TOOL: Blocks to Creativity

Introduction

Blocks to creativity is a problem everyone at some time in their life faces. Sometimes creativity can be elusive, that creative blockage can be frustrating, it can hold the individual back in life. How often is the expression “I am not creative” used as an excuse. People are not born either creative or not creative, we are all have creativity, but for some it is blocked. Fear of failure is often a big block to creativity as is perfectionism. The more one seeks perfection the more one is less likely to take risks and the more likely to procrastinate, which in turn will restrict an individual’s creativity and innovation.

The session aims to help learners understand their blocks to creativity and learn to challenge them.

The session is based around the fun activity of making, testing and modifying paper airplanes, but through this simple exercise learners start to explore and reflect on their blocks to creativity.

Learners are encouraged to identify their blocks to creativity and consider strategies to deal with creative blocks in the future.

Blocks to creativity

Trainer's delivery plan

Session Aim(s):	Learning materials:

• Awareness on creativity blocks
  ○ Discover blocks to creativity
  ○ Challenge attitudes and perceptions around creativity
  ○ Self-awareness
	- Coloured sheets of A4 paper (*number of participants)
	- Masking tape
	- White sheets of A4 paper and pens or pencils (*number of participants)

Expected learning outcomes:	Differentiated Learning Outcomes:	Differentiation achieved through:
• Understand the importance of attitudes, perceptions and myths around creativity • Identify blocks to creativity • Identify environmental, cultural, perceptual and emotional blocks to creativity • Understand and identify differences between creativity and dishonesty • Challenging Blocks to creativity	• Self-reflection • Self-knowledge • Increase awareness on the importance of communication • Team working	- Group dynamics - Team work - Interactive discussion - Critical thinking - Discussion/debate

Timings	Key Content	Trainer Activity	Learner Activity	Resources	
15 minutes	Training session kick-off	Trainer introduction and group introduction Session brief framework	Learners introduction to the group		
60 minutes	A - Paper airplane individual activity Each participant will have 2 pieces of A4 white paper Create a start line and a finishing line (1,5m) , pens or pencils will stay at hand but are not given, to check/reflect on at the debate B - Paper airplane team activity including building and racing paper airplanes Split participants into equal groups of 4 or 5 per group, give each group 10 sheets of A4 papers (Each group gets a different colour of A4 paper sheets)	*Trainer explanation on work session: Objectives, rules main activities and timing. A - Rules to set the individual activity: Each person has 2 pieces of A4 white paper, pens or pencils will stay at hand but are not given. Trainer will explain: • You will have 5 minutes to build your airplane(s), mark it and then one at a time get it (them) across the finish (taped) line • The winning persons are those who get the paper airplanes across the finish line	In a team competition get to pass the finish line with the more airplanes	- Pens or pencils - White sheets of A4 paper - Coloured sheets of A4 paper - Masking tape	

	Use the masking tape to create a start line where all groups will need to stand behind and a finish line (Distance between the start and finish lines is 1,5 for the individual activity and to 2 Meters for the team activity)	B - Rules to set the group activity: • Each team has a different colour paper • You will have 3 minutes to strategize without your paper • You will have 5 minutes to build your airplanes and get them across the finish line (that was set further then in the previous game) • The winning team will get the most paper airplanes across the taped line			
60 minutes	Debate starts by reviewing the activity(ies) itself and then go on to what they have learnt about blocks to creativity. • How did people feel about this activity? Was it more or less difficult than they had first imagined? What were the most difficult aspects, or the most difficult things to deal with? • Did people learn anything new about blocks to	Promote the discussion on what were the blocks if there were Which strategies were used to solve the problem How did each individual marked their planes, if with a pen or pencil, why not in a different way? Explore ways of marking an object (drawing on it, naming it, cutting a piece in a specific	Participate at the debate Identify blocks to creativity that were in place Identify other blocks to creativity Raise self-awareness on individual blocks to creativity		

	creativity? Were they surprised that they actually knew more than they thought they did? • Were there similarities and differences in the different performances? • Were there any fundamental disagreements over the idea of building an airplane within the group? How were these resolved? • Based on the performances, what do participants think are the most common blocks to creativity?	shape…remember that logos are marks… "branding and creativity" Individual or team work – benefits/inhibits? Use of the Blocks to Creativity PowerPoint either to summarize or induce the debate			
15 minutes	Training session assessment	Support learners if needed		Trainer and learners evaluation questionnaires	

Trainers notes:

* Trainer may decide to do both activities (individual and team) and just the team activity. If both are delivered trainer must look on debating with the group the difference between the two activities, which one was easier and why, the importance of following strictly not only the rules but also the best individual performance did it influence on team activity allowing improvement, remembering that creativity occurs also on perfecting past performances; search for other blocks to creativity that may have been present.

The main objective of both activities is to allow a time to reflect on what inhibits creativity, individually and as a group.

Even though, in the dynamics proposed, there are too few rules, the performances usually show that we tend to stick very close to the rules, make too many assumptions, do not stop to analyse the problem from different perspectives to find different and possible ways of solving it, which greatly hinders our ability to think creatively and come up with new, “out of the box solutions” to solve problems, also because people think that we can’t do it, aren’t talented enough or risk to be criticised by others…

Discussion & Debrief:

When running the team activity, most groups do not use the 3 minutes to build a good strategy and brainstorm possible ways to make the largest number of airplanes out of their 10 sheets of paper and make sure they can fly the short distance from the start to the finish line , so communication among the group is forgotten, instead they rush to get to the construction phase and most of the groups spend the 5 minutes they get for construction to create as many paper airplanes (airplanes with wings and tail) and the result is usually that most of the airplanes do not make it to the finish line because the designs are usually not very aerodynamic. When the team activity occurs after an individual challenge, copying the airplane that was the “best” tends to happen without a strategically look on what else can e done

Blocks that prevent us from thinking creatively:

1. Just doing it without any situation analysis (problem analysis)
2. Trying to Find the “Right” Answer
3. Believing you aren’t creative
4. Making assumptions
5. Following the rules too strictly (to the letter)
6. Being serious
7. Avoiding risks
8. Being wrong is bad
9. Always staying with your routines/habits
10. Thinking there is only one solution
11. Making judgments too quickly

If we apply the blocks to what happened, ask the groups what assumptions did they make and what rules did they stick to that caused them to design the airplanes the way they did?

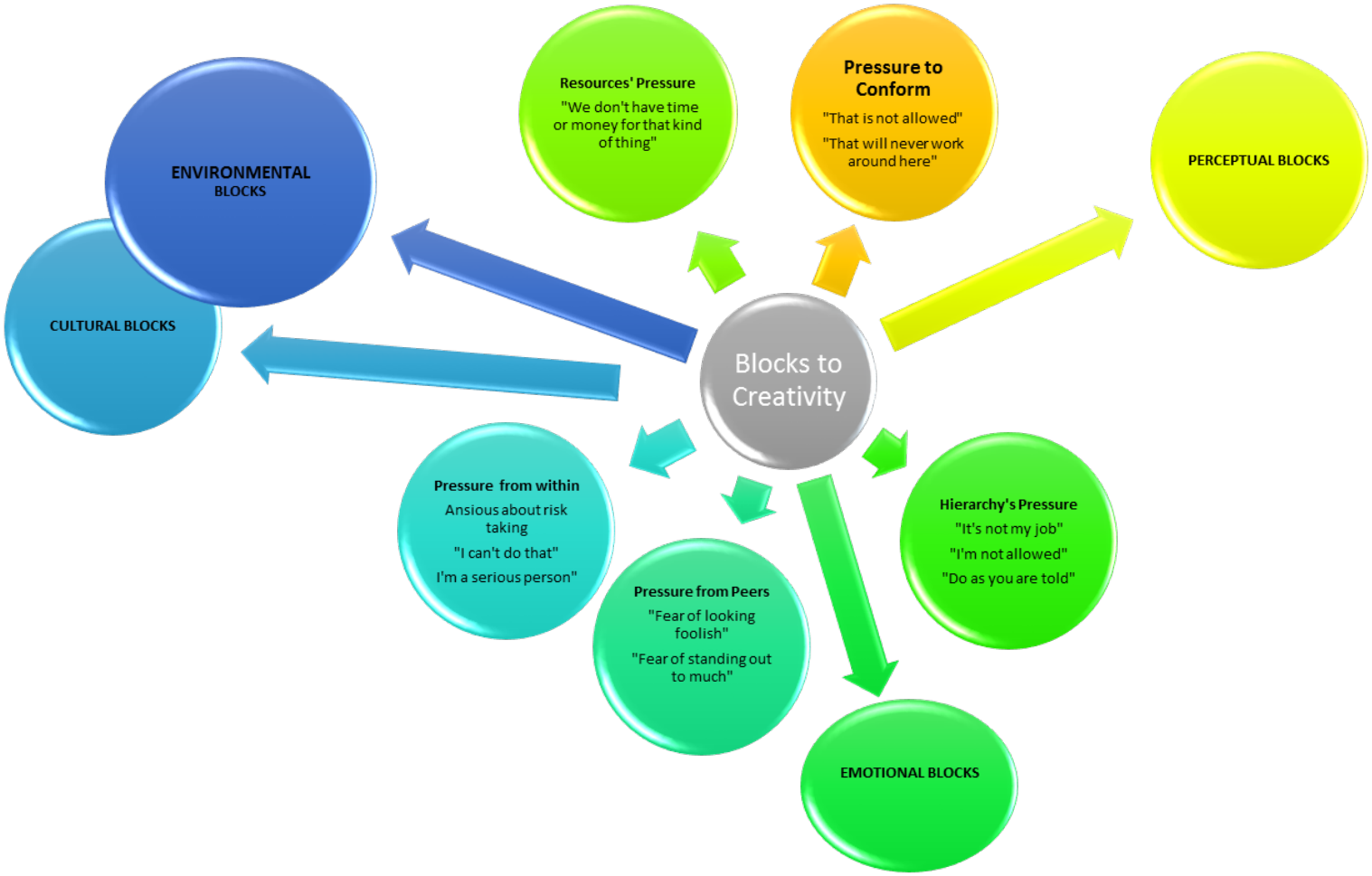
Despite having very few rules in this activity , most groups will stick very strictly (literally) to the rules , they will mostly assume that an airplane must have wings and tail to be called an airplane , while they can be more creative and simply just crumple each sheet of paper into a ball that becomes heavier and call that a new design or a futuristic airplane and then each "Airplane " will be heavier in weight and it will be very easy for them to fly or throw them over the finish line.

