Note: This document is no longer maintained. See Ethyriel's YouTube channel for up to date info: Link

Yri's Transmutation Handbook

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Proofreading by Gromek9999

Preface:

    The glitches and methods outlined in this document are the result of a considerable amount of theory crafting, spritesheet analysis, and experimentation, all with the goal of pushing the game to its limit.

The glitch of the name "Philosopher's Stone[1]" has its title with good reason- With it, any item between ID 712 → ID 5455 can be transmuted from basic materials. Zenith, wings, even boss summons such as the Celestial Sigil are obtainable with repeatable setups using the methods detailed in the pages which follow. Combined with other glitches which are set-up using Philsohper's Stone, most notably the Campfire Glitch, any item ID 1 → ID 5455 can be transmuted.

Alongside obtaining items, Transmutation glitches result in a myriad of other strange effects, ranging from hellevator generators to incincibility machines. Those will be detailed in this document, too.

In this document, I will be detailing the glitches required for Philosopher's Stone transmutation, along with a few other glitches which could prove useful.

Before we begin, below are a few special acknowledgments and credit to those who helped with the glitch hunting process. I wouldn't be here today without all of your help.

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[1] In Western mythology, the Philosopher's Stone is a magical reagent capable of being used to transmute any substance into any other. You may see why the name was applied here.

Special Thanks:

Icysnowman - For helping in the early days and creating a spreadsheet to help create transmutations, which I still use to this day.

Youtube link

Gromek999 - For encouraging me to continue pursuing these glitches and hosting Terraria Veterans all three seasons, where the very first Transmutation Glitches were discovered.

Youtube link

Dominic Karma - For lending their knowledge of the programming side of the game providing essential information in understanding how Check2xX worked, and in-turn the relationship between item drops and framedata. Knowing this proved vital to understanding how Philosopher's Stone worked.

Uftf - For helping with code inspection in figuring out how doors and bast statues interacted, alongside providing valuable seeds for the speedrun.

Glitch-specific credits:

Door Desync Glitch:
- Discovered as a result of experimentation of the "Torch Storage" bug, originally discovered by Gromek999.

Check2xX:
- Dominic Karma, for providing vital information on the exact inner-workings of the method ("check2xX()"), which not only helped saved countless hours of time but also helped to focus our research.
- Megaswuave and Wasephi, for assistance with in-game testing to try and find new transmutations.

<u>Philosopher's Stone:</u>

- Megaswave and Waseephi, for assistance with in-game experimentation during the early days of the glitch's discovery.

<u>Campfire Offset Glitch:</u>

- Megaswuave and Wasephi, for re-vitalizing the idea of using Confetti Cannons as a way to achieve frameY offsets, which eventually led to the discovery of COG.

Chest-Based Item Dupe:

- Discovered by Peachy during Terraria Veterans season 3, whose Australian ping ended up being a boon to glitch discovery. Full credit for this bug's discovery goes to her.

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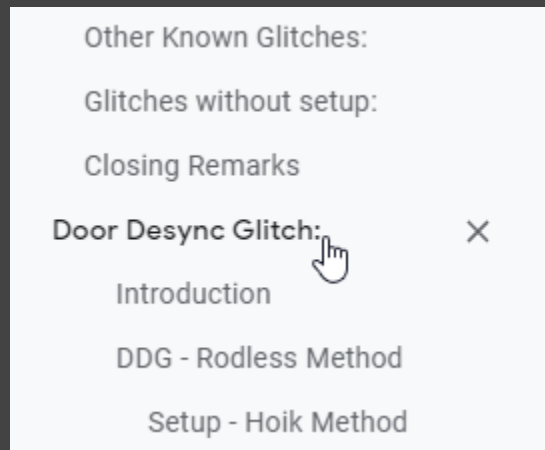
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Door Desync Glitch:

Glitch credits: Assorted; see Preface.

Video Tutorial:

▶ Door Desync Glitch Guide - Terraria - [1]

Introduction

Door Desync Glitch is the framework which makes every other glitch in this document possible. It allows for the client and server to see two different things- which, in turn, allows the client to place blocks in ways that would otherwise be impossible.

The glitch can be performed two main ways- For the second method, all you need is any gravity block and a door, however this particular method is frame-perfect. The first method is still useful for testing, as even with modern setups the first method can be difficult to pull off.

1 - Rodless DDG

Method discovered by: Yri

"Since I can't use macros during a speedrun, I'll just make my own macro in-game."

The rodless method of DDG is frame-perfect. A door must be closed on the exact frame a gravity block hits the ground in front of the door, as shown below:

Figure 1a: Coin landing on door the exact frame it is being closed.

Figure 1b: The door (now invisible in the image on the right) has become de-synced.

Upon successful execution, this creates a "server-side" door, which becomes the jumping-off point for other methods such as Check2xX "Pronging" and Philosopher's Stone Transmutation.

