



Prop Hunt – V1 Game Design Document (Tech Art-Focused)

Goal for V1: Ship a minimal, polished round-based Prop Hunt emphasizing **technical art** (VFX/shaders/transitions) with simple, deterministic rules.

1) High-Level Overview

- **Players:** Hunter(s), Prop(s), Spectator(s).
 - **Match Flow:** Lobby → Hide → Hunt → RoundEnd → Lobby (single round per match).
 - **Assignment:** Roles assigned at **Hide** start based on hard-coded distribution (below). Non-ready/late joiners are Spectators for that round.
 - **Core Constraint for V1: Props do not move** during Hunt.
 - **Focus:** No scan ping abilities; invest in **clear VFX** and **shader cues** for possession/feedback.
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2) Roles & Distribution

- **Spectators:** Unlimited; non-interactive. (Spectator join toggle lives in HUD/UI, §13.)
- **Role Distribution (Ready players at Hide start):**
 - 2 players → 1 Hunter, 1 Prop
 - 3 players → 1 Hunter, 2 Props
 - 4 players → 1 Hunter, 3 Props
 - 5 players → 1 Hunter, 4 Props

- 6–10 players → 2 Hunters, rest Props
 - 10–20 players → 3 Hunters, rest Props
 - **No-Unpossess (MVP):** Once a player possesses a prop during **Hide**, unpossessing is disabled for the round. See §5.
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3) Game States & Transitions (timings — see §14)

- **Lobby:** Players can ready. When ≥ 2 ready → start **T_lobbyCountdown = 30s**. If ready count drops below 2, cancel countdown.
- **Hide (T_hide = 35s):** Hunters remain in Lobby area; Props + Spectators moved to Arena. Props choose & possess an object. Possessables outlined **green** during Hide; outline **disappears** upon possession. Spectators see outlines; Hunters never see the outlines.
- **Hunt (T_hunt = 240s / 4:00):** Hunters are released into Arena. Props are **static** (immobile). No outlines.
- **RoundEnd (T_end = 15s):** Recap + scores. Return to Lobby.

End condition: The round ends when **all props are found** or when the **Hunt timer expires**.

Win condition: The **single player** with the **highest total score** at RoundEnd is declared the winner. (Team bonuses still contribute to individual totals.)

4) Scene Topology (Single Scene, Split Areas)

- Keep **Lobby** and **Arena** in one scene, far apart in world space (top-down camera makes this trivial). Use portals/teleports between areas at state changes.
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5) Possession Rules (Hide Phase)

- **Possessable objects** carry component **Possessable** with:
 - **IsPossessed** (bool), **OwnerPlayerId** (nullable)
 - References: **Outline**, **HitPoint** (Transform), **MainCollider**
- **Visuals:**

- Hide: All possessables show **green outline** (shader keyword toggle) and optional **idle shimmer**.
 - On possession: Play **Vanish VFX** at player → **Infill VFX** at prop → remove outline on that prop.
 - **Lock Pose:** Not applicable in V1 (props are static during Hunt).
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6) Hunter Tagging (Clean V1)

- **Interaction:** Hunter **clicks** an object **from the player body**, not the camera.
 - **Check:**
 1. Sphere/segment **raycast from hunter origin** toward click world point to the object's `HitPoint`.
 2. Validate `distance ≤ R_tag` ($R_{tag} = 4.0m$).
 3. Validate `HasComponent(Possessable) && IsPossessed == true`.
 - **Anti-spam:** Tag cooldown `TagCD = 0.5s`. No scan pings.
 - **Feedback:**
 - **Hit:** Impact VFX at prop, brief outline flash (neutral color), HUD tick + sound.
 - **Miss:** Small puff VFX at hit surface, HUD miss tick + subtle sound.
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7) VFX / Shader Spec (Primary Focus)

Global Style: Crisp, readable shapes; short, satisfying impacts. No excessive bloom.