Another possibility is to create the airplanes and put them together in one stack with a rubber band so that the combined weight of all the paper airplanes will ensure they will pass the finish line.

Or simply put all the planes on one of the office chairs with wheels and simply push a chair from the start to the finish line ensuring all their planes passed the finish line safely.

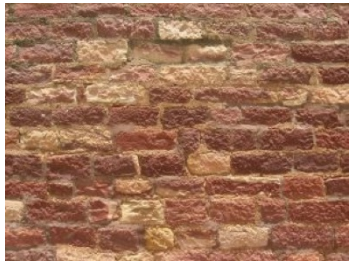
See more on building airplanes in the appendix “Fun paper airplanes”

MORE ON BLOCKS TO CREATIVITY:



From fire "discovery" to … microwave oven, at least from one million years ago…creativity has been the source of development!

Need, passion, resilience, looking to different possibilities, making unconventional connections, openness to experience are some of the ingredients to generate:





Cultural Blocks

- *Taboos*
- *Desire to conform according the norm:*
  - *"We don't think or act that way!"*
  - *"Our way of doing things is the right way!"*
  - *"We respect our traditions"*
  - *"Winning team shouldn't have changes!"*
- *Limiting beliefs*
  - *Problems are only solved by science and money*
  - *Reason, logic and statistics know it all*
  - *It's not polite to be too inquisitive*
  - *It's not wise to doubt everything*
  - *To each problem there is only one solution*
  - *Fantasy is a waste of time, lazy and even crazy*

Perceptual Blocks

- *Linked with problem's analysis*
  - *Difficulty in locating the problem*
  - *Narrowing the problem too much*
  - *Difficulty on seeing the problem from different perspectives (viewpoints)*
  - *Difficulty on defining terms*
  - *Failure to use all senses*
  - *Difficulty in seeing remote relationships*
  - *Failure to see/investigate the obvious*
  - *Overemphasis on past experiences*
  - *Failure to distinguish between cause and effect*
  - *Over-generalization*

Emotional Blocks

- *Fear of making a mistake, of risk taking, of failing*
- *Grabbing the first idea that appears*
- *Security desire*
- *Fear of distrust of others*
- *Fear of looking foolish or ridiculous*
- *Preference of judging ideas instead of generating them*

- *Rigidity of thinking*
- *Refusal to take detour in reaching goals*
- *Lack of drive in putting solutions to work*

Organization/Environmental Blocks

- *External factors that result from environment and or organization conditions such as:*
  - *Distractions – mobile, interruptions, noises…*
  - *Oppressive atmosphere*
  - *Unsafe environment*
  - *Unpleasant atmosphere*
  - *Lack of cooperation & trust among people*

Summarizing:

Some blocks to creativity are induced by the environment or the organization. For example, dress codes and strict offices at work are all subtle signals that remind us that we must conform, even in our thinking. For some people this atmosphere can be obstructive.

Many other blocks come from other people. We are highly social creatures and even the thought that a complete stranger may find us ridiculous is enough to make most of us close in on oneself. People is, generally, competitive and judgemental, so evaluating others and their ideas is easy, even when we are aware of the inhibition effect it will have on them. So, communication, the way you say or hear and understand what ihappens around may became a block to creativity.

The final and worst source of creative blocks is - oneself. That's the little voice inside that warns us of the dangers of unconventional thought, which although different has to be ethical and not connected with the dark side of creativity (dishonesty). Blocks to creativity, mostly, come from our past experiences and are programmed in since early ages. We are all taught to follow the rules, be logical and to do things as they have been done, to leave in a safe and conformed way (inside the comfort zone). Parents, teachers and peers have all helped us to build some powerful psychological blocks to keep us on track with socially accepted rules.

In a short wording: **ALL BLOCKS TO CREATIVITY ARE INTERNAL**, although people and things around us can make it easier or harder to get into a creative mind set.

Creativity as any human act bares ethical limits to be followed not creatively!

Ways to kill ideas - Creativity articles - www.creatingminds.org

There may, as Paul Simon sung, be forty ways to leave your lover, but there are even more ways to kill a new-born idea. Here are just a few. You can probably fill in the rest.

Ignore it

Say nothing. Pretend that it was not said. Let it die in silence. Most people can take this hint that they have said something that is not wanted.

Criticize it

Say how bad an idea it is. Show yourself to be an expert in such things and that the person offering the idea is not an expert and hence unable to offer any idea of any use.

Faint praise

Damn it with faint praise. Say how very *interesting* it is. Or how it *might just* work (with the wind in right direction). And by implication how useless it is.

Laugh at it

Smirk, giggle, laugh and chortle. Say how funny the idea is. This will be very effective at preventing anyone else taking it seriously.

Analyse it

Ask searching questions about it. Of course, as a simple idea, the person offering it will not have thought it through. If you probe far and fast enough, you can tie them up in knots. Then just leave it hanging, like the lawyer who has just crucified a witness.

Tried it

Say how the idea has been tried before and found to be completely ineffectual. In doing so, you show how the person in question is only good at coming up with ideas that are of poor quality and are old hat.

Compete with it

Come up with a better idea that shows the idea to be not that good. As the new idea is yours, you can either now get the credit or drop it quietly as it has done its job.

Change it

Take up the idea enthusiastically and adjust it so that it is no longer recognizable. As

Shoot the messenger

Instead of attacking the idea, have a go at the person bringing it up. Tell them that they are no good at creating ideas. That they should not be offering such thoughts here. Particularly effective at putting off other people from offering ideas.

Give it to a committee

This is the death kiss for almost any idea. Ensure the committee is made up of people who will argue or delay and end up with nothing in particular being created.

'Making the simple complicated is commonplace; making the complicated simple, awesomely simple, that's creativity.'

Available resources:

All Creative Tools – www.creatingminds.org

Here are all creative tools in alphabetic order:

- ***Absence Thinking: Think about what is not there.***
- ***Adoption Checklist: A checklist of what leads to adoption.***
- ***Art streaming: Keep creating until you get through the blocks.***
- ***Assumption Busting: Surfacing and challenging unconscious assumptions.***
- ***Attribute Listing: Listing attributes of objects and then challenging them.***
- ***Brainstorming: the classic creative method for groups.***

- ***Braindrawing**: Good for reticent groups.*
- ***Brainmapping**: Combining brainwriting and mind-mapping.*
- ***Brainwriting**: Group doodling for non-verbal stimulation.*
- ***Breakdown**: Careful decomposition to explore the whole system.*
- ***CATWOE**: A checklist for thinking about problems and solutions.*
- ***Challenge**: Challenge any part of the problem.*
- ***ChangingMinds**: The ultimate persuasion website.*
- ***Chunking**: Take a higher or more detailed view.*
- ***Concept Screening**: Comparing options against a baseline benchmark.*
- ***Context Map**: Mapping the overall problem domain.*
- ***Crawford Slip Method**: Getting ideas from a large audience.*
- ***A Day In The Life Of...**: Seeing things as they are experienced.*
- ***Delphi Method**: Explore ideas or gain consensus with remote group.*
- ***Diffusion Lifecycle**: Spreading ideas one group at a time.*
- ***Doodling**: Let your subconscious do the drawing.*
- ***Essence**: Looking elsewhere whilst retaining essential qualities.*
- ***Forced Conflict**: Using conflict to stimulate the subconscious.*
- ***Force-field Analysis**: Exploring forces for and against an idea.*

- ***Guided Imagery**: Letting your subconscious give you a message.*
- ***Head, Heart and Hands**: Get all three systems of motivation engaged.*
- ***The Hundred Dollar Test**: How will you spend $100 on your ideas?*
- ***How-How Diagram**: Break down problem by asking 'how'.*
- ***How to**: Frame statements as 'How to' to trigger focused thinking.*
- ***Incubation**: Letting the subconscious do the work.*
- ***Is – Is not**: To scope out boundary of problems.*
- ***The Kipling method (5W1H)**: ask simple questions for great answers.*
- ***Lateral thinking**: Thinking sideways to create new ideas.*
- ***Lotus Blossom**: Unfold the flower of extended ideas.*
- ***Mind-mapping**: Hierarchical breakdown and exploration.*
- ***Modeling**: For the artist in everyone.*
- ***Moment of Truth (MoT) Analysis**: Finding vulnerable customer moments.*
- ***Morphological Analysis**: Forcing combinations of attribute values.*
- ***Negative Selection**: Sort out the 'definitely nots' first.*
- ***Nominal Group Technique**: Getting ideas with minimal personal interaction.*
- ***NUF Test**: Check idea is New, Useful and Feasible.*
- ***Pause**: Think more deeply for a minute.*