2 - Setup: Hoik Method v2

Setup created by: Yri

The Hoik Setup was created as a work-around to this frame-perfect requirement- Previously, I only had luck executing this method with macros, but that would make the run a TAS. (Even the Macro usually took 5-10 attempts, at 1ms intervals.) So, instead I came up with this:
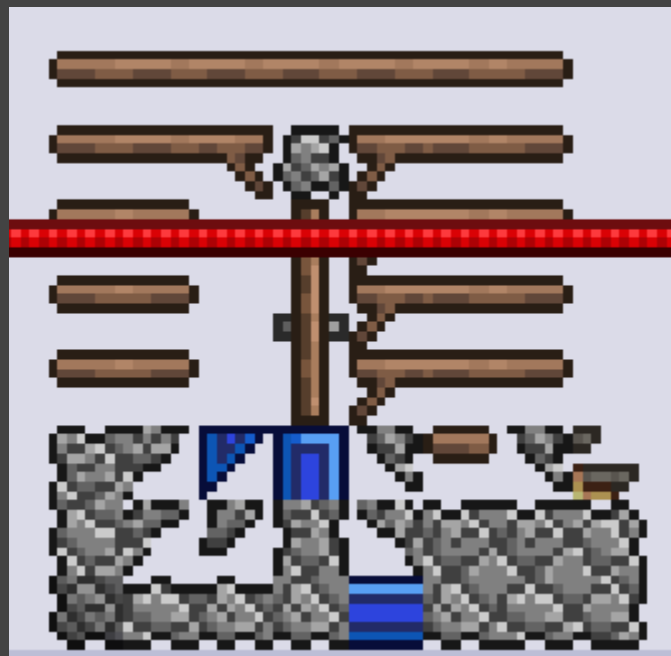
Figure 2: V2 Hoik setup for DDG. The red wire can be ignored for now; it is a part of Philosopher's Stone. The setup should be <u>made of stone blocks</u> to prevent unwanted block updates.(Wood is a workable alternative.)

3 - Notes and Troubleshooting:

- Ensure that Smart Doors are on in Settings.
- Two instances of the game are required to do useful methods with this.
- Slight seizure warning; you may want to close your eyes after lining up your cursor, as the rapid vibration makes it hard to look at.
- Multiplayer only.
- For best results on longer runs[2], re-launch the server and have the main player you are using join first. I am unsure as to why this makes a difference but doing so has helped greatly with consistency.

3 - Steps to use:

1. Enter the Hoik on the right. Hold Left and Down.
2. Align your cursor vertically with the top of the door (where the red wire is).
3. Hold down left click with copper coins (or any gravity block) in your hand. Move your cursor horizontally until they are being placed to the left of the door The coins will initially break as soon as they land.
4. Eventually, however, you will hear the door close with a "thump", and the door with disappear. The de-sync between the two clients should then look similar to the figures below.
5. Server-side doors are not useful on their own. It must be translated to a client side door; said translation is detailed on the next page.

P1 POV	P2 POV

Figure 3a: View from the client who executed DDG

Figure 3b: View of the other client (and the server)

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[2] If a run is longer than about 20 minutes, doing this trick probably helps. But, if you're doing a sub-10 minute Zenith%, then you'll be alright without a restart.

You've probably made these sorts of "vibration hoiks" by accident whilst trying to go through walls- Here, I use that rapid vibration to an advantage as a means to open/close a door even quicker than macros.

Server-Client Door Switch

Method discovered by: Yri

"Or just 'Door Switching' for short."

For Check2xX and the glitches that follow to work, we need client-side doors.

The Rodless method of DDG creates server-side doors, which by-themselves are not useful. However, they can be reliably translated.

The following setup can be used after Rodless DDG to get a client-side door.

2 - Setup: Chest Method for Door Switching

Setup by: Yri

Video Demonstration: Link

0. Have a successful DDG performed, and carefully remove the remaining coins.

P1 POV (Left player)	P2 POV (Right player)
	 P2 currently sees the serverside door.

1. Use P2 to open the serverside door.

P1 POV	P2 POV

(no visual change)	Serverside door is now open.

2. Have either player create a spot for a door on the left. (block in red)
   Then, have P1 place a door on that spot. It will not appear for P2, as this is our client-side door.

P1 POV	P2 POV

Client 1 has placed removed a platform, placed the red block, and then placed a door. *This is our client-side door.*	*The serverside door is still open during this entire process.*
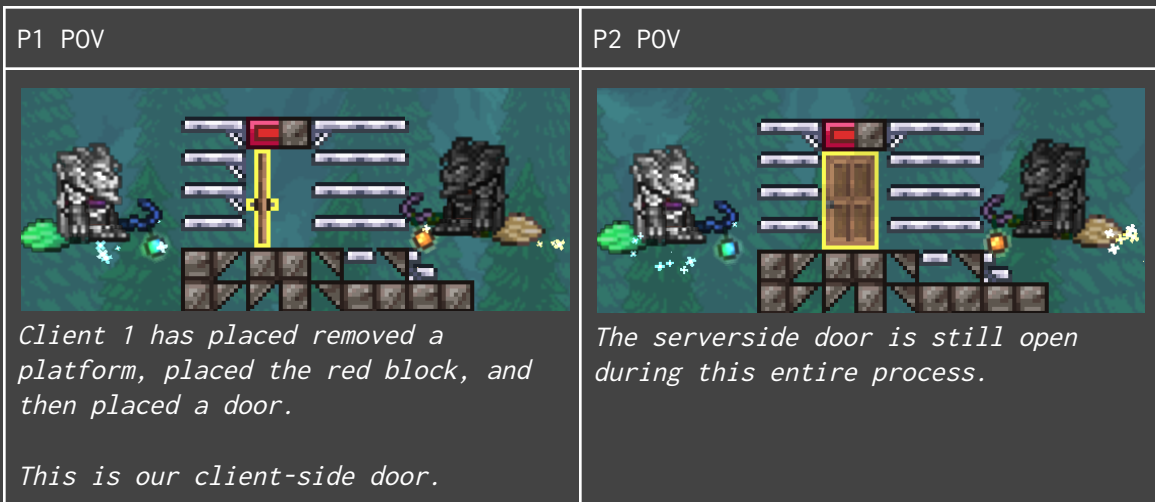
3. Have Client 2 close the door; **Ensure both doors are closed before proceeding.**

