

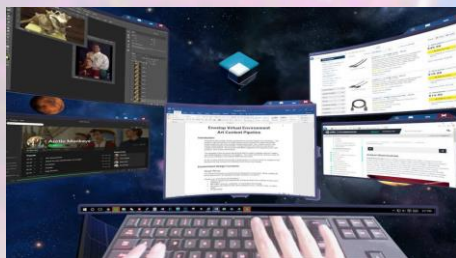
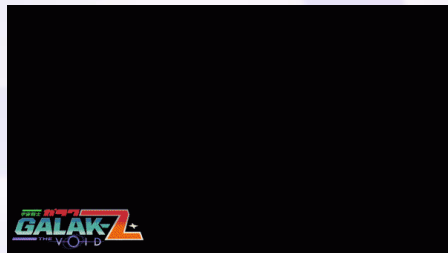
Mining Your Own Design

Crafting the Crafting System in
'Astroneer'

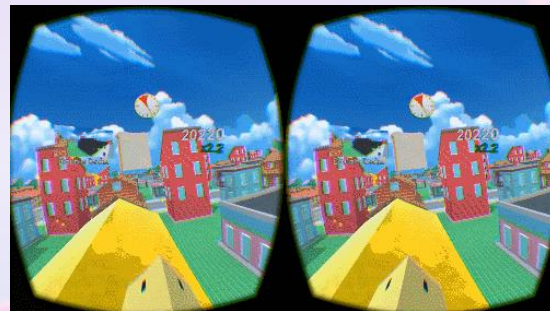
GDC 2020

Who we are

Aaron Biddlecom – Technical Designer



Elijah O'Rear – Gameplay Programmer



Introduction - Crafting the Crafting System

- The Crafting Update was one of the last features released during Astroneer's early access period
- Centered on the crafting system: a core part of the game with some glaring holes
- Changes needed to be handled delicately, and carried a high risk of destabilizing the existing game

Introduction - Mining Your Own Design

- Process for deepening your understanding of your game in order to make informed choices that address the game's needs
- We'd developed conflicting views about Astroneer that needed to be reconciled
- Doing so revealed hidden flaws in our assumptions about what the game was, and deepened our understanding of it on both sides

Introduction - Critical Collaboration

- Cross-discipline collaboration was a critical piece of getting past deadlocks
- Disparate viewpoints make it easier to challenge your assumptions about the game and reveal flawed understanding
- We analyzed Astroneer not to prove each other wrong, but to find the hidden or misunderstood piece that bridged our two perspectives
- Working together on this update resulted in improvements to our design process, and highlighted a place for engineers in it

Introduction - What is Astroneer?

- Space-based exploration/survival/crafting game
- A small solar system of vibrant planets
- Beautiful ground-based exploration
- Free-form terrain sculpting
- Toy-like, diegetic item and inventory system
- Chill, low-stakes vibes punctuated by excitement



Sounds Nice. What's the Problem?

- Player engagement dropped off after a couple hours
- Early access feedback was still *"Great concept, can't wait for full game"* right before launch
- Crafting was flat, the gameplay hardly changed past the first hour
- More dynamic game systems still funneled into crafting, but it lacked a big moment that shifted the crafting gameplay

What's the Fix?

- Crafting games often follow a pattern of introducing new steps and systems the longer you play
- That didn't happen much in Astroneer
- We could introduce a few new modules that made new resource sets
- The resources from one module could be required to build the next, giving the player an exciting sense of progression
- It would give us more options on when we introduced items to the player

Seems Obvious, But...

- Aaron agreed, but worried about guarding those chill low-stakes vibes
- Simplicity was an important quality in Astroneer
- Crafting as-is already felt complicated
- It might be shallow and repetitive, but it still had a lot of moving parts
- Diegetic interface is intuitive and engaging, but demanding