- ***PINC Filter**: Evaluate pros and cons of ideas.*
- ***Positives, Negatives**: Look at both problems and benefits.*
- ***Post-Up**: Brainstorming with Post-It Notes.*
- ***Problem Statement**: Getting a clear statement of what you are trying to achieve.*
- ***Provocation**: Shake up the session by going off-piste.*
- ***PSI**: Problem + Stimulus = Idea!*
- ***Purposing**: Finding the real purpose of what you are doing.*
- ***Random Words**: Using a random word as a stimulus.*
- ***Remembrance**: Remembering solutions not yet discovered.*
- ***Reversal**: Looking at the problem backwards.*
- ***Reverse Brainstorming**: Seek first to prevent your problem from happening.*
- ***Reverse Planning**: Working backwards from a perfect future.*
- ***Rightbraining**: Combine incomplete doodles around the problem.*
- ***Role-play**: Become other people. Let them solve the problem.*
- ***Rubber-ducking**: Get someone else to listen to your talk.*
- ***SCAMPER**: Using action verbs as stimuli.*
- ***Six Thinking Hats**: Think comfortably in different ways about the problem.*
- ***Storyboarding**: Creating a visual story to explore or explain.*

- ***Swap sort**: Sorting a short list by priority swapping.*
- ***Take a break**: When creativity is fading.*
- ***Talk streaming**: Just talk and talk and talk until you unblock.*
- ***TRIZ Contradiction Analysis**: Use methods already used in many patents.*
- ***Unfolding**: Gradually unfolding the real problem from the outside.*
- ***Value Analysis**: Deep analysis of where true value is created.*
- ***Visioning**: Creating a motivating view of the future.*
- ***Voting**: Democratic casting of votes for the best idea.*
- ***Why not?**: Challenge objections and assumptions.*
- ***Wishing**: State ideas as wishes to expand thinking.*
- ***Write streaming**: Write and write and write until you unblock.*

Some studies on Creativity

Unexpected brain structures tied to creativity, and to stifling it
Date: May 28, 2015
Source: Stanford University Medical Center
Summary: A surprising link has been found between creative problem-solving and heightened activity in the cerebellum, a structure located in the back of the brain and more typically thought of as the body's movement-coordination center.

Investigators at Stanford University have found a surprising link between creative problem-solving and heightened activity in the cerebellum, a structure located in the back of the brain and more typically thought of as the body's movement-coordination center.

In designing the study, the researchers drew inspiration from the game Pictionary.

The cerebellum, traditionally viewed as the brain's practice-makes-perfect, movement-control center, hasn't been previously recognized as critical to creativity. The new study, a collaboration between the School of Medicine and Stanford's Hasso Plattner Institute of Design, commonly known as the d.school, is the first to find direct evidence that this brain region is involved in the creative process.

"Our findings represent an advance in our knowledge of the brain-based physiology of creativity," said the study's senior author, Allan Reiss, MD, professor of radiology and of psychiatry and behavioral sciences.

The study, to be published May 28 in *Scientific Reports*, also suggests that shifting the brain's higher-level, executive-control centers into higher gear impairs, rather than enhances, creativity.

"We found that activation of the brain's executive-control centers -- the parts of the brain that enable you to plan, organize and manage your activities -- is negatively associated with creative task performance," said Reiss, who holds the Howard C. Robbins Professorship in Psychiatry and the Behavioral Sciences.

"Creativity is an incredibly valued human attribute in every single human endeavor, be it work or play," he continued. "In art, science and business, creativity is the engine that drives progress. As a practicing psychiatrist, I even see its importance to interpersonal relationships. People who can think creatively and flexibly frequently have the best outcomes."

The collaboration began about 3 ½ years ago when Grace Hawthorne, MFA, MBA, a consulting associate professor at the d.school who teaches a design-thinking skills course called "Creative Gym," and one of her students approached Reiss, who has previously studied humor and other higher-level cognitive functions. They asked if he could objectively measure creativity, the better to confirm that Hawthorne's course can enhance it.

"We didn't know that much about how to do that," Reiss said. "So we decided to design a study that would give us baseline information on creativity's underlying neurophysiological processes."

How do you measure creativity?

As much as creativity may be in demand, it's not so easy to measure. At least 25 or 30 previous studies, mostly of professionally creative people such as jazz musicians and Emmy Award winners, have tried to look at neural correlates of creativity, said the study's lead author, Manish Saggar, PhD, an instructor in psychiatry and a member of the teaching team at the school.

"Everybody wants to think creatively," Saggar said. "But how do you get somebody to actually do that on command? Forcing people to think creatively may actually hamper creativity."

The problem is exacerbated by the fact that subjects' brain processes are monitored while they're confined inside a dark, cramped MRI chamber. This environment is not exactly the first place that comes to mind when you're thinking about places where creativity can flower, Saggar said.

"Creativity has to be measured in a fun environment," he said. "Otherwise, you're bound to have anxiety and performance issues."

Saggar came up with the idea of borrowing an approach from Pictionary, a game in which players try to convey a word through drawing to help their teammates guess what the word is. He selected action words like "vote," "exhaust" and "salute." Then he, Reiss and their colleagues serially tested 14 men and 16 women in an MRI chamber, recording activity throughout their brains via functional MRI scans while they drew either a word or, for comparison, a zigzag line, which required initiation and fine-motor control but not much creativity. Participants were given 30 seconds per word, long enough for a decent scan but short enough to elicit spontaneous improvisation and stave off boredom.

"We didn't tell anyone, 'Be creative!' We just told them, 'Draw the word,'" Reiss said.

The drawings were captured on a special MRI-safe electronic tablet designed by study co-author Robert Dougherty, PhD, research director at the Stanford Center for Cognitive and Neurobiological Imaging. The drawings were then sent to Hawthorne and Adam Royalty, a researcher at the d.school and co-author of the study. Hawthorne and Royalty separately rated the drawings on five-point scales of appropriateness -- did it depict what it was supposed to? -- and creativity -- how many elements were in the drawing? How elaborate was it? How original?

When they emerged from the MRI chamber, subjects were asked to rate the words they'd been asked to draw for relative difficulty. Increasing subjective difficulty of drawing a word correlated with increased activity in the left prefrontal cortex, an executive-function center involved in attention and evaluation. But high creativity scores later assigned by the raters were associated with low activity in the executive-function center. Higher creativity scores were associated with higher activation in the cerebellum.

On analysis, a number of brain areas were more active when subjects were engaged in drawing words than when they were drawing zigzag lines. Peak activation occurred in the cerebellum and regions of the cortex known to be involved in coordinating motor control or acting as a visual sketchpad. The latter regions' involvement in detailed drawing wasn't particularly surprising.

'The more you think about it, the more you mess it up'

But the heightened activity in the cerebellum was unexpected, as was its association with high creativity scores subsequently assigned by the raters. In monkeys, this brain region has been found to be especially active in learning and practicing new movements.

But those monkey findings may have thrown researchers off, Saggar said. Newer studies show that, unlike the monkey cerebellum, the human cerebellum has robust connections not only to the motor cortex, the brain's higher movement-control center, but to the other parts of the cortex as well.

"Anatomical and, now, functional evidence point to the cerebellum as doing much more than simply coordination of movement," Saggar said.

He and his colleagues speculate that the cerebellum may be able to model all new types of behavior as the more frontally located cortical regions make initial attempts to acquire those behaviors. The cerebellum then takes over and, in an iterative and subconscious manner, perfects the behavior, relieving the cortical areas of that burden and freeing them up for new challenges.

"It's likely that the cerebellum is the coordination center for the rest of brain, allowing other regions to be more efficient," said Reiss.

"As our study also shows, sometimes a deliberate attempt to be creative may not be the best way to optimize your creativity," he said. "While greater effort to produce creative outcomes involves more activity of executive-control regions, you actually may have to reduce activity in those regions in order to achieve creative outcomes."

Saggar put it more bluntly. "The more you think about it, the more you mess it up," he said.

Stanford University Medical Center. "Unexpected brain structures tied to creativity, and to stifling it." ScienceDaily. ScienceDaily, 28 May 2015. <www.sciencedaily.com/releases/2015/05/150528084158.htm

Scientists search for source of creativity

Date: March 5, 2012
Source: University of Southern California
Summary: Researchers are working to pin down the exact source of creativity in the brain -- and have found that the left hemisphere of your brain, thought to be the logic and math portion, actually plays a critical role in creative thinking.

It takes two to tango. Two hemispheres of your brain, that is. USC researchers are working to pin down the exact source of creativity in the brain and have found that the left hemisphere of your brain, thought to be the logic and math portion, actually plays a critical role in creative thinking.

"We want to know how creativity works in the brain?" said Lisa Aziz-Zadeh, assistant professor of neuroscience at the USC Dornsife College of Letters, Arts and Sciences.

If you paint or sculpt, you may think of yourself as right-brained. The right hemisphere of your brain often is thought to be the creative half, while the left is thought to be the rational, logical side.

But a new study from a team led by Aziz-Zadeh demonstrated that while the right half of your brain performs the bulk of the heavy lifting when you're being creative, it does call for help from the left half of your noggin.