P1 POV	P2 POV

(no visual change)	*The serverside door is now closed.*
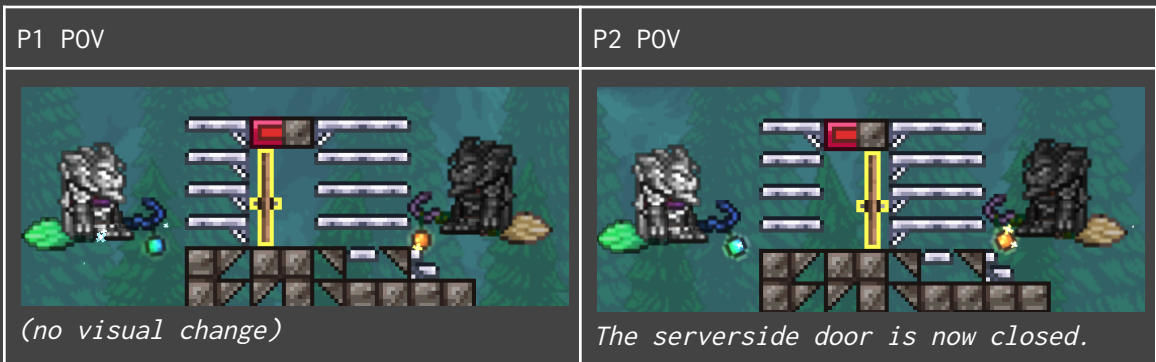
4. Break the server-side door (P2 in this case.)

P1 POV	P2 POV

Clientside door persists.	*Serverside door is gone.*

5. Open the client-side door (P1)

P1 POV	P2 POV
Clientside door is now open.	(no visual change)

6. Have P2 place a chest[3] where the door is on P1's screen.

P1 POV	P2 POV
The chest, placed by P2, is clipped inside the door.	*P2 has placed a chest where the door is on P1's screen.*

7. Have P1 close the client-side door. The chest and door will both pop; this desyncs the block under the door ("desync block"), allowing for the setup of other desync glitches.

P1 POV	2 POV
P1 has closed the door; P1 now has a "desync block".	(no visual change)

8. Both the small door remnant and the chest itself can now be freely broken.

P1 POV	P2 POV

---

[3] Wooden Chest is safe and known working. You can test with others, but I can't guarantee they'll work. I have a theory that the game reads the framedata of the chest as mis-interprets it as the top piece of a door, hence why it breaks a block lower than it should when the door "breaks", and the top piece stays.

The "door remnant" is broken. P1 still has the "desync block".

P2 can freely place items above where the "desync" block is.
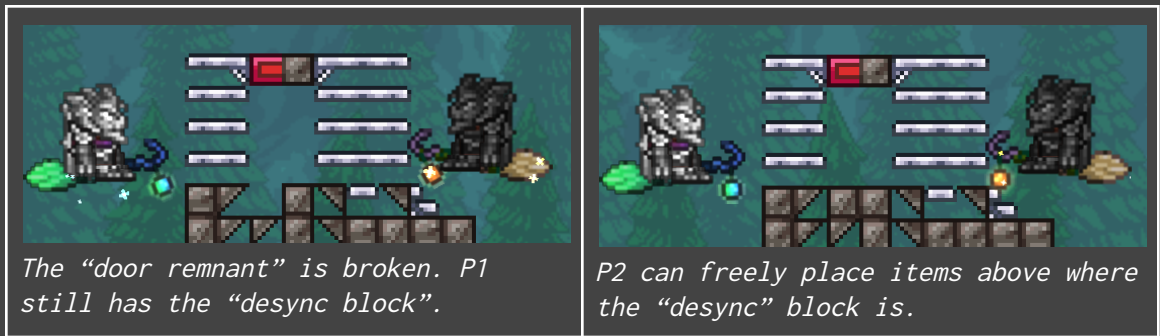
With the "desync block", any furniture placed by P2 above that spot will not appear on P1's screen.

This is the placement glitch which makes Check2xX and Philo work- As P1's client does not acknowledge the furniture there, it allows P1 to freely place blocks there. This free block placement is otherwise only achievable with inventory editors; however, with these methods, we can do it in-game.

Consider this setup the foundation for the glitches which will be shown next.

The "Prong" Glitch:

The "Prong" glitch is fundamental to the setup of Philosopher's Stone. It allows for fragments of furniture items to be placed in-game, like you would in T-edit - most notably, the floating bast statue head.

A floating Bast head with CGO.

▶️ Philosopher's Stone Glitch Guide - Terraria - [2] (timestamped)

Theory Behind Check2xX and Philosopher's Stone:

In Terraria, each tile has a stored "FrameX" and "FrameY" value.

The game reads these values, and uses them to determine the visual appearance of a tile visual appearance.