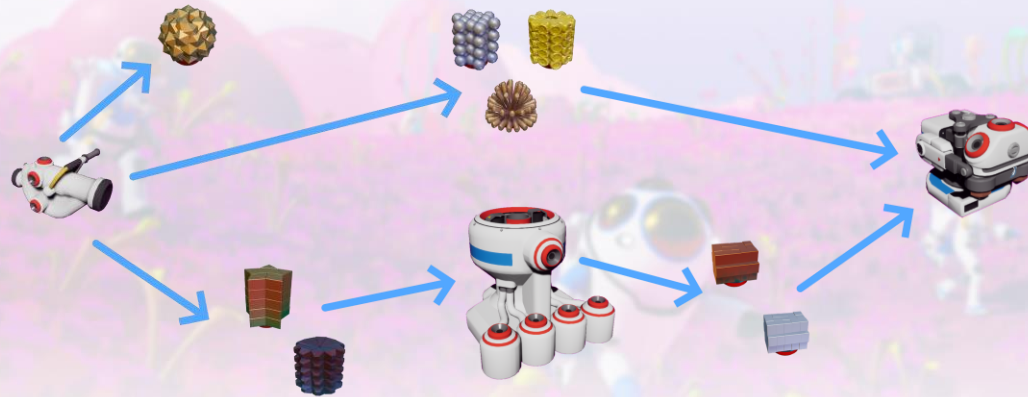
Cognitive Load

- Often talked about as a negative, but it's necessary!
 - Too little, the player is bored
 - Too much, the player is confused
- Astroneer seemed too simple
 - It took little effort to get access to all resources in the game
 - Player faced few tradeoffs with resources
- And too complicated
 - Modules we'd added seemed to be adding confusion instead of providing alternative
- How could both of these be true at once?

Takeaway - Dig Deeper into Disagreements

- Don't dismiss apparent contradictions between two different viewpoints on your game
- Avoid speaking in general terms, and provide specific examples behind each perspective
- Often, it can turn out that both views are valid, but are focused on different problems in the same design domain

Crafting Loop - The Core



Crafting Loop - The Core Deconstructed

- The Smelter was the only module that unlocked unique resources
 - Players got the smelter within the first 30 minutes of play
 - It only unlocked 2 new ones
- Very simple to use, did a straight conversion of ore to metals
- Ore could only be smelted, there weren't many tradeoffs for how the player used resources
 - Easy UX, no tradeoffs, low cognitive load

Smelter Demo



Crafting Loop - The Spur



Crafting Loop - The Spur Deconstructed 1/2

- Soil Centrifuge brought soil collection into crafting
 - Complex to use but could make any mined resource
 - Sample resource was fiddly for players to use
 - Variable exchange ratios were hard to interpret



Soil Centrifuge Demo



Crafting Loop - The Spur Deconstructed 2/2

- The Atmospheric Condenser produced Hydrazine
 - An important fuel for rocket engines
 - Not used in crafting at all
- The Chem Lab also produced Hydrazine
 - Introduced to give Hydrazine a more complex crafting story
 - Had the side benefit of limiting the Condenser's unbounded output
 - Planned for it to produce additional advanced resources, but currently limited to Hydrazine
- Like Soil, Hydrazine was stored in canister items, which ended up being fiddly

Condenser & Chem Lab Demo



Good Designs that Don't Play Nice with Others

- The 'spur' modules weren't inherently broken; taken in isolation, they were great examples of Astroneer's tactile aerospace aesthetic
- But they didn't mesh well with other parts in the game:
 - Either they were too cut off from other systems and felt like a minigame,
 - Or they were redundant with other systems
- This makes for a subtle design problem that can only be addressed by looking at the big picture and evaluating each part of design in the context of the whole

Crafting Sinks: Design Intent

- Two modules functioned as different kinds of sinks
 - The Soil Centrifuge was a sink for soil
 - The Atmospheric Condenser was a sink for power
 - Their redundant outputs undercut the incentive to explore
 - Without exploration breaks, base management became monotonous
- The Chem Lab was an experiment in combining resources
 - Only produced Hydrazine (like the Condenser)
 - Undercut our only power sink

Player Junk Food: Player Incentive

- The Condenser and Centrifuge were basically "player junk food"
 - Fine in small doses, but a poor substitute for the more "balanced meal" of the mining and exploration loop
- The Centrifuge had been designed to discourage overuse
 - Required a 'sample' of a desired resource
 - Unfavorable exchange rate with soil compared to resource deposits
- We wanted it to supplement resource mining by using the soil collected from mining deposits
- Instead, players started excavating the terrain around their base, rather than "wasting" time looking for deposits

Breaking the Stalemate

- The design intent was to provide resource sinks and base building gameplay
- The player incentive was providing resource shortcuts
- Over time, the intent and the incentive fused in our minds
- Elijah brought in the perspective that we needed the resource set and crafting gameplay to change over time to keep it from growing stale.
- It nudged Aaron to re-examine the whole crafting system and realize *"Wait, maybe these modules don't have the right incentive at all"*

Takeaways - Intents vs Incentives

- When your design's incentive and intent become tightly aligned, you're on the right track
- If you're struggling to align them, challenge your assumptions of each half can reveal flawed assumptions
- If you're struggling to challenge your assumptions, collaborate with someone who has a different vision for the design
- Let go of your design. This can be scary, but powerful!

