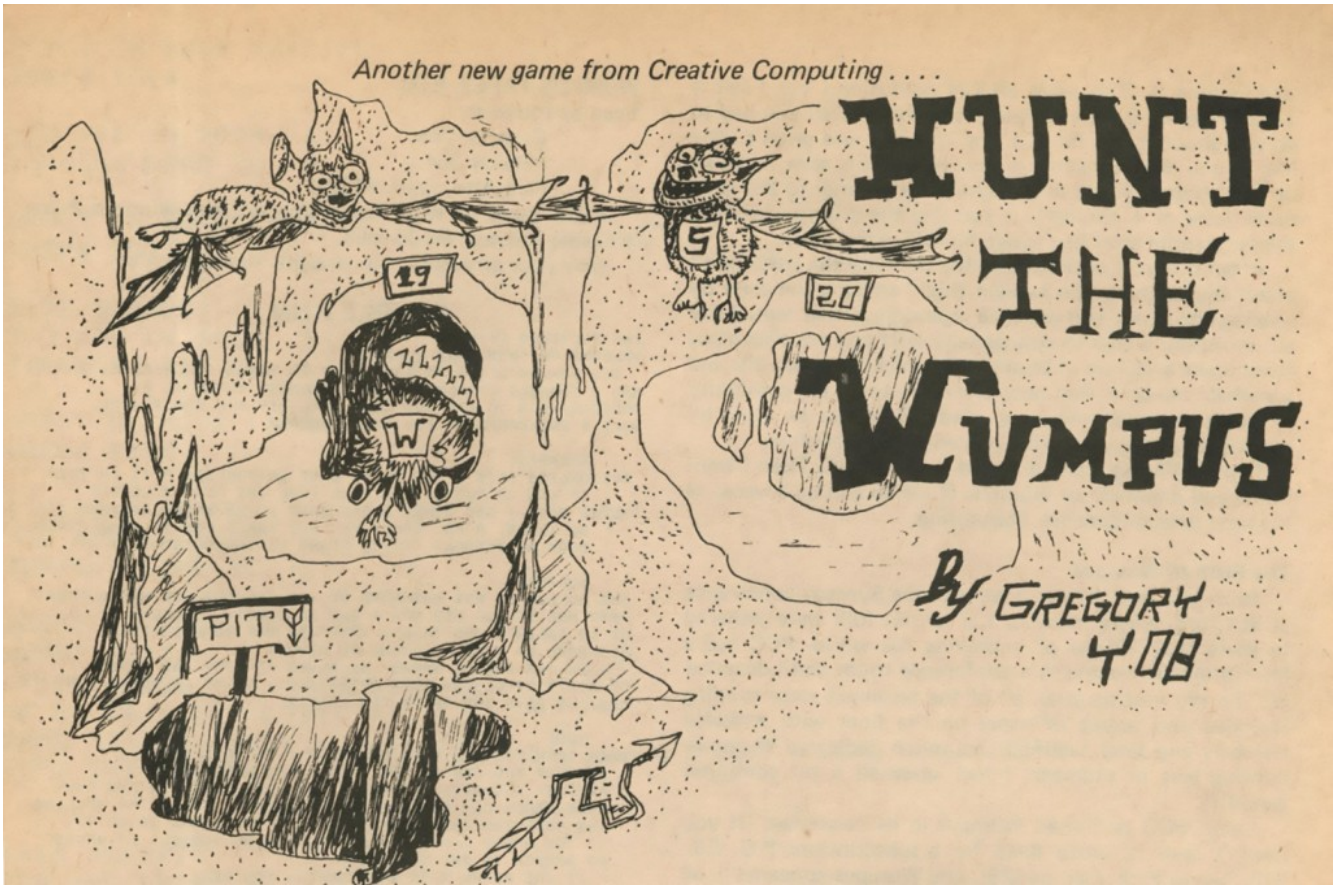
Hunt the Wumpus

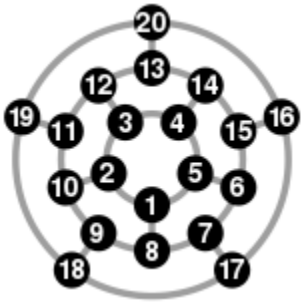
See https://en.wikipedia.org/wiki/Hunt_the_Wumpus and https://wiki.c2.com/?HuntTheWumpus and the original publication at https://www.atariarchives.org/bcc1/showpage.php?page=247