Certain items of the same type with multiple variants, i.e. Torches, Beds, Chests, etc. are stored in the same spritesheet. In these instances, the game reads the FrameX and FrameY values to determine what item should be returned.
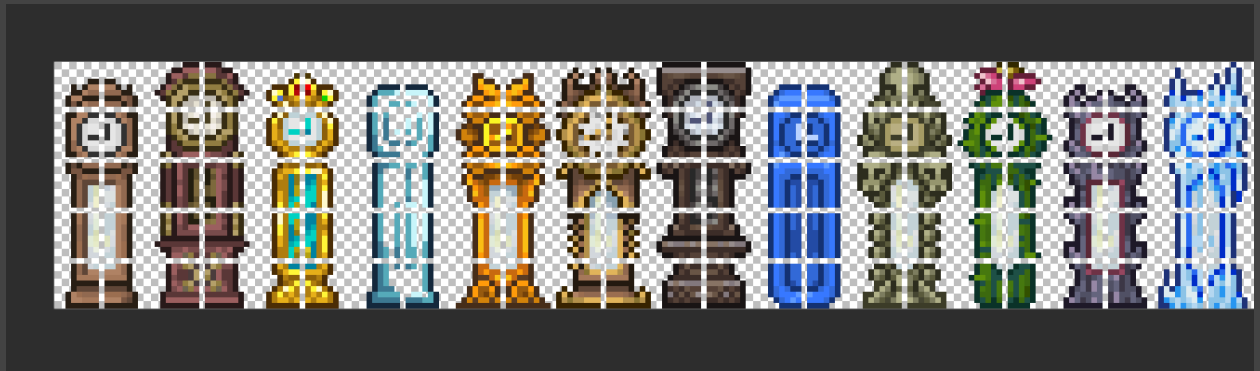
A part of the spritesheet for clocks. Different clocks are arranged horizontally, making them FrameX sensitive.

For example, with torches, the game does not care about FrameX for the sake of determining item drops (as all torches in a row are the same type, just different placements). However, different torches are arranged vertically, and so the game reads the FrameY value whenever a torch is given to determine what should be dropped.

Part ofthe spritesheet for torches- Different torches are arranged vertically, making torches FrameY sensitive.

Herein lies the fundamental idea behind transmutation- Manipulating FrameX and/or FrameY values to cause the game to return items outside the expected range.

Philosopher's Stone (Philo) takes advantage of how certain wire objects are programmed (in particular, the Bast Statues). Philosopher's Stone works on *any* tile in the game, but it does not always give a useful[4] results. However, this is largely made up for by the fact that through a combination of two items- doors and torches- you can obtain any item in the game.

Philosopher's Stone:

Video Tutorial:

▶ How to Transmute (almost) any item in Terraria, usin…

(timestamped)

Philosopher's Stone is the most powerful glitch to be discovered since the item frame dupe. With it and its derivatives, any item between ID 1 and 5455 can be obtained.

It is worth noting that Philoher's Stone ("Philo" for short) is strongly dependent on both DDG and the "Prong" gltich to work. It cannot be performed without one or both.

Technical Background

In Terraria, some furniture items have both an "on" and an "off" state. These sprites are normally arranged vertically, like with the Fountain spritesheet.

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[4] For items without Sub-IDs, Philo usually just mangles the sprites a bit and creates either mis-connected tiles, or "void" tiles that are purely black. It can also render certain bits of furniture, like switches, invisible.

Part of the spritesheet for fountains.

This is likely for standardization- however, there are exceptions to this.

Bast Statues are one of these exceptions, with its on/off sprites arranged
    horizontally rather than vertically.
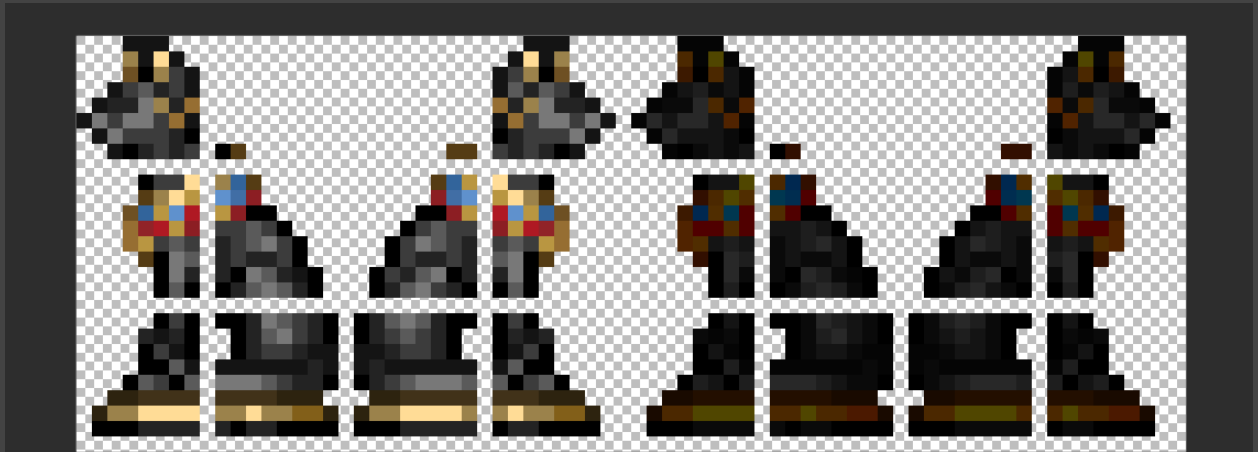
The full Bast Statue sheeting. From here, we can see why increasing FrameX is on → off, and decreasing FrameX is off → on.

