

# Concept and Priority Analysis

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## Priorities (in order of importance):

1. Feasibility (whether the design can realistically be achieved)
  - A rating of one means the design is highly unlikely to work, a rating of ten means the design is highly likely to work
2. Accuracy (ability to launch the projectile to a consistent spot)
  - A rating of one means the device is highly unlikely to hit targets consistently, while a rating of ten means the device is highly likely to fire accurately
3. Simplicity (limited amount of moving parts)
  - A rating of one means the design has too many moving parts, decreasing its ease of construction and use, while a rating of ten means the design has little to no moving parts
4. Durability (ability of the device to withstand repeated usage)
  - A rating of one means the device is unlikely to resist damage with use or operation, while a rating of ten means the device is likely to be resilient to operation

## Crossbow Wrist Launcher<sup>1</sup>

1. Feasibility — 7 (technology is proven to work, but reloading seems difficult)
  - Pro: Because the main component of the design is based on existing technology, the feasibility is proven

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<sup>1</sup>Two crossbow designs were proposed — one has been omitted to avoid repetition, leaving seven designs total

- Con: The reloading mechanism that releases the ping pong ball from a cup seems overly complicated and not likely to work
2. Accuracy — 9 (Power output makes it accuracy, loses one point because it is questionable whether the accuracy suits our needs)
    - Pro: The power output of the crossbow makes it fairly accurate, as long as it is well-calibrated
    - Con: If the goal is to make it into a cup, there will be fairly little arch to the projectile's motion, making success unlikely
  3. Simplicity — 5 (The complex reloading mechanism, coupled with the simple crossbow, make it neither simple nor complex overall)
    - Pro: The wrist strap concept makes this design fairly simple to transport, in addition to being lightweight
    - Con: There are a lot of moving parts in the reloading mechanism which can cause an increase in wear and tear
  4. Durability — 6 (There is nothing that suggests the crossbow will be highly or barely durable)
    - Pro: The crossbow itself should be fairly strong and reliable
    - Con: The complexity of the reloading mechanism increases the chances of it breaking

### Mangonellian

1. Feasibility — 8 (The overall design is fairly easy to construct, but the wind up mechanism may be a bit difficult)
  - Pro: The mangonel, similar to the crossbow, is a tested, historically-verified projectile-launching machine, which compliments its feasibility
  - Con: The wind-up mechanism might be difficult to implement for a single-handed individual
2. Accuracy — 6 (The possibility of leading left or right upon launch makes the device not too accurate laterally)
  - Pro: As a result of the launching mechanism, the distance the projectile is launched should stay fairly consistent
  - Con: Depending on the stability of the projectile in the basket and the device itself, the projectile may lead left or right on launch

3. Simplicity — 7 (The design doesn't depend on too many components, with the exception of the wind-up)
  - Pro: There aren't too many components, making construction and operation fairly easy
  - Con: The design seems a bit bulky and unlikely to fit size requirements
4. Durability — 8 (Similar devices generally utilize strong materials which allow for easy reuse, some points lost because of the dependence on a string for winding)
  - Pro: The sturdy base and overall strong material that should accompany this design make it fairly reliable
  - Con: The winding mechanism could wear the string quickly, causing it to snap (and possibly making operation of the device more dangerous)

### Concentric Tube Launcher

1. Feasibility — 3 (The complexity of the design make it unlikely to function as intended)
  - Pro: In general, the gun-like construction of the launcher makes it a good concept
  - Con: The complexity of reloading may be unnecessarily difficult and hard to construct
2. Accuracy — 4 (Dependence on elastics make this device unlikely to fire as intended or consistently)
  - Pro: If the barrel is constructed with a good radius to hold the projectile, the design should be quite accurate
  - Con: The reliance on rubber bands and difficulty to construct an ideal barrel make it unlikely to fire consistently
3. Simplicity — 2 (The idea of having to utilize two tubes and pressing one in to reload adds a lot of part movement that makes the device complex)
  - Pro: The reloading mechanism is probably as simple as can be: simply pop the projectile into the barrel
  - Con: Reloading depends on a lot of undependable moving parts, making the design quite complex
4. Durability — 6 (In general, the device should be fairly stable, but the reliance on elastics causes a drop-off in effectiveness)
  - Pro: Although made of very light material, the method by which the launcher fires makes it highly unlikely to be damaged during operation

- Con: Rubber bands can dry out fairly quickly, decreasing the effectiveness of the launcher over time