The study, which focuses on how the brain tackles visual creative tasks, supports previous findings about how the brain handles musical improvisation.

Co-authored by USC graduate student Sook-Lei Liew and USC undergraduate Francesco Dandekar, the study was posted online last month in *Social Cognitive and Affective Neuroscience.*

"We need both hemispheres for creative processing," Aziz-Zadeh said.

The USC scholar and her team used functional magnetic resonance imaging (fMRI) to scan the brains of architecture students, who tend to be visually creative.

While being scanned, the subjects were shown three shapes: a circle, a C and an 8. They then were asked to visualize images that could be made by rearranging those shapes -- for example, a face (with the 8 on its side to become the eyes, the C on its side to become the smiling mouth and the circle in the center as the nose).

The students also were asked to simply try to piece three geometric shapes together with their minds and see if they formed a square or a rectangle -- a task that requires similar spatial processing but not necessarily creativity.

Even though it mainly was handled by the right hemisphere, the creative task actually lit up the left hemisphere more than the noncreative task. The results indicated that the left brain potentially is a crucial supporter of creativity in the brain.

Aziz-Zadeh said she plans to explore more of how different types of creativity (painting, acting, singing) are created by the brain, what they have in common and what makes them different.

Support for the research came from the Brain and Creativity Institute at the USC Dornsife College of Letters, Arts and Sciences, the USC Division of Occupational Science and Occupational Therapy, the National Science Foundation and the USC Provost's Ph.D. Fellowship program.

University of Southern California. "Scientists search for source of creativity." ScienceDaily. ScienceDaily, 5 March 2012. <www.sciencedaily.com/releases/2012/03/120305132438.htm>.

How does our brain form creative and original ideas?

Date: November 19, 2015
Source: University of Haifa
Summary: A new study attempted to crack the connection between brain activity and creativity. The results shed a new, perhaps unexpected light, on our ability to think outside the box

Developing an original and creative idea requires the simultaneous activation of two completely different networks in the brain: the associative -- "spontaneous" -- network alongside the more normative -- "conservative" -- network; this according to new research conducted at the University of Haifa.

The researchers maintain that "creative thinking apparently requires 'checks and balances'." The new research was conducted as part of the doctoral dissertation of Dr. Naama Mayseless, and was supervised by Prof. Simone Shamay-Tsoory from the Department of Psychology at the University of Haifa in collaboration with Dr. Ayelet Eran from the Rambam Medical Center.

According to the researchers, creativity is our ability to think in new and original ways to solve problems. But not every original solution is considered a creative one. If the idea is not fully applicable it is not considered creative, but simply one which is unreasonable.

The researchers hypothesized that for a creative idea to be produced, the brain must activate a number of different -- and perhaps even contradictory -- networks. In the first part of the research, respondents were give half a minute to come up with a new, original and unexpected idea for the use of different objects. Answers which were provided infrequently received a high score for originality, while those given frequently received a low score. In the second part, respondents were asked to give, within half a minute, their best characteristic (and accepted) description of the objects. During the tests, all subjects were scanned using an FMRI device to examine their brain activity while providing the answer.

The researchers found increased brain activity in an "associative" region among participants whose originality was high. This region, which includes the anterior medial brain areas, mainly works in the background when a person is not concentrating, similar to daydreaming.

But the researchers found that this region did not operate alone when an original answer was given. For the answer to be original, an additional region worked in collaboration with the associative region -- the administrative control region. A more "conservative" region related to social norms and rules. The researchers also found that the stronger the connection, i.e., the better these regions work together in parallel -- the greater the level of originality of the answer.

"On the one hand, there is surely a need for a region that tosses out innovative ideas, but on the other hand there is also the need for one that will know to evaluate how applicable and reasonable these ideas are. The ability of the brain to operate these two regions in parallel is what results in creativity. It is possible that the most sublime creations of humanity were produced by people who had an especially strong connection between the two regions," the researchers concluded.

University of Haifa. "How does our brain form creative and original ideas?." ScienceDaily. ScienceDaily, 19 November 2015. <www.sciencedaily.com/releases/2015/11/151119104105.htm>.

Trust your aha! moments: Experiments show they're probably right

Date: March 7, 2016
Source: Drexel University
Summary: A series of experiments showed that sudden insight may yield more correct solutions than using gradual, methodical thinking. In other words, say the researchers, it's absolutely worth listening to your "aha!" moments

When a solution to a problem seems to have come to you out of thin air, it turns out you've more than likely been struck with the right idea, according to a new study.

A series of experiments conducted by a team of researchers determined that a person's sudden insights are often more accurate at solving problems than thinking them through analytically.

"Conscious, analytic thinking can sometimes be rushed or sloppy, leading to mistakes while solving a problem," said team member John Kounios, PhD, professor in Drexel University's College of Arts and Sciences and the co-author of the book "The Eureka Factor: Aha Moments, Creative Insight and the Brain." "However, insight is unconscious and automatic -- it can't be rushed. When the process runs to completion in its own time and all the dots are connected unconsciously, the solution pops into awareness as an Aha! moment. This means that when a really creative, breakthrough idea is needed, it's often best to wait for the insight rather than settling for an idea that resulted from analytical thinking."

Experiments with four different types of timed puzzles showed that those answers that occurred as sudden insights (also described as Aha! moments) were more likely to be correct. Moreover, people who tended to have more of these insights were also more likely to miss the deadline rather than provide an incorrect, but in-time, answer. Those who responded based on analytic thought (described as being an idea that is worked out consciously and deliberately) were more likely to provide an answer by the deadline, though these last-minute answers were often wrong.

Trust Yourself

Carola Salvi, PhD, of Northwestern University, was lead author on the paper "Insightful solutions are correct more often than analytic solutions" in the journal *Thinking & Reasoning*.

"The history of great discoveries is full of successful insight episodes, fostering a common belief that when people have an insightful thought, they are likely to be correct," Salvi explained. "However, this belief has never been tested and may be a fallacy based on the tendency to report

only positive cases and neglect insights that did not work. Our study tests the hypothesis that the confidence people often have about their insights is justified."

Other co-authors on the paper with Salvi and Kounios were Mark Beeman (co-author of "The Eureka Factor" with Kounios), also of Northwestern, Edward Bowden, of the University of Wisconsin-Parkside, and Emanuela Bricolo, of Milano-Bicocca University in Italy.

Putting Insight to The Test

Each experiment making up the study used one group of distinct puzzles: one experiment used only linguistic puzzles, another used strictly visual ones, and two used puzzles with both linguistic and visual elements.

For example, one type of linguistic puzzle showed three different words: "Crab," "pine" and "sauce." The experiment participant was then asked to provide the word that could fit all of them to make a compound word, which was "apple," in this case. The visual puzzle provided a scrambled image and required the participant to say what object they thought the puzzle depicted.

Each experiment consisted of between 50 and 180 puzzles. Participants were given 15 or 16 seconds to respond after seeing a puzzle. As soon as the participant thought they solved the puzzle, they pressed a button and said their answer. Then they reported whether the solution came through insight or analytical thinking.

Overwhelmingly, responses derived from insight proved correct. In the linguistic puzzles, 94 percent of the responses classified as insight were correct, compared to 78 percent for the analytic thinking responses. For the visual puzzles, 78 percent of the responses were correct, versus 42 percent for the analytic responses.

Bad Guesses, Good Insights

When taking the timing into account, answers given during the last five seconds before the deadline had a lower probability of being correct. For the linguistic puzzles, 34 percent of the responses were wrong, compared to 10 percent of the responses being wrong for quicker answers; for the visual puzzles, 72 percent of the answers given during the last five seconds were wrong.

The majority of those late wrong answers were based on analytic thinking. In one of the experiments, the number of incorrect responses related to analytic thinking recorded in the last five seconds was more than double the number of incorrect responses recorded as insights.

Those numbers for the last five seconds pointed to some participants guessing at the puzzles' solutions. These participants were analytical thinkers.

"Deadlines create a subtle -- or not so subtle -- background feeling of anxiety," Kounios said. "Anxiety shifts one's thinking from insightful to analytic. Deadlines are helpful to keep people on task, but if creative ideas are needed, it's better to have a soft target date. A drop-dead deadline will get results, but they are less likely to be creative results."

Insightful thinkers tend not to guess. They don't give an answer until they have had an Aha! moment.

"Because insight solutions are produced below the threshold of consciousness, it is not possible to monitor and adjust processing before the solution enters awareness," Salvi said.

Hmm vs. Aha!

Analytical thinking is best used for problems in which known strategies have been laid out for solutions, such as arithmetic, Kounios said. But for new problems without a set path for finding a solution, insight is often best. The new study shows that more weight should be placed on these sudden thoughts.

"This means that in all kinds of personal and professional situations, when a person has a genuine, sudden insight, then the idea has to be taken seriously," Kounios said. "It may not always be correct, but it can have a higher probability of being right than an idea that is methodically worked out."

Drexel University. "Trust your aha! moments: Experiments show they're probably right." ScienceDaily. ScienceDaily, 7 March 2016. <www.sciencedaily.com/releases/2016/03/160307144013.htm>.

The neuroscience of creativity www.medicalnewstoday.com/articles

Written by Tim Newman - **Published:** Wednesday 17 February 2016 **Published:** Wed 17 Feb 2016

Neuroscientific investigations often cross the borders between scientific disciplines; they walk boldly from biology to psychology and stride straight through to the other side, dipping their toe - and sometimes their entire leg - in the murky waters of philosophy.