In order to perform this transition from "on" to "off", the game changes the FrameX value of a 2x3 (size of the Bast Statue) of tiles by 72 pixels.

Critically, owever, the game does *not* check if this 3x2 of pixels is actually a Bast Statue.

Therefore, by using the Prong Glitch to get only the top half of a bast statue, we can place something else within that 2x3 rectangle, and the game will offset its sprite data as if it were a Bast Statue

The floatingbast head which is funemental to Philospher's Stone.

This is the fundamental idea basis on which Philo resides.

Chandeliers are another wire object with similar sprite arrangement, however they are immune to the Prong Glitch (as they are not "two by X" in size). A similar story goes for Campfires.

Author's Note:

It is something of a miracle that an in-game setup for Philo was discovered at all. The overlapping requirements of needing to be both "prong-able", wire-activated, and having horizontally arranged on-off states was very difficult to pin down, and I nearly gave up on finding setup a few weeks in.

The idea of using a Bast Statue is an "Eureka!" moment I am still quite proud of.

Setup - Bast Statue

Note: I do not recommend using exclusively this setup in a run, unless you are doing Zenith%; for Any% ML, see "Stabilized Bast Statue" under the "Campfire Glitch" section for how to improve this setup.

Requirements:
- Successful DDG setup
- 1x Bast Statue
- 1x desert fossil
- 2x sandstone
- 8x wood

Door Method for Transmutation

"New Zenith crafting tree: Bast Statue + Steampunk Door = Zenith."

The door method is the strongest out of all Philo methods, and it makes up the majority of the ID coverage (blah to end).

With the aforementioned setup, Philo can only offset tiles in its effective area (blah) pixels forwards, or (blah) pixels backwards, and back again[5].

Now then, what if those tiles moved out of the way, so we could reset the Bast Statue and then step forwards again?

Opening and closing doors proved to be the solution to the Bast Statue only allowing us to go forwards / backwards in (blah) pixel "steps".

We can open the door (place into Bast Area of Influence, or AoI), offset the door forwards, close the door by clicking on the affected tile (this stores our transmutation and overrides the old door data), and then re-set the Bast to an "on" state without needing to step back the door at the same time.

This is best illustrated with an example.

(bast head on, Crystal door open)

(bast head off, door top-left tile is now (blah))

(click top left to "store' that transmutation; close door)

---

[5] *It is, hypothetically, possible to make "tower" of Bast Statue remnants to get larger offsets, however this setup is both a massive pain and time-inefficient to execute in a speedrun.*

(Toggle Bast again; door is out of the way, Bast is ready to step us forwards again)

(Click any tile of the door so it is in Bast AoI again, offset, repeat).

Numerical Background

Another benefit of doors is that each Transmutation moves us 36 IDs at a time, rather than 1 ID at a time. So, going from 721 to 4956 does not take a three-thousand transmutations.

This occurs because doors, like Statues, are sensitive to both FrameX and FrameY. Doors separated by 1-ID, i.e. Wooden to Ebonwood, are vertical. Doors separated by 36 IDs, i.e. Wooden to Crystal, are arranged horizontally. As we are doing horizontal offsets, we trick the game into using these 36-ID steps.

Predicting Transmutations

The Wooden Door goes from 721 (Tungsten Brick Wall) to 757 (Terra Blade), a difference of 36 IDs. The next transmutation nets you 793 (Crimson Scale Mail), another difference of 36. All doors follow this rule.

Therefore, the following expressions can be derived.

Equation 1: Obtaining the Door Index Required for a Given Item

$$d \ = \ (n - 721) \ \% \ 36$$

where:

d[6] = Door Index, with wooden corresponding to d = 0

n = desired item ID

and % is the modulo division operator

---

[6] The system of door indices exists purely for bookkeeping reasons. It does not have a direct basis in the game's code, but it is useful for various things concerning Transmutation.

Equation 2: Approximate Number of Transmutations Required to Reach a Given Item

$$Tr = \frac{n-(722+d)}{36} + 1$$

Where:

    n = Desired item ID

    d = Door index (index d = 0 being wood)

An example calculation for finding the door to get Zenith is shown below:

$$d = (4956 - 721) \% 36$$

$$= (4235) \% 36$$

$$d = 23$$

Index 23 corresponds to the Steampunk door- and this is consistent with the in-game setup for Zenith, which uses the Steampunk door as a starting point.

The approximate number of transmutations required is:

$$Tr = \frac{4956-(722+23)}{36} + 1$$

Below is a visual reference for translating between door indices and items.

Figure 1: Reference for Door Indices

Doors in the same row give an identical result, i.e. doing Wood and Crystal doors is identical. In fact, the Wooden Door becomes a Crystal Door after the first transmutation.

Useful Notes:

- Doors which are not feasible to obtain early in a speedrun, like a Steampunk Door, are obtainable using CGO. Therefore, one should not worry if the index of a door is something made of Hardmode materials, as it can be obtained using a pre-Hardmode door as a base.
  - The one exception to this is the Locked Lihzahrd Door, which is index (blah); however this can be worked-around using Offset-Tweak Transmutation (see advanced methods).
- If the index returned is negative, then the item is unobtainable with Philosopher's Stone. (This only occurs if you're trying to get an item below ID 721.)
  - If this is the case, see the section on the "CGO-Torch method".

