (airbags) and orienting them in a complementary fashion makes the combination (constraining) in both directions.

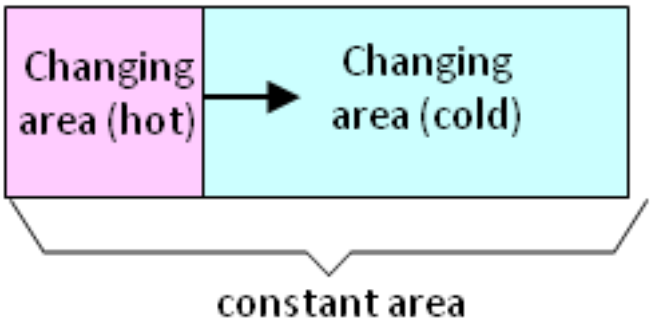


L3-Coordinated Parts



Adjustable (elements) have the property of being (setting A). When coordinated with each other by (method), the overall effect is (setting B). (Setting A) is (expressed or hidden).

Adjustable (flow areas) have the property of being (changing). When coordinated with each other by (a coordinated partition), the overall effect is (NOT CHANGE). (CHANGES) is (expressed).



A coordinated partition between the hot and cold flow areas moves back and forth so that the net area does not change.

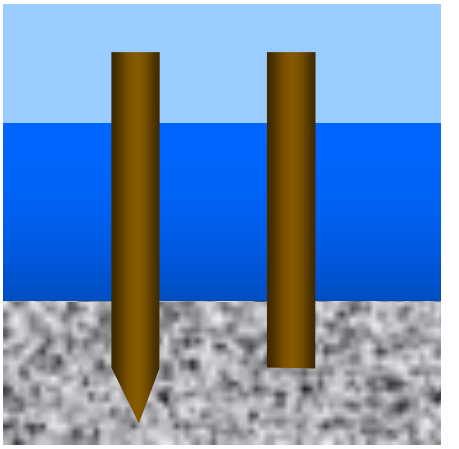
Imagine that the water is flowing out of the page through each respective flow area. As the partition moves, the percent of cold and hot changes, but the combined flow area remains constant.

Separate by Direction

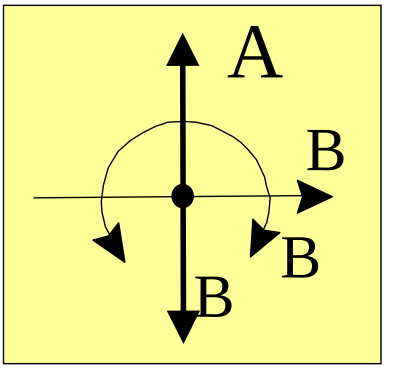
L3-Test for Separation by Direction

Does one of the conflicting properties already exist in a different direction or can it be modified to be so? If "no" then continue to separate by perspective. Otherwise try to separate by direction.

Does one of the conflicting properties already exist in a different direction or can it be modified to be so? The pile is already blunt in its sides. We conclude to try to separate by direction.

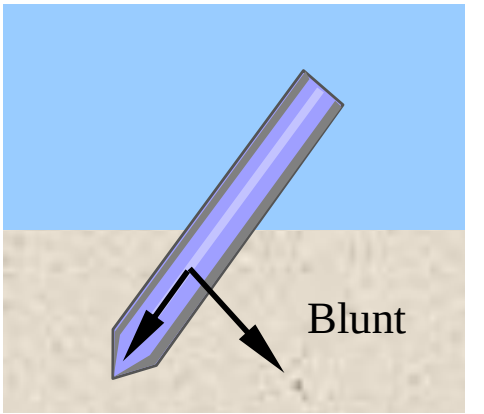


L3-Direction



The (element) is (setting A) (in direction A). The (element) (is already or can become) (setting B) (in the opposite direction or at right angles or in the rotary direction) if (new conditions—give explanation if required).

The (pile) is (sharp) (in the direction of driving). The (pile) (is already) (blunt) (at right angles) if (the supporting force is directed in the sideward direction).



Sharp

Separate by Perspective

L3-Test for Separation by Perspective

Is it sufficient to only appear to have one of the knob settings? If "no" then continue on to Separate by Frame of Reference. Otherwise try to separate by perspective.

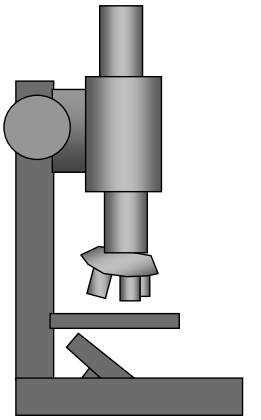
Is it sufficient too only appear to have one of the knob settings? No, it is not good enough. We need both properties to actually exist in the piles. We will go on to Separation by Perspective

L3-How you Look or Perceive

Actually: A
Looks: B
(In microscope)

The (element) is naturally and unfortunately (setting A). It (looks like, sounds like, feels like or smells like) it is (setting B) when (a method of measurement or detection is used).