Neuroscience can be a dense and unrelentingly complex area of study. The scientists involved strive to answer disparate questions ranging from "how do we walk?" to "how do we remember things?" and from "how do nerve cell membranes communicate?" to "what is pleasure?"
It takes a brave researcher to attempt to bridge the gap between the physics of a firing neuron and the construction of a jazz drum solo.
The gap is nowhere near fully bridged, but strides are being made to answer some of the more esoteric questions humanity has posed.
One such intractable topic is creativity. What is it? Why does it exist? And how on earth does a spongy 3 lb lump create surreal landscapes and construct soaring arias?
Some scientists believe creativity is not a subject worth pursuing, that it is too ethereal and perhaps not relevant to science. Others disagree.
Humanity's ability to create novel solutions to problems has allowed us to thrive on almost every patch of ground on this blue ball we call home.
From the frozen north to the tropical waistband of our world, humanity has figured out creative ways of staying alive, solving life-threatening problems every step of the way.
Evolution has fostered and rewarded creativity. Creativity is as human as conversation.
In this article, we will look briefly at some aspects of the brain that are suspected to be involved in creativity, as well as some experiments and theories that shed a little light on such a difficult area of science.

Networks vs. regions

The first point to make is that creativity is not to be found in one distinct section of the brain or a singular clump of nerves behind your left ear. The process is shared across a number of regions and involves a concerto of brain-wide neuronal activity.

This makes sense when considering the variety of tasks that exercise our creative bent. Completing a jigsaw or a sudoku involves a certain amount of creative thought, but the sections of the brain relevant to carry out these types of tasks will be different from those involved in designing an art installation or forging the perfect sentence to explain a complex concept.

The general consensus is that the creative process has two stages. The first stage (which we will mostly be discussing here) is the free flow of experimentation and the creation of a new concept or work of art. The second phase involves rehearsing, editing and assessing the final product as it evolves into the final piece.

As with the study of other dense areas of neuroscience, like emotions, brain-wide networks are key to understanding our thoughts. Below are three such networks that are considered to play important roles in creative thought.

The executive attention network

If a task requires a thorough level of concentration, the executive attention network will be called into play. Connecting lateral regions of the prefrontal cortex and areas toward the back of the parietal lobe, this network is engaged when focusing all of your attention on a task and utilizing your working memory.

Creativity seems to be dependent on the interaction between networks rather than specific brain areas.

For example, as you read this, your executive attention network will be busying itself (as long as you are paying attention, of course).

The executive attention network is not engaged for all creative processes; sometimes, allowing your mind to wander away from its watchful gaze is necessary, as we shall see.

The executive attention network is probably used more heavily in the second phase of creativity mentioned above - focusing on, checking and sharpening the final product, rather than the initial freeform creative process.

The default network

The default network, also referred to as the imagination network, is used to construct dynamic mental simulations. Situated deep in the prefrontal cortex and temporal lobe, with connections to parts of the parietal cortex, it builds pictures based on previous experiences and imagines alternative scenarios and events.

Active during bouts of daydreaming, when the brain is not focused on the outside world, the default network is implicated in functions such as collecting facts about the self, reflecting on personal emotions and remembering past events.

This network also appears to be involved in social cognition and empathy; it plays a part in helping us imagine what another individual might be thinking.

The salience network

The dorsal anterior cingulate cortices and anterior insular house the salience network. This set of circuitry helps the brain decide what to pay attention to. Our eyes, ears, mouth, nose and skin are constantly bombarded with sensory stimulation. The salience network helps us choose which inputs to pay attention to and which to ignore.

The salience network is thought to be involved in switching between relevant networks of neurons, turning the most appropriate groups off or on depending on its assessment of a situation.

As an example, while driving a car, your visual field is filled with asphalt, sky, trees, traffic lights, birds, the steering wheel, your eyelashes and much, much more. Despite the wealth of options, the salience network draws your attention to the woman with the buggy attempting to cross the road 200 m down on the right.

The ability to switch between networks is a vital aspect of creativity. For instance, focusing on a creative puzzle with all of your attention might recruit the skills of the executive attention network. On the other hand, if the creative task involves producing a sonically pleasing guitar solo, focus might be switched from intense concentration to areas more involved in emotional content and auditory processing.

The role of latent inhibition

As mentioned, the brain is required to constantly weed out irrelevant information entering our senses and to put the correct emphasis on incoming information that is deemed relevant.

Without latent inhibition, we would be forced to perceive everything around us.

This ability to essentially ignore information we have previously rated as irrelevant is called latent inhibition. For instance, if we are attending a lecture and hear a lawnmower start up outside, it is not long before the lawnmower's sound moves to the back of our consciousness as the speaker's voice moves to the front.

Without the subconscious' ability to pick and choose what enters our attention, the world would be a loud, bright and confusing place to inhabit.

Some studies have linked a reduction in latent inhibition to psychosis. However, a study using high-IQ individuals found that those with lower latent inhibition scores were more likely to be creative.

The authors wonder whether an innate propensity to be open to experience might play a role in creativity. Simply put, people who are less likely to classify an object or a sound as "irrelevant" are at an advantage when it comes to producing creative, original content.

Jazz piano and brain scans

A study published in 2008 investigated the neural correlates of jazz improvisation in pianists' brains. They took MRI (magnetic resonance imaging) scans of pianists' brains as they performed well-practiced pieces and compared the results with scans taken while they improvised.

The authors reported that during the creative act of improvisation, they found:

"A dissociated pattern of activity in the prefrontal cortex: extensive deactivation of dorsolateral prefrontal and lateral orbital regions with focal activation of the medial prefrontal (frontal polar) cortex."

In other words, parts of the brain responsible for self-monitoring and the conscious control of actions were suppressed; the inner critic was silenced. The dorsolateral prefrontal and lateral orbital regions can be viewed as the brain's self-checking modules, making sure we conform to social demands and inhibiting inappropriate performance.

On the other hand, the medial prefrontal (frontal polar) cortex is thought to be involved in generating autobiographical narratives and the creation of self. So, an activation in this region might imply that the pianist's improvisations had a personal, story-like property.

Although this is vastly over-simplifying things (while inflating others), the idea of a jazz musician weaving an intimate tale with his melody is a tempting conclusion to draw.

The authors conclude that in this particular activity, a reduction in self-monitoring with increased activity in the "story-telling" part of the brain worked together to produce an original composition in real time.

Freestyle rapping in a scanner

Creativity seems to rely on stimulating some brain areas while repressing others.

Another study, conducted in 2012, took MRI scans of rappers as they "freestyled." They compared these with scans of the artists' brains as they performed raps they had rehearsed and knew well.

The results shared some similarities with the jazz pianist experiment. The frontal cortex was once again the primary area of activity. The medial (autobiographical area) was activated while the dorsolateral (self-monitoring) region was deactivated.

The team also found increased activity in areas of the brain involved in motor activity, which is unsurprising given the task at hand.

Additionally, increased activation of the cerebellar hemisphere and vermis was found; other studies have implicated both of these regions in tasks involving remembering and matching rhythmic patterns.

The alpha wave

Since the discovery and perfection of electroencephalography (EEG), scientists have measured the electrical output of the brain during a variety of tasks. One type of neurological output referred to as alpha waves has been implicated in the process of creativity.

Alpha waves are strongest during wakeful relaxation with closed eyes and show reduced activity with open eyes, drowsiness and sleep.

Initially, these types of waves were considered to be the "sound" of the visual cortex at rest. A more recent theory is that alpha waves might inhibit areas of the cortex when they are not in use.

Some scientists have linked the strength of alpha waves to levels of creativity. One study measured EEG alpha waves while participants solved verbal problems. Individuals were asked to come up with as many original solutions as possible. The results showed that the most creative solutions were accompanied by measurable increases in alpha power.

Other research has shown similar matches between creative acts and alpha waves; it seems we might have yet another player in the neural game of creation.

Training Resources

APPENDIX - "Fun paper airplanes"

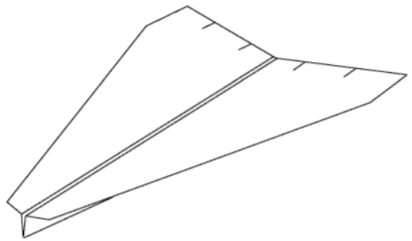
www.funpapersairplanes.com

see file "Airplanes_Models"

Following are just a selection of the many different paper airplane ideas available at www.funpaperairplanes.com

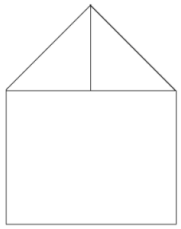
www.funpaperairplanes.com

Arrow

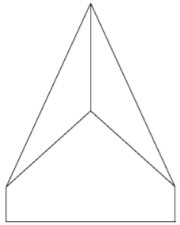


This plane is easy to fold and flies straight and smooth. Add a small amount of up elevator for long level flights.

Orient the template with the "UP" arrow at the top of the page. Then, flip the paper over onto its backside, so that you cannot see any of the fold lines.

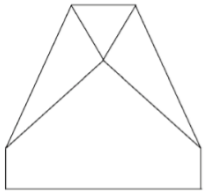


Pull the top right corner down toward you until fold line 1 is visible and crease along the dotted line. Repeat with the top left corner.

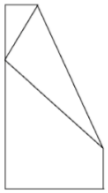


Fold the right side over again and crease along fold line 2. Repeat with the left side.