Finding a Better Fit

- We couldn't tune our way around the redundancies, but we could remove them
- All we had to do was give each module unique resources
 - We could tie resource acquisition into other systems beyond exploration
 - It would expand crafting without adding new modules
 - It would reduce complexity by making more meaningful connections between the modules

The Soil Centrifuge Redefined

- Still produced resources from Soil
- Simply replacing the resource set allowed us to tune the module as intended, without having ripple effects on the deposit mining game loop



The Atmospheric Condenser Reloaded

- Still produced resources from the air using nothing but power
- Instead of a single resource, it now collected a different set of resources on every planet



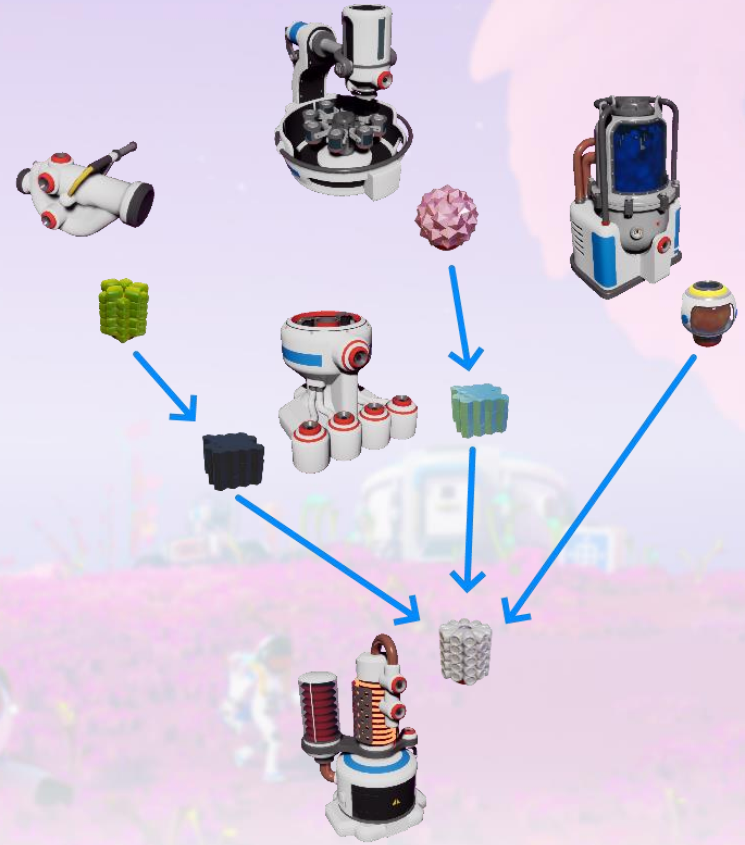
The Chem Lab Revised

- Produced composite resources out of mixed ingredients
- Further differentiated complex resources like Hydrazine from the simple refined resources produced by the Smelter



All Together Now

- The Atmospheric Condenser and Soil Centrifuge:
 - Formed a trifecta of raw resources alongside deposit mining
 - Created new gameplay vectors for resource scarcity
- The Chem Lab:
 - Allowed for a huge permutation of new resources



Takeaway - Asking the Right Questions

- Two questions can help focus on both sides of a design challenge
 - *"What do you want the player to do?"*
 - *"Why is the player willing to do it?"*
- The first looks at the problem through the eyes of the developer
 - What systems/mechanics/features are do you want the player to engage with?
 - How can these systems tie together and compound the gameplay possibilities for the player?
- The second looks at the problem through the eyes of the player
 - What motivates the player to engage with it? Rewards, mastery, joy, fantasy fulfillment are all potential motivations
 - The desire path players take to get what they want

Using the Questions

- You're not trying to impose your designer will, just make sure the player's not unduly suffering while trying to have fun
- Identifying negative player motivations will lead you back to the question of *"what do we want the player to do?"*
- Every iteration of asking these questions should align your design closer to player intent
- It can be easy to not fully consider both questions

So Close, Yet So Far

- Astroneer used real-world materials to fulfil that aerospace fantasy
 - Real-world materials led to intuitive recipe design
 - But we were struggling to pick a good set
- Perhaps we were just unfamiliar with these new resources?
- We tagged them by material properties. “electrical conductor”, “light structural material”, “shock absorber”, etc
- It just shifted the judgement criteria. Which is more valuable "shock absorption" or "radiation shielding?"

Asking the Wrong Questions

- Going in circles like this is a sign there's a hidden constraint or design pillar you haven't identified yet
- *"We need more resources"* was assumed to be the reason to add them, but we hadn't given much thought to how printers would use them
- *"What are these materials used for in the real world?"* wasn't nearly as important as *"What are these materials used for in Astroneer?"*



Cutting the Gordian Knot

- We cleared the board of ingredients, put up the printed items, and started asking *"what would be important if you made this?"*
 - A shuttle would need to be light, strong and resist heat
 - A rover would need to be tough and have good shock absorption
- We followed the existing design logic in our recipes to map between printed items and resources using shared material properties
- This made it clear which resources would be useful in practice, and not just in theory

Takaway - Identify Your Design Intuitions

- Design intuitions work great when your game is simple, but can break down as the game grows in complexity
- Try to tease out the hidden rules guiding your intuition
- Being able to articulate those rules allows design decisions to be made far more efficiently than just *"listening to your gut"*

What About the Gases?