Title and illustration for Hunt the Wumpus article, Creative Computing 1975

Hunt the Wumpus is a text-based adventure game, originally developed by Gregory Yob in 1973, with source code published in the Creative Computing magazine in 1975. Since then it has had multiple variations and implementations in multiple languages and technologies.

The premise is that there is a network of caves connected by tunnels. In one of the 20 caves is a Wumpus. Two caves also contain bottomless pits, and two others contain “super bats”, which will pick up the player and move them to a different random cave. The game is turn-based. Each cave is given a number:



and each turn begins with the player being told which cave they're in, and which caves connect to it. The set of caves is always the same, and always fully-connected (the cave shape is actually a projection of a dodecahedron).

For a turn, a player make either move to another cave or shoot one of their five "crooked arrows" (which can change direction in flight, and so go between caves; an arrow is given a set of caves to traverse, and if the provided cave isn't reachable, randomly chooses which cave to go into next up to the extent of its flight path, and so it may loop around and hit the player).

If the arrow hits the Wumpus, the player wins.

If the arrow does not hit anything, the Wumpus is startled and may move to a new cave; if the Wumpus enters the players cave, the player is eaten and loses.

Instruction text:

```
Welcome to "Hunt the Wumpus".
The wumpus lives in a dungeon of 20 caves. Each cave has 3 tunnels to other caves.
(Look at a dodecahedron to see how this works. If you print "don't know what a
dodecahedron is, ask someone.)

Hazards:
  Bottomless pits - Two caves have bottomless pits in them. If you go there, you
fall into the pit (& lose)!
  Super bats - Two caves have super bats. If you go there, a bat grabs you and
takes you to some other room at random (which may be troublesome).
 Wumpus:
   The wumpus is not bothered by hazards. (He has sucker feet and is too big for a
bat to lift.)  Usually he is asleep. Two things wake him up: your shooting an
arrow, or your entering his room. If the wumpus wakes, he moves (75% of the time)
one room or stays still (25% of the time).  After that, if he is where you are, he
eats you up and you lose!

Each turn you may move or shoot a crooked arrow.
Moving:  You can move one cave (through one tunnel).
Arrows:  You have 5 arrows.  You lose when you run out.  Each arrow can go from 1
to 5 caves.  You aim by telling the caves to which you want the arrow to go.  If
the arrow can't go that way (if no tunnel) it moves at random to a neighboring
cave.
    If the arrow hits the wumpus, you win.
    If the arrow hits you, you lose.

Warnings:
   When you are one room away from a wumpus or hazard, the computer says:
   Wumpus:  "I smell a wumpus!"
   Bat   :  "Bats nearby!"
   Pit   :  "I feel a draft!"
```

Functional Requirements

1. The dungeon shall have 20 caves spatially organized as a flattened dodecahedron.
2. Each cave shall connect to 3 other caves.
3. At the start of a game, the Wumpus is randomly assigned to a cave.