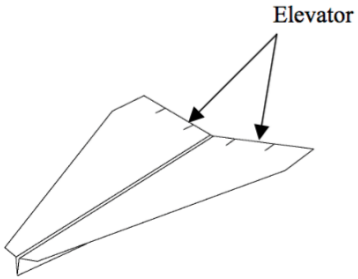
www.funpaperairplanes.com



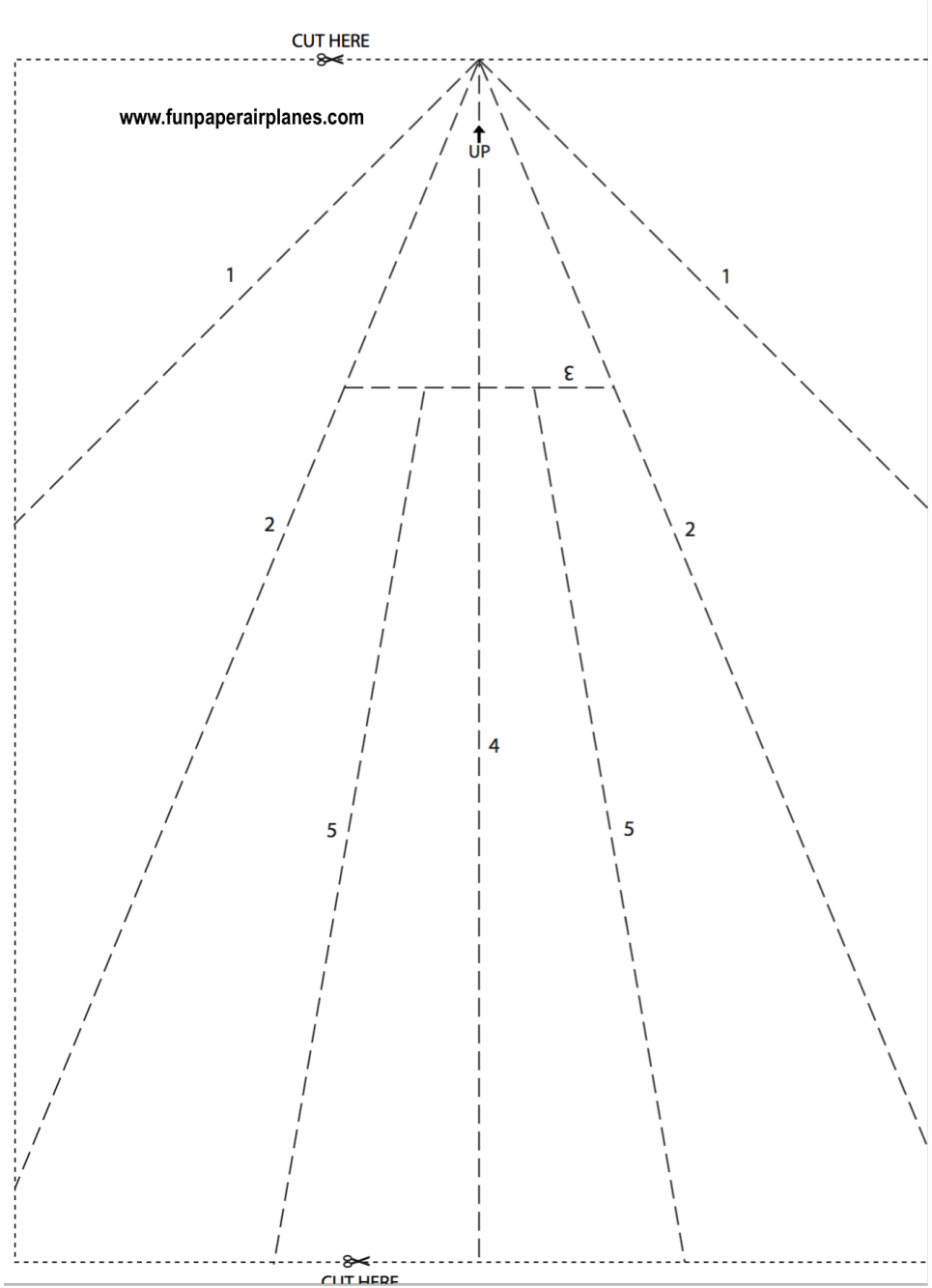
Fold the tip down toward you and crease along fold line 3.



Now, flip the paper over. Then, fold the left side over onto the right side and crease along fold line 4 so that the outside edges of the wings line up.

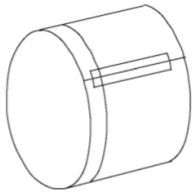


Fold the wings down along fold lines 5. Partially open the folds you just created so that the wings stick out straight. Cut two slits, one inch apart, along the back edge of each wing for elevator adjustments. Add wing dihedral by tilting the wings up slightly away from the fuselage. The wings will have a slight "V" shape when viewed from the front. Read the Introduction for more information about dihedral. Now you are ready to fly!

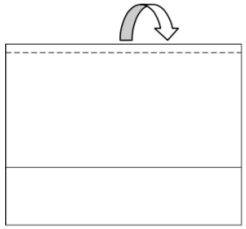

CUT HERE
www.funpaperairplanes.com
UP
1
1
3
2
2
4
5
5
CUT HERE

www.funpaperairplanes.com

Flying Ring

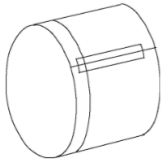


The Flying Ring doesn't look like something that would fly, but it does amazingly well. Throw it with the folded edge to the front, and let it roll off your fingertips. The spin stabilizes and produces long, fast flights.

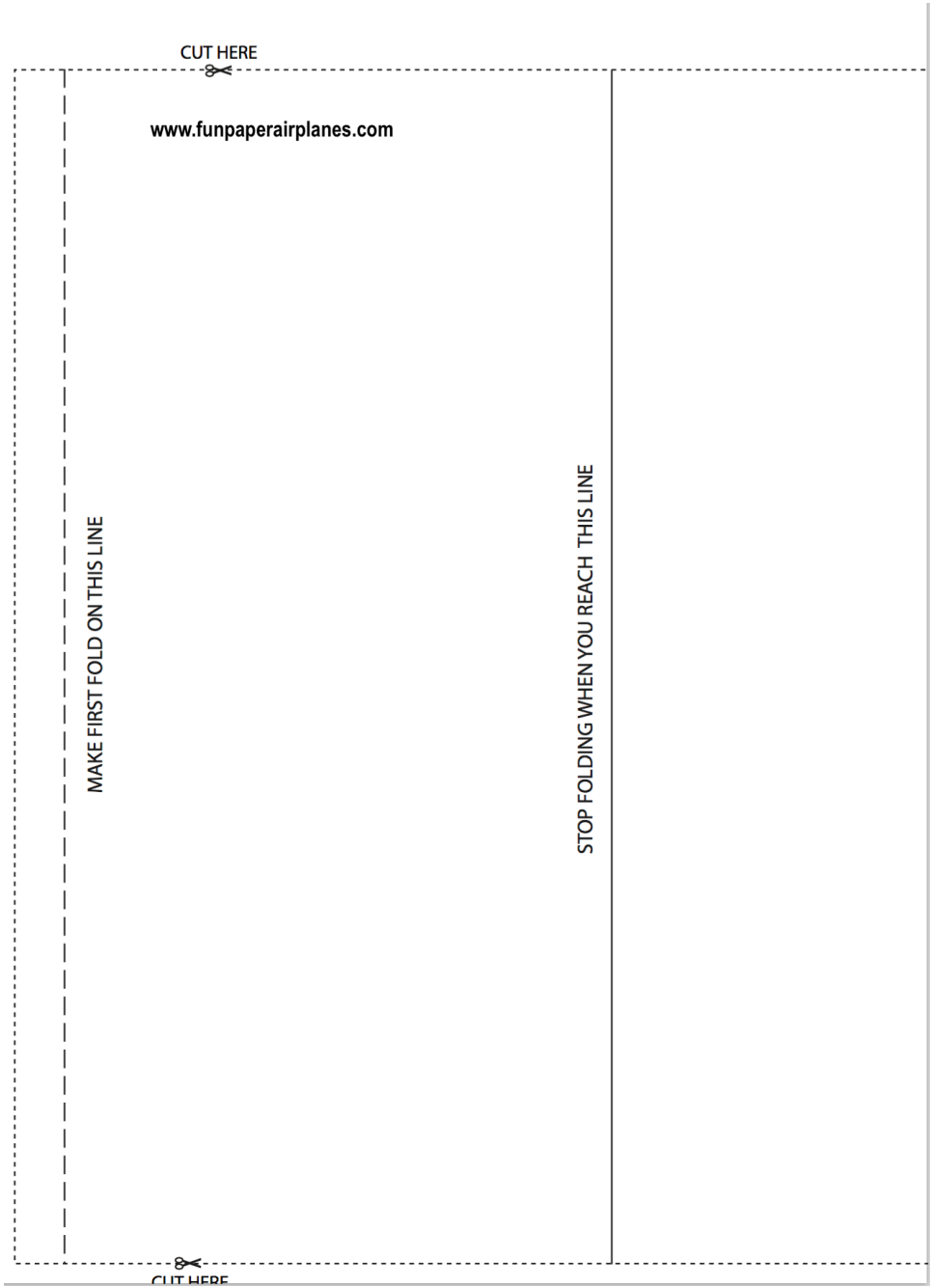


Begin by folding along the first fold line. Continue folding this strip over itself until you reach the stop line. Make firm creases with each fold.