- **Phase Transitions:**
 - **Lobby → Hide:** World desaturates in Lobby, Arena gains a quick **pulse-in** gradient. Teleport beams on Props/Spectators.
 - **Hide → Hunt:** Arena vignette expands; outlines globally fade out with a synchronized **dissolve sweep**.
 - **RoundEnd:** Confetti/sparkles for winner team; subtle screen-space ribbon trails on score tally.
- **Possession VFX:**

- **Player Vanish:** Vertical slice dissolve with soft sparks; 0.4s.
 - **Prop Infill:** Radial mask inwards; emissive rim grows then normalizes.
 - **Double-Possess Attempt (One-Prop Rule):** Brief red edge flash + rejected "thunk" sound.
 - **Tagging VFX:**
 - **Hit:**
 - Core: Compressed ring shock at **HitPoint**, 0.25s.
 - Secondary: 3–5 micro-spark motes outward; faint chromatic ripples.
 - **Miss:**
 - Dust poof decal, 0.15s, color-neutral.
 - **No-Unpossess (MVP):** During **Hide**, a player may possess exactly once; after possession, unpossessing is disabled for the round. On conflicting attempts, play rejection VFX and keep current owner.
 - **Prop Status Shader:**
 - **Hide:** Green outline + mild fresnel sparkle.
 - **Hunt (Possessed):** No outline; subtle heartbeat emissive (very faint) to avoid hard reveals.
 - **Spectator Filters:** Slightly cooler LUT; faint edge glow on Props/Hunters (non-informational, purely aesthetic).
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8) Taunt – Visual “Lure” (Nice-to-Have)

Rationale: No reliable directional audio in V1. Replace with **area VFX lure**.

- **Trigger:** Prop presses Taunt (cooldown **12s–15s**, tuneable).
- **VFX (no audio necessary):**
 - A **pulsing ring** around the prop (radius ~3m) with rising **wisps**. Visible to Hunters and Spectators; muted to Props.
- **Gameplay Hook (deferred/NTH):**
 - When a taunt fires, start a **Taunt Window** (e.g., **10s**). If the Hunter **does not** successfully tag that prop within the window, grant the prop a **Taunt Reward** (e.g., **+20 points**). If tagged within window, **no reward**.

- Prevent spam by limiting **N_taunts_per_round** (e.g., 5–6) or rely on cooldown only.
- **Telemetry:** Log (tauntTime, hunterDistanceAtTaunt, wasFoundInWindow).

Marked as Nice-to-Have for V1.0; can stub the button and VFX first, wire scoring later.

9) Scoring (Static Props)

- **Props:** Gain passive points by **time survived during Hunt** with **zone weights**.
 - **Tick:** Every **5s** alive → $+10 \times \text{ZoneWeight}$.
 - **Survive Bonus:** If not found when timer ends → $+100$.
- **Hunters:**
 - **Find Prop:** $+120 \times \text{ZoneWeight}$ (of the prop's position at tag).
 - **Miss Click:** 8 .
 - **Accuracy Bonus:** End-of-round $+\text{floor}((\text{Hits} / \max(1, \text{Hits} + \text{Misses})) \times 50)$.
- **Teams:**
 - Hunter Team Win (all props found) → $+50$ to each Hunter.
 - Prop Team Win (any prop survives) → $+30$ to each surviving Prop; $+15$ to found Props.

Zone Weights (3–5 zones recommended):

- **NearSpawn:** 1.5
- **Mid:** 1.0
- **Far:** 0.6

Author zones via invisible volumes; see §11.

10) Win Logic

- **Round end:** Occurs when **all props are found** or the **Hunt timer expires**.

- **Winner:** The player (hunter or prop) with the **highest total score** at RoundEnd.
 - **Tie-breakers:** (1) Highest number of **correct tags** (for hunters) or **survival ticks** (for props), whichever applies; if still tied, (2) **earliest last scoring event** timestamp; if still tied, (3) declare a **draw**.
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11) Level Authoring (Zones)

- Place non-rendered colliders/volumes with a `ZoneWeight` property:
 - Tags: `Zone_NearSpawn`, `Zone_Mid`, `Zone_Far`.
 - Store numeric `ZoneWeight` on a small `ZoneVolume` script.
 - On each scoring tick and on tag, query the **highest-priority** zone containing the prop's origin to fetch the weight.
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12) Networking Authority (Summary)