The (bacterium) is naturally and unfortunately (small). It (looks like) it is (large) when (viewed under a microscope).



L3-Looks/feels Like

Actually: A Looks Like: B

The (element) is unfortunately (setting A). But we can change its (appearance, sound, feel or smell) to seem like (setting B) when using (paint, a substitute or covering fake object, camouflage, substitute smells, substitute taste, substitute sound).

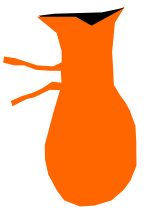
The (panel) is unfortunately (wood). But we can change its (appearance) to seem like (marble) when using (paint).

L3-Inference

Actually: A
Inferred to be: B

The (element) is unfortunately (setting A). But we can change its (appearance, sound, feel or smell or effect) to seem like it is (setting B) by (a method to infer that it is setting B).

The (pebble) is unfortunately (black). But we can change its (appearance) to seem like it is (white) by (drawing a black pebble from the bag and not showing it, but dropping it on the ground among white and black pebbles. By inference, they can see which one was picked by looking into the bag and finding the second black pebble. Everyone infers that a white pebble was withdrawn.).



Separate by Frame of Reference

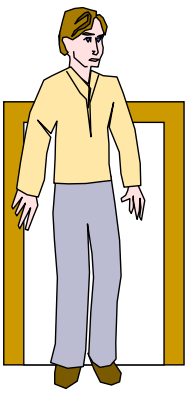
A: Compared to Property Element 2
B: Compared to changed property

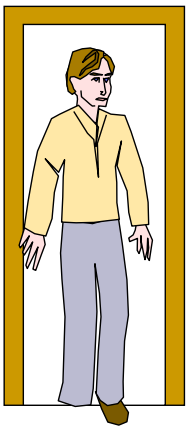
Strong Acidifiers (Strong compared to Small Objects and Weak compared to Large objects)

L3-By Comparison

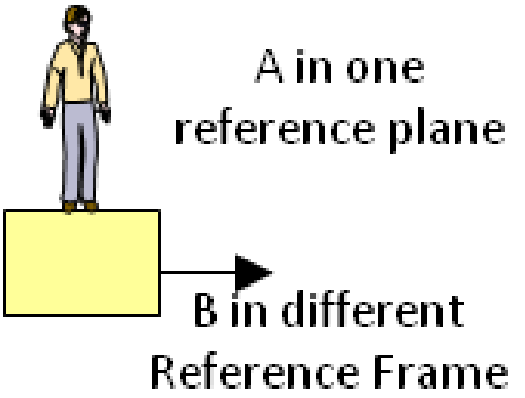
The (element) is already (setting A) when compared to (property of element 2). Changing (element 2) by (method of changing the property of element 2) makes the (element) (setting B).

The (actor) is already (short) when compared to (the size of surroundings and other actors). Changing (the surroundings and other actors) by (miniaturizing the set props and putting the actor on a raised platform) makes the (actor) (tall).



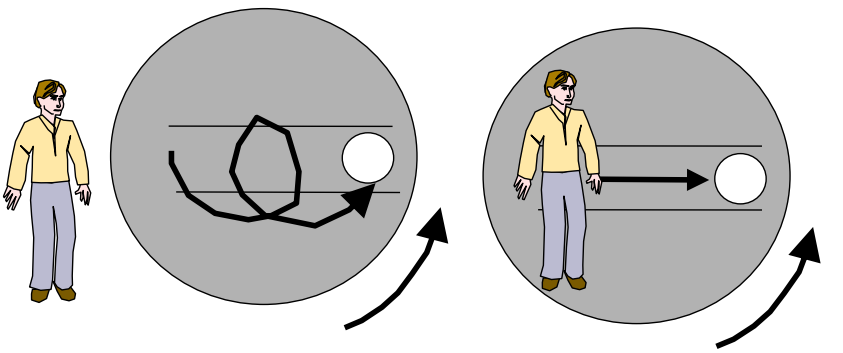


L3-Inertial or Spatial Frame of Reference



The (element) is already (setting A) when compared to (inertial, rotational, spatial or coordinate system frame of reference). Changing the frame of reference by (method) makes the (element) (setting B).

The (ball) is already (curved motion) when compared to (a stationary, non-rotating frame of reference). Changing frame of reference by (observing the motion of the ball while rotating with the platform) makes the (ball) (linear motion).