Statue Transformations

Other Oddities

Given how fundamentally Philosopher's Stone changes framedata, it's unsurprising that it causes the game to freak out in a myriad of broken yet interesting ways.

Here are a few peculiar applications that are likely not useful to speedruns, but still interesting nonetheless.

Note: These are mostly oddities are more fun that practical; the more practical oddities reside in the "CGO" sections.

This section is quite long, so be ready.

Drax Timer

For unknown reasons, executing Philosopher's Stone on a 1-second timer creates something nicknamed the "Drax Timer"- a timer which goes faster than a ¼

second timer, and is otherwise identical to a regular timer (aside from having a visually broken sprite).

While not useful for Speedrunning, I figured I'd include this as it's fun to fiddle with, and gives an idea of how weird some of the things Philoshper's Stone can induce is.

Invisible Rail Glitch

This particular glitch requires CGO, however to condense the number of sections I have included it here.

Executing CGO on the ending to a rail causes any furniture below it to become invisible, as long as the rail is loaded by your client.

This falls under the category of "Weird occurrences which I have zero idea as to why they occur", but is included both because it is a fun gltich and for completeness.

This also causes the "T-pose" glitch, explained in more detail below.

Unobtainble Chest T-Pose

In Terraria, there are two unobtainable chests- a Golden and Crystal chest. These two chests were (added in 1.2 but were not available until 1.3), and are different from the modern Golden / Crystal chests because they are on the Type 1 Spritesheet (at the very end), while the obtainable ones are a part of the Type 2 spritesheet.

Given their incomplete nature, these chests have a few very weird properties.

First and foremost, mousing over them causes all of your character's vanity items to disappear- only equipped armor and dyes remain.

Secondly, your character will freeze both mid-air and mid-animation.

Dresser T-pose

Clipping a chest inside of a dresser results in a strange, walking t-pose glitch
    when attempting to block-swap the chest.

This one is best illustrated with a video.

Biome Chest Lockpicking

CGO can be used to make (any tile breakable)- this includes both chests with
    items in them, *and* locked chests.

While arguably less practical than transmutation, I spent a good few hours
    attempting to lockpick biome chests about a month before Transmutation was
    discovered. As such, it is somewhat special to me personally to finally have a
    practical way to crack open biome chests.

Bore Drills

Ever wanted Tekkit in Terraria? Well, now you can.

(Demo video drilling through a Lihizard temple.)

The "Drill" uses doors as "fuel"; it can only go a certain distance before you
    need to "re-fuel" it by replacing the door. (As the existing door has run out
    of FrameY.)

Why do doors exhibit this bore-drill behaviour when set up in this way? I
    couldn't tell you, frankly. But that is part of why it is in the "Oddities"
    section.

Campfire-Glitch Offsetting: (CGO)

Under normal circumstances, attempting to use CGO on a piece of furniture will only allow you to reach the top of a spritesheet. I.e. If you start w/ Bamboo Toilet, you will cycle forwards all the way through the sheet until you hit the top, wherein it will cycle between (the two toilets), but will not allow you to go into extreme FrameY offsets.

However, by placing an open door next to a CGO setup, we can trick the game into allowing us to go much further than the ends of a spritesheet.

Video Demonstration:

Below, the conditions for setting up this glitch are shown .

(CGO, door on left, one tile space, then two "safe" affected tiles"

(note orange tiles that are unsafe because of updating the door)

The one critical note with this tech is that the door will cycle between 'stable" and "unstable" states. The left door (our "catalyst") can only be touched when in a stable state (ergo, it looks "roughly" like a door), or else the Transmutation setup will be destroyed.

Below is a quick video demonstrating stable vs. Unstabe doors:
Video Demonstartion:

This occurs because the game tracks what tiles to destroy when "breaking" a door from the bottom point; and so if the bottom of a door is in the center, the game will incorrectly break a 3x2 of tiles above where the door is. This breaks a tile in the 'safe zone' of the Bast Statue; which, does not break the Bast, but it renders us unable to place more Doors, thereby rendering this glitch impossible to execute without resetting.

CGO: Advanced Applications

"What's better than one Transmutation setup? Stacking two of them together, of course!"

Philo-CGO is fairly novel compared to some of the other glitches here, yet it is one of the most exciting due to the potential for powerful transmutation combos. It allows for FrameY values to be set arbitrarily low, and it is thus far the only way to quickly and reliably go backwards in IDs.

Philo-Door method's main limitation (aside from needing a Bast) is that it (effectively) starts around ID 720; Philo CO can go all the way back to ID1 from your starting point, and stop at IDs in-between.

In the tentative Transmutation-based Any% route, Philo-CO-Torch is used to obtain a Guide Voodoo doll and skip house building.

Setup Part 1a - Door Desync Propagation

For clarity reasons, these setups will not be explained in text. Rather, it will be done through two short videos.

(video) (length)

Setup Part 1b - Double Bast

To utilize both CGO and Philo simultaneously, two Bast Statues are required. (One to set-up CGO and one to do Philo on a door).

This does *not* require finding two Bast Statues; as the Prong Glitch dupes the Bast for you. All that is required is placing a second Bast Statue next to the first.

(video) (length)

<u>Non-Destructive Transmutation (NDT)</u>

Non-Destructive Transmutation is a fairly new tech that makes use of Double Bast to have both a CGO setup and a Philo setup in proximity.