Your paper should look like this when you reach the bottom fold line.

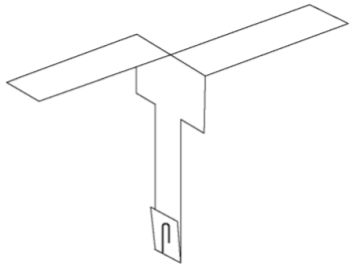


Gradually work the paper into a cylinder shape with the folded edge along the outside. Sometimes it is easier to do this by grasping both ends of the paper and pulling it back and forth over the edge of a desk to help start the curve. Once you have made the cylinder shape, overlap the edges by about ½ inch and place a piece of tape on the outside seam to hold it together. You're ready to fly! Throw the ring with the folded edge forward by letting it roll off your fingertips to put spin on it as you release.

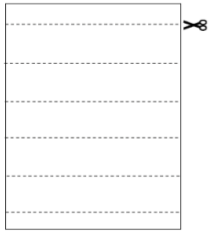

CUT HERE
MAKE FIRST FOLD ON THIS LINE
www.funpaperairplanes.com
STOP FOLDING WHEN YOU REACH THIS LINE
CUT HERE

www.funpaperairplanes.com

Helicopter

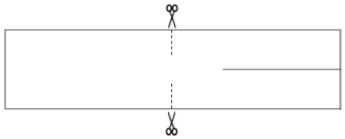


The helicopter is a classic design that spins rapidly as it descends. It works great when dropped from a high place. Try different amounts of weight on the bottom tab. Notice that the helicopter spins in different directions depending on which direction the rotors are folded.

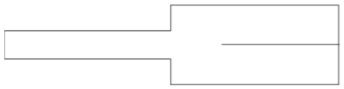


Cut out all five helicopter templates by cutting along line 1.

Cut along cut line 2.

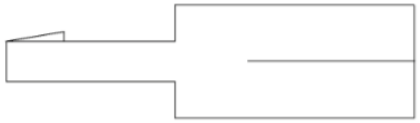


Cut along cut line 3.

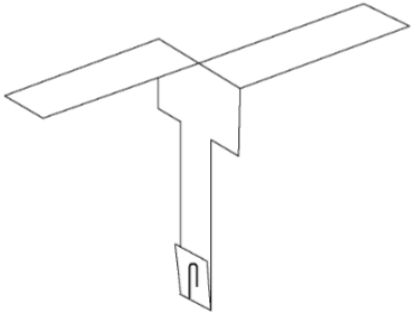


Fold flaps toward each other along fold lines 4. One will overlap the other.

www.funpaperairplanes.com

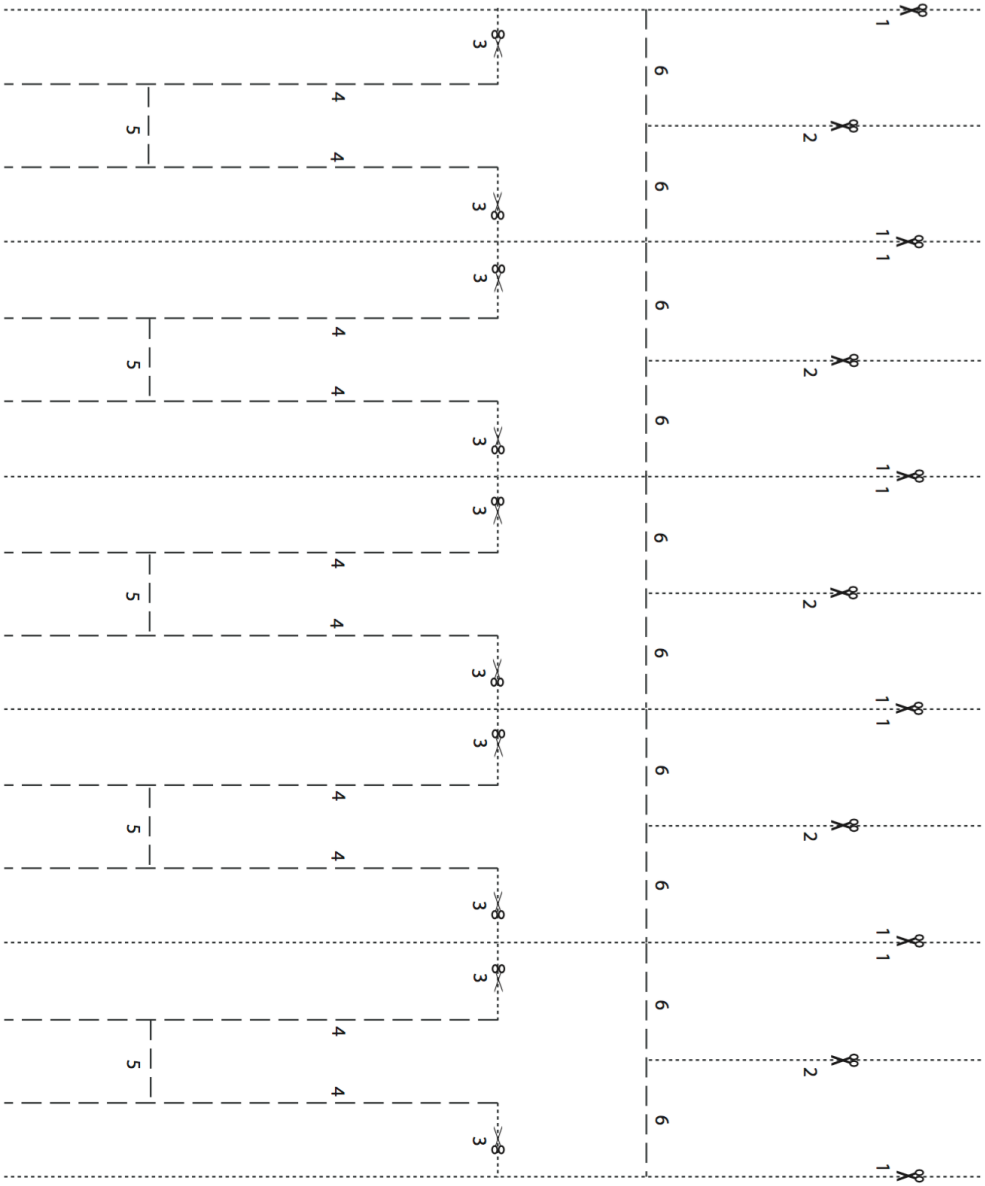


Fold up bottom tab along fold line 5.



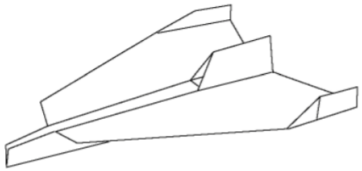
Fold rotors down along fold lines 6 in opposite directions. Attach a paper clip to the bottom tab to add weight. Drop from high over your head and watch the helicopter spin as it descends slowly.

www.funpaperairplanes.com



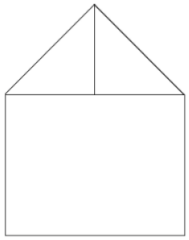
www.funpaperairplanes.com

Interceptor

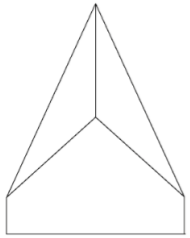


This plane has a central vertical stabilizer on the fuselage that helps produce excellent straight flights. Make sure to complete the final step of the instructions for good performance.

Orient the template with the "UP" arrow at the top of the page. Then, flip the paper over onto its backside, so that you cannot see any of the fold lines.

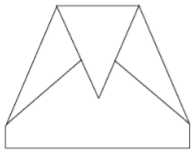


Pull the top right corner down toward you until fold line 1 is visible and crease along the dotted line. Repeat with the top left corner.

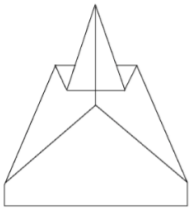


Fold the right side over again and crease along fold line 2. Repeat with the left side.

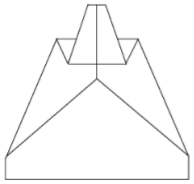
www.funpaperairplanes.com



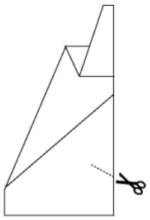
Fold the nose down toward you along fold line 3.



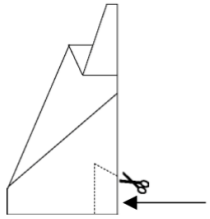
Fold the nose back up and crease along fold line 4.



Fold the tip of the nose back away from you and crease along fold line 5.

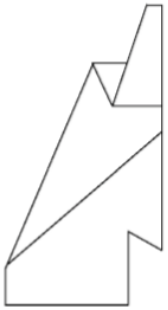


Flip the plane over. Fold the right half of the plane over onto the left half along fold line 6. Cut along the dotted line 7 for the vertical stabilizer.

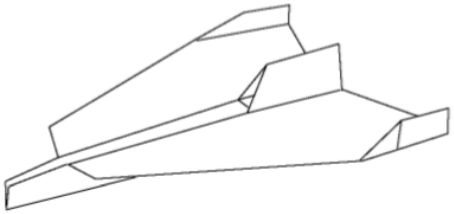


Tuck the flap that was formed by your cut between the two halves of the plane and crease it along fold lines 8.