- Server-authoritative on: ready-state, role assignment, possession, tagging, scoring, timers, teleportation.
 - Client-predicted movement not needed in V1 (props static; hunters simple movement). Keep RPCs minimal.
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13) HUD / UI (Minimal V1)

- **Lobby:** Add a **Join as Spectator** toggle beside **Ready** (applies to the next round only).
 - **All:** Round timer.
 - **Prop:** Status ("Possessed"), Zone label, (Taunt button + CD if enabled NTH).
 - **Hunter:** Tag CD indicator, Remaining props counter, Hit/Miss tally.
 - **Kill Feed:** "HunterX found PropY (Kitchen – NearSpawn)".
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14) Parameters (Initial Defaults)

```
{
  "Lobby": { "MinReadyToStart": 2, "Countdown": 30 },
  "Phases": { "Hide": 35, "Hunt": 240, "RoundEnd": 15 },
  "Tagging": { "R_tag": 4.0, "Cooldown": 0.5 },
  "Scoring": {
    "PropTickSeconds": 5,
    "PropTickPoints": 10,
    "PropSurviveBonus": 100,
    "HunterFindBase": 120,
    "HunterMissPenalty": -8,
    "HunterAccuracyBonusMax": 50
  },
  "Zones": {
    "NearSpawn": 1.5,
    "Mid": 1.0,
    "Far": 0.6
  },
  "Taunt": { "Cooldown": 13, "Window": 10, "Reward": 20, "Enabled": false }
}
```

16) State Machine Diagram (Mermaid)

```
stateDiagram-v2
    [*] → Lobby
    Lobby → Lobby: < 2 ready (wait)
    Lobby → Hide: ≥ 2 ready & countdown==0
    Hide → Hunt: after T_hide
    Hunt → RoundEnd: all props found
    Hunt → RoundEnd: timer expires
    RoundEnd → Lobby: after T_end
```

17) QA Checklist (V1 Exit Criteria)

☐ Role distribution matches the table at 2–20 players; late joiners are Spectators.

- ☐ Hunters never see outlines during Hide; Props/Spectators do.
 - ☐ Props are immobile in Hunt; **No-Unpossess** is enforced per §5.
 - ☐ Tagging originates from player origin; respects **R_tag = 4.0m** and **0.5s** cooldown.
 - ☐ Zone-weighted scoring: tick every **5s** with weights **Near=1.5, Mid=1.0, Far=0.6**.
 - ☐ End condition & win condition match §10; recap shows the **highest-score** winner and tie-breaker outcome.
 - ☐ Phase transition and tag hit/miss VFX trigger reliably.
 - ☐ One-Prop conflict attempts show rejection VFX/SFX and do not change ownership.
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18) Nice-to-Have Backlog (Post V1)

- Visual **Taunt Lure** scoring hook enabled.
 - AFK handling, spawn protection, join-in-progress auto-ready.
 - Movement-enabled props with footstep pings and freeze/lock pose.
 - Accuracy and team banners, richer killfeed with area icons.
 - Dynamic risk factor scoring (distance-based) and analytics-driven tuning.
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19) Task Breakdown (for "actions used to create systems")

- **State Machine:** Implement state controller + timers; teleport handlers.
- **Role System:** Distribution logic + rotation + UI badges.
- **Possession System:** Outline control (Hide only), One-Prop rule, possess VFX.
- **Tagging System:** Player-origin raycast, hit/miss logic, cooldown, VFX.
- **Scoring System:** Tick scheduler, zone volumes, end-of-round bonuses, recap UI.
- **VFX/Shader Pass:** Phase transitions, possess, tag hit/miss, round-end.
- **Level Authoring:** Place ZoneVolumes (Near/Mid/Far), spawn points, culling.

- **UI/HUD:** Timers, counters, minimal indicators; recap panel.
 - **Analytics:** Log taunt stubs, hits/misses, zone usage for tuning.
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20) Open Questions

- Exact number/placement of Near/Mid/Far volumes for each arena?
- Should props see their **current zone weight** label during Hunt?
- Any restrictions on prop categories (size classes) required for V1 aesthetics?