4. A cave shall support a set of cave denizens.
5. The set of possible cave denizens are a bat, a pit, the Wumpus, the Hunter, and an arrow.
6. At the start of a game, two bats are randomly assigned to caves.
7. At the start of a game, no cave shall contain two bats.
8. At the start of a game, two pits are randomly assigned to caves.
9. At the start of a game, no cave shall contain two pits.
10. At the start of a game, the Hunter is randomly assigned to a cave.
11. At the start of a game, the cave the Hunter is placed in shall have no bat, pit, or Wumpus.
12. At the start of a game, the Hunter shall have 5 arrows.
13. When the Hunter enters a cave containing a bat, the bat presence shall be reported, and the Hunter carried to a different randomly-assigned cave in the entire Dungeon, at which point the Hunter shall be considered as having entered that new cave and the bat shall return to its original cave.
14. When the Hunter enters a cave, if that cave contains a pit, the pit presence shall be reported, the Hunter shall be reported as dead, and the game ended with a lost outcome.
15. When the Hunter enters a cave, if that cave contains the Wumpus, the Wumpus shall either eat the Hunter (with 25% probability) resulting in the game ending with a lost outcome, or shall move to a randomly chosen neighboring cave (75% probability).
16. The order of processing of cave denizen behaviors shall be bat, then pit, then Wumpus.
17. When the Hunter enters a cave, the neighboring caves shall report the presence of any denizens.
18. The Hunter shall be able to enter a new cave connected to the Hunter’s current cave.
19. The Hunter shall be able to shoot an arrow through a specified list of caves up to 5 caves long.
20. When an arrow cannot reach the next cave on its flight list from the current cave, it shall instead randomly choose a new cave connected to the arrow’s current cave.
21. When the arrow enters a cave containing the Wumpus, the Wumpus is considered shot and the game is over with a win outcome.
22. When the arrow enters a cave containing the Hunter, the Hunter is considered shot and the game is over with a lost outcome.
23. If the arrow traverses its specified flight path and does not hit the Wumpus, the Wumpus shall be awakened and small move to a randomly chosen neighboring cave of the Wumpus’ current cave.
24. After an arrow has completed its flight it shall be removed from the set of arrows available to the Hunter and and removed from the Dungeon.
25. If the Hunter has no more arrows, the game is over with a lost outcome.