- Gases still didn't have a clear use
- Real world examples didn't help: gases are part of the manufacturing environment, but often aren't ingredients
- Only hydrazine had a clear gas ingredient, hydrogen
- Several ideas "worked" but felt too abstract or limiting

Finding the right Sink

- Asking the question *"what's this for?"* led us to think about resources in a new way
- We needed a sink for the gases to preserve the Atmospheric Condenser's role as power sink
- The printer recipes were a sink, but not the only sink
 - Treating them like "crafting fuel" was a better conceptual fit and made them essential
 - Gave us the freedom to add a needed, novel behavior to the new crafting modules

Takeaway - WTF: What's This For

- *"What do you want the player to do?"* and *"Why is the player willing to do it?"* are variations of a more basic concept: *"What's this for?"*
- Helps you to focus on the desired outcome, rather than any given approach to it
- It's easy to fall into the trap of only asking *"what do you want the player to do?"* or *"why is the player willing to do it"* but not both

Finalizing the Crafting Modules

- Narrowed our new crafting steps down to two modules that paired well with the gases:
 - Alloy Furnace: inert gases
 - Chemistry Lab: volatile gases
- Playtesting showed that they were too similar
 - Players couldn't intuit which resources came from each
 - All other modules had unique interactions; the new ones behaved identically
- Consolidated into a single module

Reduce, Reuse, Recycle

- We re-used the existing UX for the Soil Centrifuge, Atmospheric Condenser, and Chemistry Lab
- Small changes were made to accommodate the new inputs and outputs, as well as to add clearer interfaces
- This preserved the recognizable parts of all three modules, and significantly reduced the cognitive load of the new behaviors
- Our conflicting concerns for the game were at last resolved: we'd deepened the crafting system without further complicating it



Stumbling at the Finish Line

- Crafting Update was a success...
 - ...but it wasn't perfect
- We made some compromises that ended up hurting the feature in the long run
- Insufficient buffer in the schedule and Elijah's absence at the tail end weakened the collaborative process we'd used up until then
- *"Mining your own design"* isn't just for figuring out what's broken: it can help you protect what works

Abandoning the Soil Centrifuge

- Changing the Soil Centrifuge introduced new problems
 - Players could no longer "graduate" past mining for basic deposit resources
 - Grinding for soil was no longer optional
- To fix this, we removed the exclusivity on soil resources
 - Common deposit resources were added to the Centrifuge
 - The soil resources were given deposit equivalents
- The crafting progression suffered, with only the Chemistry Lab and Atmospheric Condenser left to provide an upgrade path across six planets

Knowing When to Compromise

- We lost sight of our primary goals for the update:
 - Improve the crafting progression
 - Make the crafting system cohesive
- Applying the principals of *"mining your own design"* yields alternatives that could have addressed the problems with the centrifuge
- Compromises are inevitable in design; when problems arise, don't panic
- Asking yourself *"what do you want the player to do?"*, *"why is the player willing to do it"*, and *"What's this for"* are all ways to separate critical pieces from the ones you can let go

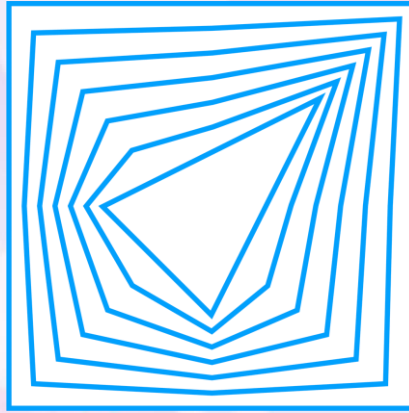
The Crafting Update's Legacy

- The Crafting Update has had a lasting impact on both Astroneer and our team
- We've doubled the number of printed items, without needing any new crafting modules or resources
- We applied the lessons learned to our design process, resulting in more efficient iteration on later features, and more consistent alignment with Astroneer's core principles
- We introduced an entirely new automation system that smoothly integrated with the crafting system, and addressed many of its remaining shortcomings without having to overhaul it yet again

We Mined Our Own Design, And So Can You!

- *"Mining Your Own Design"* in a nutshell:
 - Avoid the trap of falling into design patterns simply because you've done them before
 - Challenge your assumptions about how your game works, and "mine the text" for a deeper understanding
 - Utilize diverse perspectives to break free of misleading design constraints
 - Cross discipline collaboration is an effective way to look at a problem from multiple angles
- When in doubt, ask yourself the three fundamental questions:
 - *"What do you want the player to do?"*
 - *"Why is the player willing to do it?"*
 - *"WTF: What's this for?"*

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Thanks for watching!