As the name implies, it allows for an item to be obtained from Transmutation without re-setting the setup, allowing for items to be obtained along the way to a far-away item (i.e. Zenith), or obtaining multiple of an item (i.e. Multiple Zeniths). In a way, it is a sort of quasi-dupe glitch.

Limitations: Non-destructive transmutation can only be done for every third item in a Transmutation table. (fix me lmao).

Furthermore, NDT requires the right Bast Statue to be a "Stabilzied Bast". (see above, or whether ever it is)

Theoretical Background:
(CGO-Door Stacking) -> Show door glitched w/ top part of door on a bottom part. Top part breaks

restore block

bottom part can then be restored via opening with valid top black

Below is a quick video demonstrating NDT being performed as a means to dupe Zenith. This is not *the main use for this glitch; however, I have not gotten as far as doing advanced routing with NDT, due to its novelty.*

Multi-Item Transmutation

This is another advanced tech which builds on the same general idea as NDT. CGO is used to create a door which actually consists of two different doors; the main application of this is transmiutating two different items at once, which reside fairly close-by in the ID list.

Below, a demonstration is shown for transmuting both Zenith and Celestial Starboard at the same time.

The exact mechanics behind multi-item transmutation are clearer when performed on a visible door.

(Picture of a door which is not invisible).

Doors appear to check a 2x3 of tiles from their bottom-left corner when determining which tiles to break. Under normal circumstances, this only removes the door itself; however, using CGO, it is possible to make a door which is made *exclusively* of the bottom piecies of doors. Through this, we can make a door which breaks tiles like so:

(Red, top set of tiles broken.
(blue, middle set of tiles broken,
(Green, last set of tiles).

With this premise, three items can be obtained from one transmutation.

One must be careful when grabbing the items from these doors, as they can be incredibly sensitive to block updates from adjacent tiles. In fact, the general setup for Multi-Item Transmutation is not fully consistent as of writing. Instead, two main setups for the Any% run are used:

(Zenith+Starboard Setup)

(Altar+Power Cell Setup)

(…)

There may be ways to stack this tech with NDT, but as of writing I have not yet had the time to investigate these possibilities further. As such, this is yet another possibility for advanced routing, as it could be used to save on the number of Transmutations required (less time executing Philo), but with elaborate enough planning obtaining certain extra items as transmutation bases could be skipped entirely.)

Offset-Tweak Transmutation

Requires: CGO-Door method, Stabilized Bast Statue

Recall that Philo-Door jumps in offsets of 36; using CGO, we can move in much smaller offsets of -1, hypothetically going as far as - (36) in individual steps.

This is in its own section from the previous two methods primarily due to lack of research as to how the three interact, despite how they are all using very similar background tech.

(Thereby, at some point, Not-Destructive Multi-Item Offset-Tweak transmutation may exist at some point. But if I were to start researching that I would never finishing writing documentation for the existing stuff.)

Video demonstration:

For further information, see the CGO-Torch method, which uses this exact tech.

CGO-Torch Method

Utilizes: Offset-Tweak Transmutation

This method is tentatively in the Any% route as a means to obtain a Guide Voodoo Doll, allowing for WoF to hypothetically be killed before Night Day 1, and skipping house building.

Theoretical Background:
The torch sprite sheet is attached below.

Different torches are arranged vertically in the sheet, thereby making them vulnerable to CGO transmutations. When combined with CGO-Door offsets, we can achieve an incredible range of offsets.

Using regular Torches and Blue Torches are a starting point, IDs (blah) to (blah) are now obtainable.

CGO-Torch is a very quick transmutation as well, however its primary downside is that it is one-way, meaning that if you miss, you cannot go backwards. (God dammit I just had an idea; break the door and see if the offset resets backwards.)

Torches go from ID (blah) to (blah) in (blah) intervals. Blue torches do (…)

If a Blue Torch is needed to reach a certain ID, like the Guide Voodoo Doll (327??), a forwards-CGO can be used to step to a Blue Torch, which can then be transmuted into the doll.

Execution:
(one or more torches, can place at different times to boot so that you can be transmuting multiple different things simultaneously. Idea credit: Gromek999)

CGO-Statue Method

Firework Projectile Glitch

This particular glitch, currently, does not have a useful application, and so this section is less formal compared to others. However, there could be game-shattering potential below the surface- so, this is a notable area for further research to be done.

Setup - Philo-CO-Door Based

Theoretical Notes:

In short, this glitch allows us to manipulate the projectile a firework spawns upon clicking it. Rockets come in four colors:

Red Rocket

Statistics

Type [Furniture] [Mechanism]
Placeable ✔ (1 wide × 2 high)
Use time 15 (Very fast)
Rarity **White**
Buy 15 ⬤
Sell 3 ⬤
Research 5 required

Projectile created

Red Firework Rocket

Internal Item ID: 970
Internal Tile ID: 216
Internal Projectile ID: 167

Green Rocket

Statistics

Type [Furniture] [Mechanism]
Placeable ✔ (1 wide × 2 high)
Use time 15 (Very fast)
Rarity **White**
Buy 15 ⬤
Sell 3 ⬤
Research 5 required

