

Programming Proverbs

- 8. “Avoid side effects.”
- Henry F. Ledgard, “Programming Proverbs: Principles of Good Programming with Numerous Examples to Improve Programming Style and Proficiency”, (Hayden Computer Programming Series), Hayden Book Company, 1st edition, ISBN-13: 978-0810455221, December 1975.

Extending the Remote procedure call API

- `disableAI () : boolean`
 - disable the in game C AI
 - return True/False if successful
 - (completed)

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Implementing these two function calls

- we need to modify the Python remote procedure call interface
- then we need to modify the ioquake source code
 - (completed)

Disable/Enable ioquake AI

- this has been completed in your source file
 - these notes show how the changes were made and
 - importantly also show you which files were altered

Python

- open up `ioquake-latest/python-bot/bot-legoman/botfiles/bots/botlib.py`

- alter

- ```
AI codes
SKILL, CONT = range(1, 3)
```

# Python

- to

- ```
# AI codes  
SKILL, CONT, CAI = range(1, 4)
```

- we now are going to define this new function CAI

Python

- now move to the definition of `class bot:` and continue down to find `def cont (self):`

- we now add

- ```
def cai (self, boolean):
 """ enables/disables the C AI engine inside ioquake """
 """ It returns the previous value of the C AI engine state """
 """ True means it was on, False means it was off """
 return calliB(AI, CAI, boolean)
```



# Python

- calliB passes the three parameters as integers and returns a boolean result

- we now implement two more Python functions:

```
def disableAI ():
 """ disable the C AI and return True if successful """
 return cai(False)=True

def enableAI ():
 """ enable the C AI and return True if successful """
 return cai(True)=False
```

- the Python code is complete!



- open up the file: `ioquake-latest/ioquake3/code/botlib/be_ai_char.c`

```
//a bot character
typedef struct bot_character_s
{
 char filename[MAX_QPATH];
 float skill;
 int isPythonBot;
 py_bot_t py;
 bot_characteristic_t c[1];
} bot_character_t;
```



■ and change it to:

```
///a bot character
typedef struct bot_character_s
{
 char filename[MAX_QPATH];
 float skill;
 int isPythonBot;
 int c_ai;
 py_bot_t py;
 bot_characteristic_t c[1];
} bot_character_t;
```



■ change:

```
■ #if 1
 if ((strlen(charfile)>3) && (strcmp(&charfile[strlen(charfile)-3], ".py") == 0)) {
 ch->isPythonBot = qtrue;
 if (initPy(&ch->py, ch)) {
 ch->skill = skill;
 }
 }
#endif
```



■ to

■ 

```
#if 1
ch->c_ai = qtrue;
if ((strlen(charfile)>3) && (strcmp(&charfile[strlen(charfile)-3], ".py") == 0)) {
 ch->isPythonBot = qtrue;
 if (initPy(&ch->py, ch)) {
 ch->skill = skill;
 }
}
```



- add the new function underneath `contrpc`



```
/*
 * cairpc - called by the rpc.
 * Bytes: <length><CODE><FUNCTION>
 * Integer: <True/False>
 *
 * The Integer value turns the C AI on/off.
 */

int cairpc (void *p)
{
 py_bot_t *py = (py_bot_t *)p;
 int *onoff = (int *)&py->inBuf[3];
 bot_character_t *ch = py->ch;
 int oldValue = ch->c_ai;

 ch->c_ai = *onoff;
 returnBoolean(p, (unsigned char)oldValue);
 return qtrue;
}
```



- open up `ioquake-`  
`latest/ioquake3/code/botlib/be_ai_char.h` and add this  
prototype to the end of the file:

```
/*
 * use_c_ai - returns true if, client, should use the C AI engine.
 */

int use_c_ai (int character);
```





- now open up ioquake-  
latest/ioquake3/code/botlib/be\_ai\_char.c and add this  
function after isPythonBot

```
/*
 * use_c_ai - returns true if, client, should use the C AI engine.
 */

int use_c_ai (int character)
{
 return (botcharacters[character] != NULL) && (botcharacters[character]->c_ai);
}
```



- now we need to add the C AI rpc call, so open up `ioquake-latest/ioquake3/code/botlib/be_ai_py.h` and alter

```
/*
 * AI codes
 */

typedef enum AIcode_t {
 pyAIDummy, pySKILL, pyCONT, pyAImax,
} AIcode;
```



■ to

```
/*
 * AI codes
 */

typedef enum AIconde_t {
 pyAIDummy, pySKILL, pyCONT, pyCAI, pyAImax,
} AIconde;
```





- now we need to modify the call to `initAImethods` (found in file `be_ai_char.c`)

```
if (initPy(&ch->py, ch)) {
 ch->skill = skill;
 initAImethods(&ch->py, skillrpc, contrpc, cairpc);
}
```

## Exercise for the reader

- at this point the Python rpc mechanism can turn off/on the `c_ai` value
- the C `ioquake` code can use the function `use_c_ai` to test this bit
- we still need to modify `ioquake` so that it does not call the C AI if this function returns `TRUE`