System Design

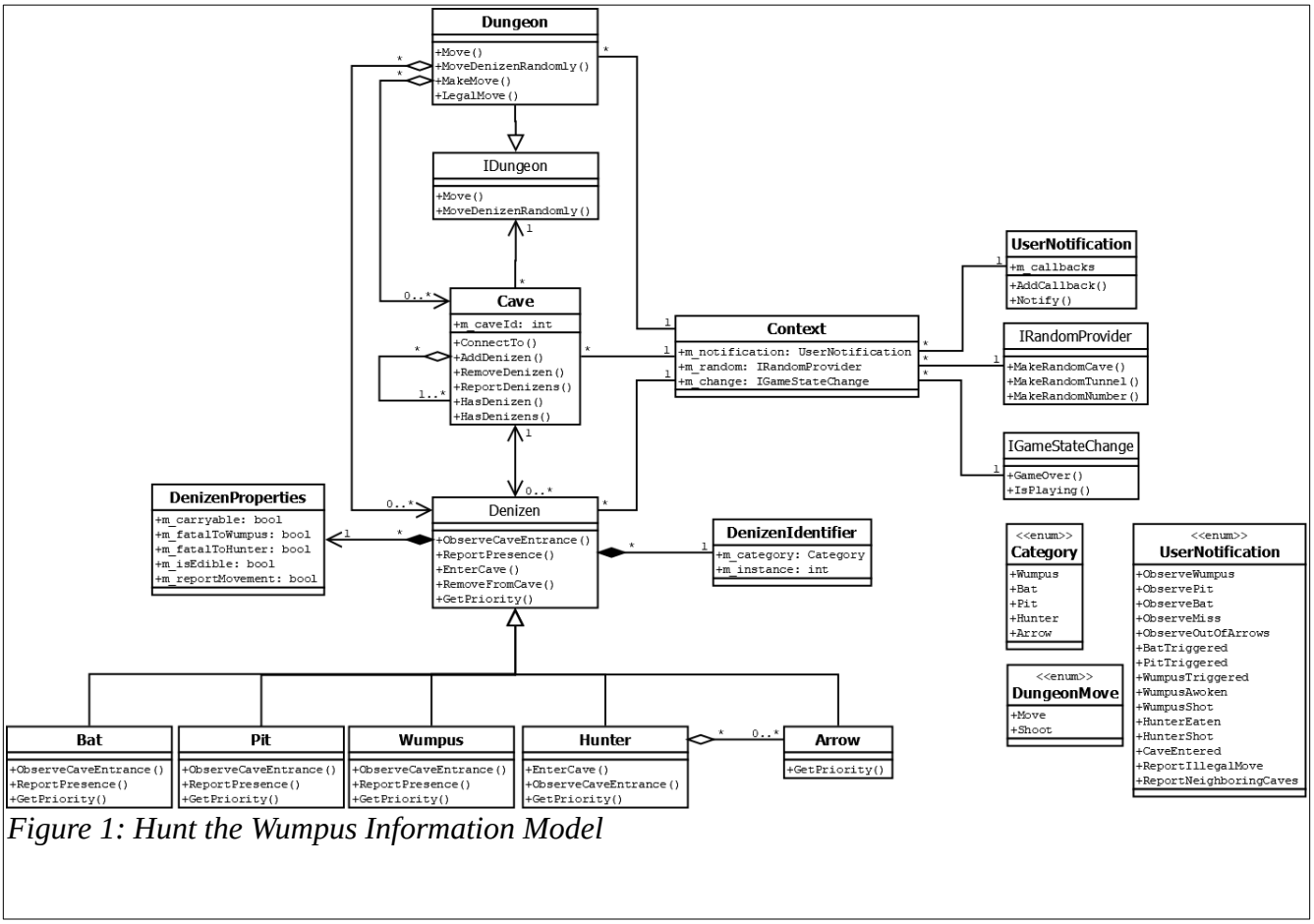


Figure 1: Hunt the Wumpus Information Model

A Dungeon contains a set of Caves. Each Cave has a set of Denizens, which may be empty. The Hunter also has a set of Arrows.

A Cave relates to a set of other Caves that represent tunnels, and thus the connectivity of the dungeon.

Each Cave has an identifier that lets it be identified and discussed (e.g. for movement and shooting arrows). Cave numbering starts at 1.

A Denizen may move between caves (except for Pits). When a Denizen enters a new cave, it triggers an observation of that entrance by the current cave denizens. For example, if an arrow enters a Cave that has a Wumpus, the Wumpus is shot. Similarly, if the Wumpus enters a Cave containing a Hunter, the Hunter is eaten.

A Denizen also has properties that allow other Denizens to determine the behavior to take. For example, an Arrow is not carryable (as this is from the Bat's perspective; only the Hunter is carryable, while the Wumpus and Pits are not).

Property	Bat	Pit	Wumpus	Hunter	Arrow
Carryable	No	No	No	Yes	No
Fatal to Wumpus	No	No	No	No	Yes
Fatal to Hunter	No	Yes	Yes	No	Yes
Edible	No	No	No	Yes	No
Report Movement	No	No	No	Yes	No

A Denizen also has a relationship to what Cave it's in. When a Denizen is added as a denizen to a cave, it finds out about the cave. Similarly, when it's removed from a cave (e.g. by movement), it's no longer a denizen of that cave, and also breaks its relationship to that cave. Note that an Arrow has no relationship to a Cave when it's held by the Hunter.

The Dungeon holds the set of Caves and all Denizens; it links the Caves to each other (creating the tunnels), and assigns the Denizens to Caves on game initialization.

Access to shared game state is provided through a Context instance. The Context supports a random-number-generating interface, a user notification interface for observing events, and a game-state (won/lost) tracking interface.

Design for Testability

The Context object supports supplying test-oriented interface implementations for observing game state, supplying numbers in particular sequences or values, and observing game outcomes.

The IDungeon interface also allows a Cave to be put into a test dungeon.