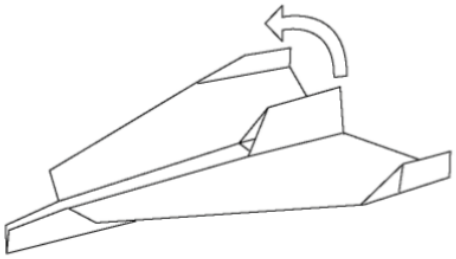
www.funpaperairplanes.com



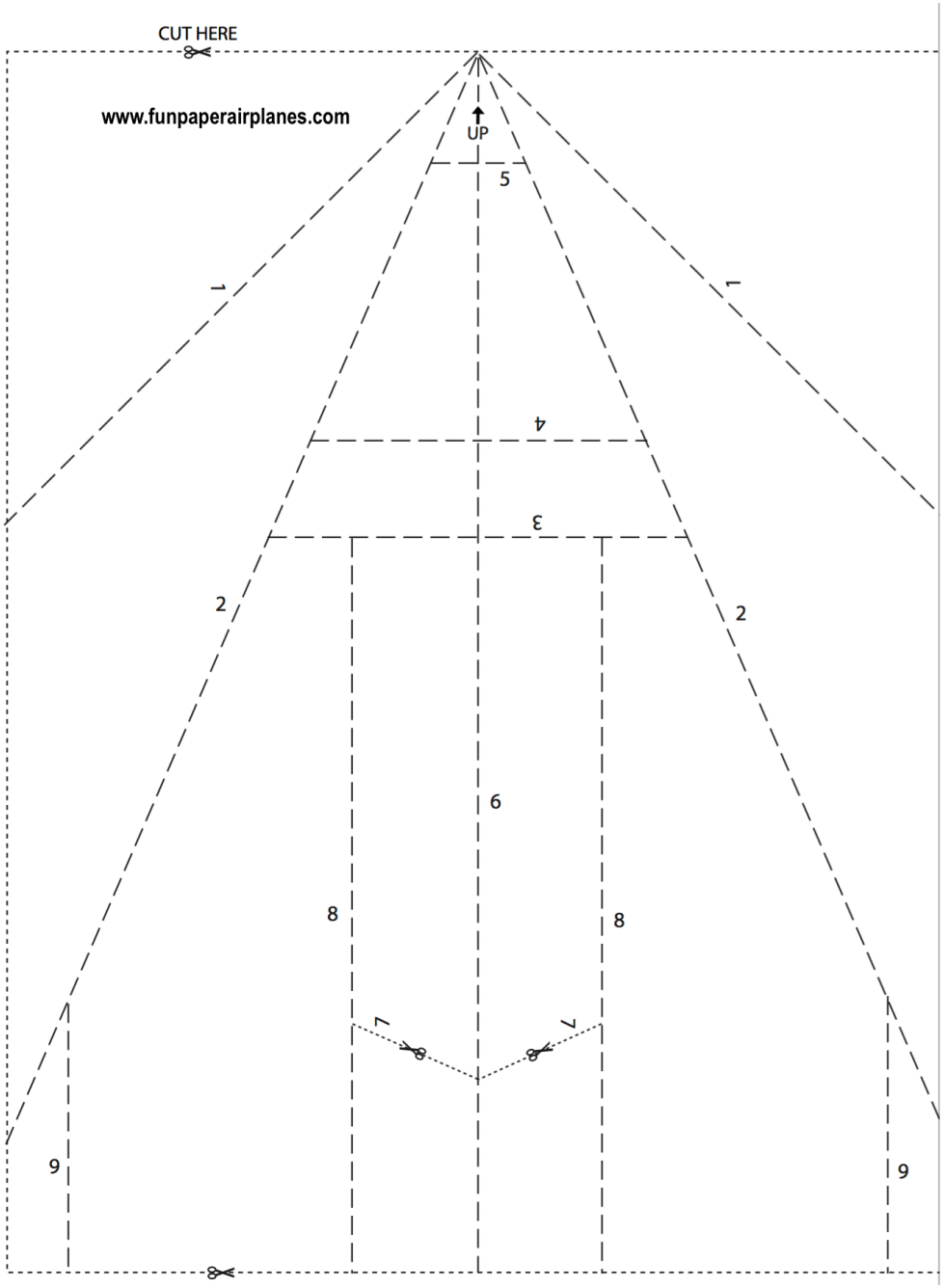
When you have completed the step above, your plane will look like this.



Fold the wings down along fold lines 8 and the winglets up along fold lines 9. Add wing dihedral by tilting the wings up slightly away from the fuselage. The wings will have a slight "V" shape when viewed from the front.

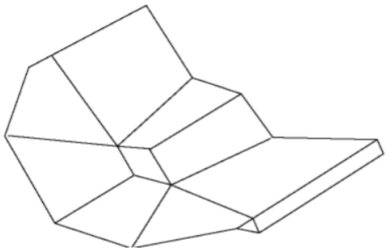


VERY IMPORTANT: Pull the back tip of the vertical stabilizer up and toward the front of the plane to put a slight upward curve to the trailing edge of the wings. This is to prevent the back edge of the wings from sagging downward. If you do not do this, your plane will nose-dive straight to the ground. After completing this step, you are ready to fly!

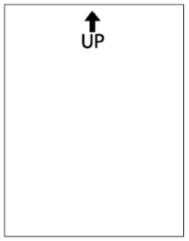

CUT HERE
www.funpaperairplanes.com
UP
5
1
1
4
3
2
2
6
8
8
7
7
9
9

www.funpaperairplanes.com

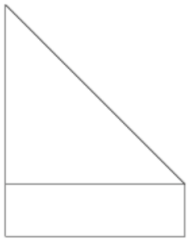
Stealth Wing



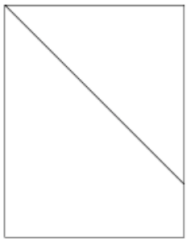
This plane is an advanced design. With careful folding, it will reward you with long smooth glides. Launch gently from high above your head or an elevated area.



Orient the template with the "UP" arrow at the top of the page. Then, flip the paper over onto its backside, so that you cannot see any of the fold lines.

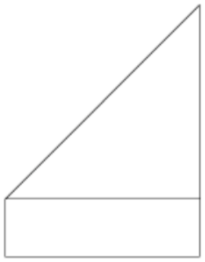


Fold the top right corner down and to the left until fold line 1 appears and crease along the dotted line.

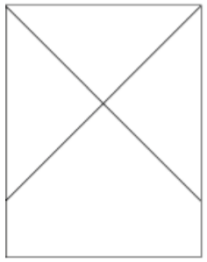


Unfold the fold you just created.

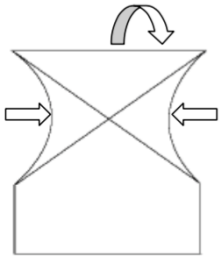
www.funpaperairplanes.com



Repeat the procedure above by folding the top left corner down and to the right. Make a crease along fold line 2.



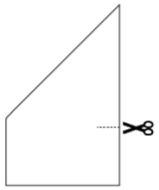
Unfold the fold you just created.



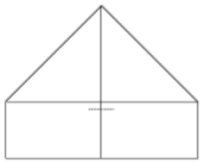
This step is a bit tricky. Lift the left and right edges of the paper and push them toward each other while folding the top triangle onto the bottom one. This will make a crease along fold lines 3 so that you end up with the shape below.

This is the shape you should have after completing the step above.

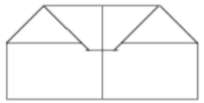
www.funpaperairplanes.com



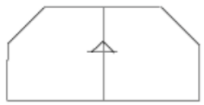
Fold the right side over onto the left side along fold line 4. Cut along the dotted cut line 5.



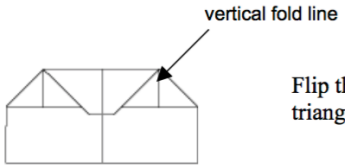
Unfold to produce this shape.



Fold the top point over and crease along fold line 6. Tuck the nose into the slit you cut along cut line 5.

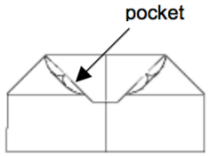


Flip the paper over and fold the nose up along fold line 7.

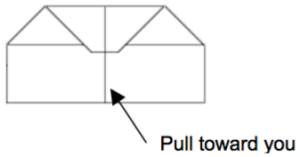


Flip the paper back over again. Fold the top layer of the triangle shaped flaps in along the vertical fold line 8.

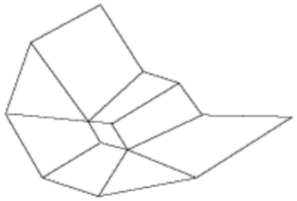
www.funpaperairplanes.com



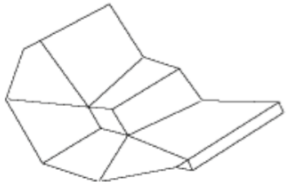
Tuck the flaps into the pockets near the nose of the plane. Push the flaps completely into the pockets.



You should now see this shape. Locate the crease below cut line 5. Pull this crease toward you while also folding the plane in half toward you. This will create creases along fold lines 9.



Partially unfold the fold you just created. You should see this shape.



Fold down the winglets along fold lines 10. Now you are ready to fly! Hold the plane with your thumb against the nose and your index and middle finger behind cut line 5. Launch very gently from above your head.