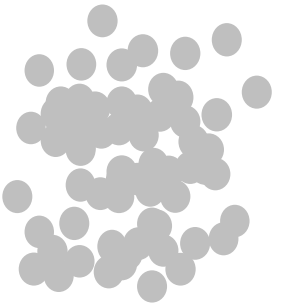


L3-Acts Like

Actually: A
Acts Like: B

The (element) must actually be (setting A) in order to (Requirement). However, it must act like (setting b) in order to (2nd Requirement). This will be accomplished by using the principle of (Physical Effect or Phenomenon).

The (damping fluid) must actually be (Solid) in order to (survive in deep space at low temperatures). However, it must act like (fluid) in order to (provide correct damping in the damping piston). This will be accomplished by using the principle of (very small round solid particles that act like a fluid).



Separate by Response of Fields

L3-Test for Separation by Response of Fields

Are both properties (knob settings) directly related to a substance and the way that fields (particularly super-imposed fields) respond to that substance? If "yes" then continue to the next part of the test. If "no" then continue on to Separation between Substance and Field. Complete the following, while identifying separate fields or field regions which make these statements true:

It is essential that:

The field response to the (substance in the operating region) must be (setting A) for (field region A or field A)

The field response to the (substance in the operating region) must be (setting B) for (field region B or field B)

Is it essential that field region or field A and B overlap? If they must overlap, then jump to Separation between Substance and Field.

Are both properties (conducting and non-conducting) directly related to a substance and the way that fields (particularly super-imposed fields) respond to that substance? Yes, both conducting and not conducting are related to a substance and the way that light fields respond to that substance. Complete the following, while identifying separate fields or field regions which make these statements true:

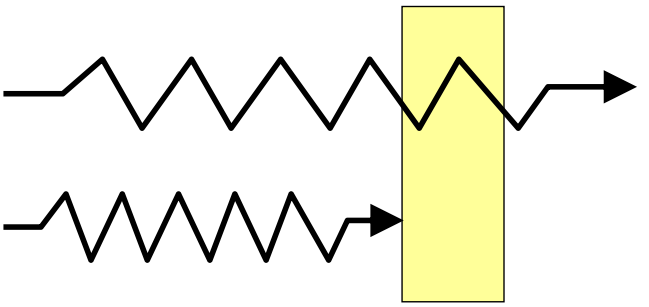
It is essential that:

The field response to the (pressure barrier) must be (conducting) for (visible light)

The field response to the (pressure barrier) must be (not conducting) for (UV light)

Is it essential that field region or field A and B overlap? No, it is not essential that they overlap. We will try to use separation by field response.

L3-Separate by Response of Fields



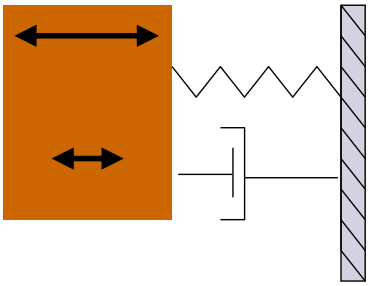
- Optically transparent materials
- Resonant structures
- Field shape changing materials
- Field gradient changing materials
- Reflective or channeling structures
- Filters
- Frequency or color changing
- Speed changing
- Phase changing
- Polarization changing
- Field Type changing
- Field absorption changing materials
- Field segmentation (Increases action)
- Field scale

The response of (field region A or field A) to (material, coating or structure) is (setting A). The response of (field region B or field B) to (material, coating or structure) is (setting B).

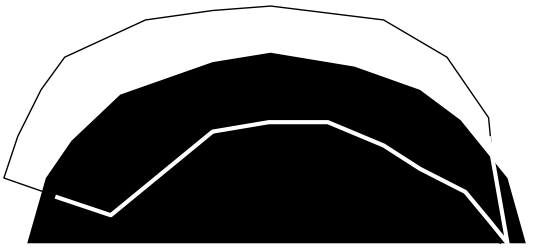
73-Separate by Response of Fields

The response of (visible light) to (glass) is (conducting). The response of (ultraviolet light) to (glass) is (non-conducting).

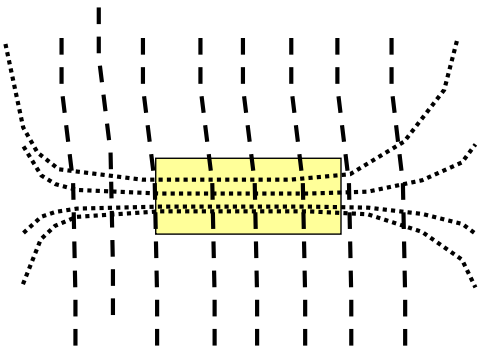
The response of (low frequency vibration) to (a spring-mass-damper system) is (conducting). The response of (high frequency vibration) to (a spring-mass-damper system) is (non-conducting).