Projectile created

Green Firework Rocket

Internal Item ID: 971
Internal Tile ID: 216 (2)
Internal Projectile ID: 168

Blue Rocket

Statistics

Type [Furniture] [Mechanism]
Placeable ✔ (1 wide × 2 high)
Use time 15 (Very fast)
Rarity **White**
Buy 15 ⬤
Sell 3 ⬤
Research 5 required

Projectile created

Blue Firework Rocket

Internal Item ID: 972
Internal Tile ID: 216 (3)
Internal Projectile ID: 169

Yellow Rocket

Statistics

Type [Furniture] [Mechanism]
Placeable ✔ (1 wide × 2 high)
Use time 15 (Very fast)
Rarity **White**
Buy 15 ⬤
Sell 3 ⬤
Research 5 required

Projectile created

Yellow Firework Rocket

Internal Item ID: 973
Internal Tile ID: 216 (4)
Internal Projectile ID: 170

The four types of fireworks. Image credit: Terraria Wiki

Fireworks are all stored on the same spritesheet. For reference, the spritesheet is included below:

Table N: List of All Furniture Items Suceptible to Check2xX

To the left, you can see the Firework spritesheet. All four items are stored in the same sheet, differentiated by their frameY values.

The game reads this FrameY value to determine what projectile to spawn- i.e. Should it be the red firework rocket, or the green firework rocket, etc?

The game does not check to ensure that this FrameY value stays within proper bounds. As such, we can manipulate these values outside their normal range with Philo-COG-Door to spawn projectiles other than fireworks.

I have yet to find an application for this aside from spawning tons of pets, as the projectiles spawned lack their usual properties. (For example, minions lacking damage.)

But, perhaps there's a way to use a projectile to trick the game into thinking we've progressed to a certain milestone, i.e. something in Hardmode. This is all just theory, of course- but who knows! Four months ago I didn't think Zenith pre-HM was possible. And now, it's doable in under 10 minutes.

So, who knows what other spectacular glitches are still waiting to be discovered!

"Here, there be dragons" is an old saying for when mapmakers didn't know what lie in a certain area.

In this case, I'm using it to refer to the *really* weird, yet useful glitches included under Philosopher's Stone.

These advanced techs have the potential for large timesave; however, the
    underlying functionality behind them is not fully understood, nor do fully
    reliable setups exist just yet.

However, due to their potential, I have included them in the document to the
    extent that they are understood.

Behold: The *even crazier* side of Philo.

Miscellaneous Non-Transmitation Glitches

This section is for glitches which don't fit any of the other categories, but I
*   still wanted to include. They are of varying degrees of utility- some are fun*
*   visual glitches, others could have applications in a run with creative*
*   applications.*

"Hammer Anything"

Glitch discovered by: Yri
Setup by: Yri

Double Pylon Method

Glitch discovered by: Yri
Setup by: Yri

Astral Projection

Glitch discovered by: BobdaBiscuit (footnote)
Setup by: BobdaBiscuit

Lag-Based Chest Dupe

Glitch discovered by: Peachy3334

Setup by: Peachy3334 ; slight updates by Yri

Tables

Full list of items susceptible to check 2xX:

Table 1 - List of Items Susceptible to Check2xX

Item (Item ID)	Sub-ID Count	Can transmute?	Technical Notes
Clocks (104)	40	Yes	- Return range appears to be locked with the bounds of its 40 sub-IDs. - Unaffected by FrameY changes.
Statues (105)	79	Yes	- Sensitive to changes to both FrameX and FrameY. Statues are _very_ unique in this regard. - FrameY is locked to % 3 values (i.e. CGO will not get you very far)
Fountains (207)	10	Yes	- Only sensitive to changes in FrameX. - Interesting applications due to repeatability when paired with Check2xX transmutation methods. - Can be infinitely duped via right click with correct setup.
Seaweed Planter (320)	0	No	
Letter Statues (337)	36	Yes	Curious applications for early-game Check2xX setups, due to availability of Xeno Staff, however 13 iron (5 for an anvil and 8 for a Heavy Workbench) is needed to start crafting letter statues.
Mushroom Statue (349)	0	No	Seperate from the others due to its animation.

Enchanted Sundial (356)	0	No	
Target Dummy (378)	0	No	• Noteworthy for being a tile entity; specifically one that takes priority over other tiles when placed. Modern setups no longer require using this attribute, however.
Monoliths (410)	4	Yes	• Despite being innately close to useful items, the monoliths being normally obtained post-Cultist makes them of limited use. • Can be infinitely duped via right click with correct setup.
Silly Tied Bundle of Balloons (456)	0	No	
War Table Banner (465)	0	No	
Blood Moon Monolith (480)	0	No	
Pin Wheel (489)	0	No	
Bast Statue (506)	0	No*	• The "*" here is that you technically can't Transmute the Bast itself. But the Bast can certainly transmute other things…
Void Monolith (509)	0	No	
Boulder Statue (531)	0	No	
Lawn Flamingo (545)	0	No	
Golf Trophies (560)	3	Yes	• Can be used to obtain Desert Tiger Staff via moderate offsets. • However, the need to farm golf score likely makes this

			prohibitive.
Hanging Pots (591)	8	Yes	• Can be used to get Hellstone Crates pre-HM using nothing but Check2xX. ○ (This was more exciting of a prospect before Philo was discovered.)
Hanging Brazier (592)	0	No	

Date	Version Number	Changes
4.3.23	0.5.0	- Worked on trying to get previous sections up-to-date - Cut most of the stuff on Check2xx since CGO made it obsolete