

## RedRhex 分段訓練與播放完整流程 ( Hydra 版 , 已修正 env. 前綴 )

重點 : Hydra override 必須用 env.<key> , 例如 env.stage=1。  
你剛剛的錯誤就是用了 stage=1 ( 頂層 ) , 所以 Hydra 報 Key not in struct。

Stage1:

```
python scripts/rsl_rl/train.py --task=Template-Redrhex-Direct-v0 --headless --num_envs=4096 --max_iterations=5000 --run_name=stage1 env.stage=1 env.draw_debug_vis=False env.dr_try_physical_material_randomization=False
RUN1=$(basename "$(ls -td logs/rsl_rl/redrhex_wheg/*stage1* | head -1)")
CKPT1=$(basename "$(ls -v logs/rsl_rl/redrhex_wheg/$RUN1/model_*.pt | tail -1)")
```

Stage2 (resume from stage1):

```
python scripts/rsl_rl/train.py --task=Template-Redrhex-Direct-v0 --headless --num_envs=4096 --max_iterations=5000 --run_name=stage2 --resume --load_run="$RUN1" --checkpoint="$CKPT1" env.stage=2 env.draw_debug_vis=False env.dr_try_physical_material_randomization=False
RUN2=$(basename "$(ls -td logs/rsl_rl/redrhex_wheg/*stage2* | head -1)")
CKPT2=$(basename "$(ls -v logs/rsl_rl/redrhex_wheg/$RUN2/model_*.pt | tail -1)")
```

Stage3 (resume from stage2):

```
python scripts/rsl_rl/train.py --task=Template-Redrhex-Direct-v0 --headless --num_envs=4096 --max_iterations=5000 --run_name=stage3 --resume --load_run="$RUN2" --checkpoint="$CKPT2" env.stage=3 env.draw_debug_vis=False env.dr_try_physical_material_randomization=False
RUN3=$(basename "$(ls -td logs/rsl_rl/redrhex_wheg/*stage3* | head -1)")
CKPT3=$(basename "$(ls -v logs/rsl_rl/redrhex_wheg/$RUN3/model_*.pt | tail -1)")
```

Stage4 (resume from stage3):

```
python scripts/rsl_rl/train.py --task=Template-Redrhex-Direct-v0 --headless --num_envs=4096 --max_iterations=5000 --run_name=stage4 --resume --load_run="$RUN3" --checkpoint="$CKPT3" env.stage=4 env.draw_debug_vis=False env.dr_try_physical_material_randomization=False
RUN4=$(basename "$(ls -td logs/rsl_rl/redrhex_wheg/*stage4* | head -1)")
FINAL_CKPT=$(ls -v logs/rsl_rl/redrhex_wheg/$RUN4/model_*.pt | tail -1)
```

Play:

```
python scripts/rsl_rl/play.py --task=Template-Redrhex-Direct-v0 --num_envs=64 --checkpoint="$FINAL_CKPT"
```

Eval:

```
python scripts/rsl_rl/eval_command_sweep.py --task=Template-Redrhex-Direct-v0 --headless --num_envs=256 --checkpoint="$FINAL_CKPT" --warmup_steps=120 --sweep_steps=600 --accept_duration_s=2.0 --accept_vy_abs=0.15 --accept_wz_abs=0.40 --accept_yaw_tilt_bound=0.60 --accept_diag_sign_ratio=0.70
```

Checkpoint path:

```
train: logs/rsl_rl/redrhex_wheg/<run>/model_*.pt
play export: logs/rsl_rl/redrhex_wheg/<run>/exported/policy.pt and policy.onnx
```