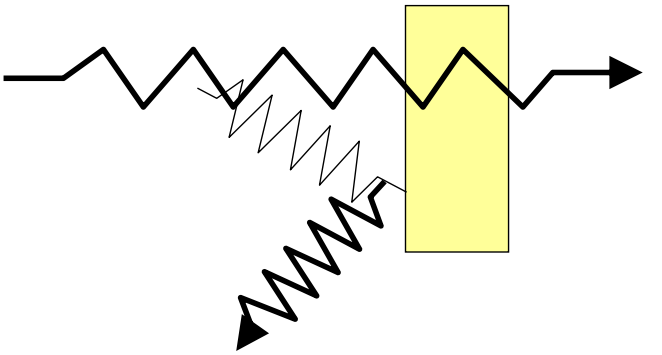
The response of (an optical field) to (a transparent fender) is (conducting). The response of (a pressure field) to (a transparent fender) is (non conductive).



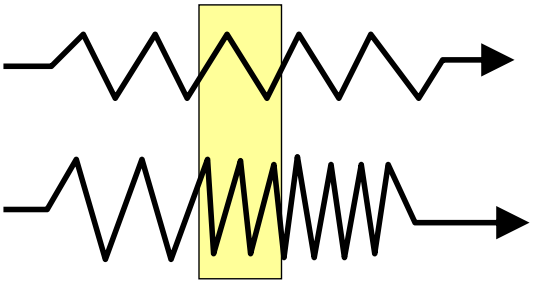
The response of (a gravitational field) to (a magnetic material) is (a uniform gradient). The response of (a magnetic field) to (a magnetic material) is (a high or non-uniform gradient).



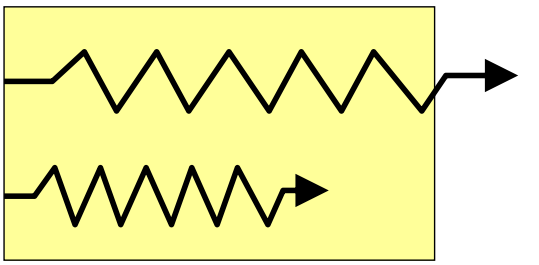
The response of (x-ray) to (a mirror) is (unaltered movement). The response of (optical light) to (a mirror) is (reflected altered movement).



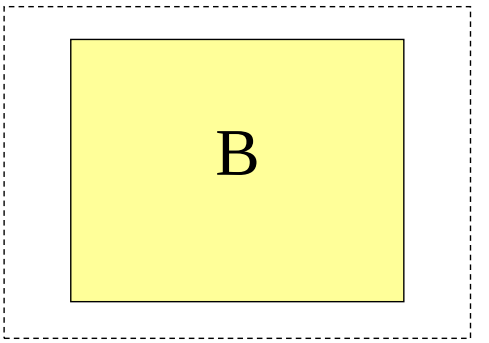
The response of (red light) to (a red filter) is (unaltered transmission or amplitude). The response of (orange light) to (a red filter) is (reduced transmission or amplitude).



The response of (green light) to (optical glass) is (higher speed). The response of (blue light) to (optical glass) is (lower speed).

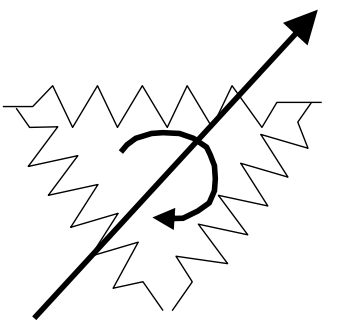


Separate Between the Substance and the Field



The field element associated with the conflict is (a field element). The substance element associated with the conflict is (a substance element). The (field element) is (setting A) and the (substance element) is (setting B). This is accomplished by (architecture).

The field element associated with the conflict is (a magnetic field). The substance element associated with the conflict is (the field coils). The (magnetic field) is (rotating) and the (coils) are (stationary). This is accomplished by (switching on the coils in a predetermined sequence. The magnetic field direction appears to rotate, depending on the sequence of the switching).



Compensation

L2-Method

Step 1: Set a critical property to one setting which solves the main problem.

Step 2: Look for another knob which can be turned to compensate for the harmful effect created by step 1.

Step 2: Look for another knob which can be turned to compensate for the harmful effect created by step 1.

Iterate on Solutions

Rather than abandon the solution, we should continue with this solution path until we are satisfied with the solution. Each solution path may branch many times with the ensuing iterations. This is fine. It is not unusual to have a number of potential solutions. The intention is to continue evolving the solutions as long as it is practical before making a decision. It is not unusual to have several ideas to work on at the same time. In some ways, this creates a state of mind that is very healthy. Rather than focusing in on one idea and sending it to finishing school, you will greatly increase your chances of success by thinking in terms of solution sets. Further discussion on this topic can be found in the book concerned with implementing solutions.