### Blowgun Launcher

1. Feasibility — 8 (The device is quite easy to operate and construct, making it easy to test and employ)
  - Pro: The design is fairly easy to construct, relies on very little materials, and is thoroughly tested
  - Con: Its effectiveness is difficult to determine until it is fully constructed
2. Accuracy — 6 (Because of the dependence on breathing output, the accuracy of the device has a great amount of variability)
  - Pro: The simple, single-tube design makes the launcher fairly consist in its ability to fire the projectile
  - Con: The accuracy also depends on the user's ability to blow into the tube
3. Simplicity — 10 (No moving parts make the device nearly impossible to malfunction)
  - Pro: The design is probably most simple of any provided, and can be constructed fairly easily
  - Con: The reloading mechanism seems unnecessarily complicated; would probably be better to go with something less complex
4. Durability — 9 (In terms of purely operation, the device should take very little to no damage each use)
  - Pro: The lack of any moving parts in the actual launching mechanism make the launcher highly unlikely to break
  - Con: The structural integrity of the launcher itself is easily compromised by outside forces

### Step-on Catapult

1. Feasibility — 7 (As history has shown, catapults generally work, but the stepping component adds a layer of complexity)
  - Pro: The fairly simplistic idea make the design easy to model and prototype, as well as test in real conditions
  - Con: The material will need to be fairly resilient to resist collapsing under stress from stepping
2. Accuracy — 4 (The reliance on a stepping motion make consistent firing unlikely)

- Pro: The range of launching the object, similar to the mangonel, should stay fairly consistent
  - Con: The reliance on someone stepping adds a lot of factors that could influence the output of the projectile
3. Simplicity — 8 (The design and concept overall relies on very little moving parts)
- Pro: The concept itself is fairly simple and, in theory, should work fairly easily
  - Con: It is, however, difficult to imagine the device operating consistently given the requirement of stepping
4. Durability — 4 (It is difficult to imagine the device holding up to constant stepping)
- Pro: Most likely, strong material will be used to construct the design
  - Con: Repeated stepping may cause the device to collapse or be damaged in some way

### One-Handed Catapult

1. Feasibility — 8 (In general, the device seems like it can operate with very little difficulty)
- Pro: It is definitely possible to construct this and operate it with one hand
  - Con: It is difficult to imagine what kind of material we could use to bend the catapult backwards and release
2. Accuracy — 5 (The varying ability does allow for some improved accuracy, but this device seems likely to lead left or right)
- Pro: The ability to vary the amount the catapult is pulled back allows for improved and more adjustable range on the projectile
  - Con: Again, similar to the mangonel and step-on catapult, the left-right variation in launching a projectile may be difficult to prevent
3. Simplicity — 8 (The device doesn't depend on too many parts, and, as such, should be fairly stable)
- Pro: The design is quite simple, and has fairly few moving parts
  - Con: The material used for the stalk of the crossbow seems a bit complex, it is unclear what could be used
4. Durability — 6 (Nothing indicates whether the device should be of above or below average strength)

- Pro: The sturdy base and general design of a catapult should be fairly strong and, therefore, resilient
- Con: Again, it is unclear whether the material for the stalk itself would be durable

### Clip-On Slingshot

1. Feasibility — 7 (The device seems fairly easy to construct and test, but the clipping aspect needs some more work and explanation)
  - Pro: A slingshot is, as is well known, quite reliable for launching projectiles, and therefore, should work well
  - Con: The clipping aspect of the device needs to be quite sturdy, otherwise the device may rotate or unclip during operation
2. Accuracy — 7 (The ability to aim in more directions gives more freedom, but makes it slightly less accurate)
  - Pro: The slingshot should be able to consistently output a good amount of power
  - Con: The fact that it is necessary to aim side to side, as well as up and down, make it a bit difficult to score into a cup
3. Simplicity — 9 (Overall, the design depends on very little moving parts, with the exception of elastics)
  - Pro: The design is definitely quite simple, and it only depends on the elastics for moving parts
  - Con: It is unclear how to construct durable clips with easily accessible materials, in addition to making these clips adjustable for different surfaces
4. Durability — 6 (The device itself is fairly sturdy, but the reliance on elastics allows for a lot of drop off in effectiveness)
  - Pro: The base itself and the clips should be fairly sturdy
  - Con: The elastics, especially with age and use, will dry out, and most likely cause a decline in effectiveness

### Materials

Cardboard
Tape
Tube <sup>2</sup>
ABS or PLA <sup>3</sup>
Rubber bands
String