In [1]:
```python
import sys
from pathlib import Path

# Add project root to Python path
ROOT = Path.cwd().parent  # adjusts if notebook is in /notebooks/
sys.path.append(str(ROOT))
```

In [2]:
```python
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

from pathlib import Path
from src.stats import group_descriptives, independent_t

ROOT = Path.cwd().parents[0]  # adjust if needed
data_path = ROOT / "data" / "processed" / "study_results_clean.csv"

df = pd.read_csv(data_path)
df.head()
```

Out[2]:

	participant	group	correct_1	correct_2	correct_3	correct_4	correct_5	correct_6	correct_7	correct_8	...	abs_19	cws_19	p_20	abs_20	cws_20
0	CG1	CG	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	...	1.000000	0.400000	1.000000	0.000000	0.000000
1	CG2	CG	0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	...	0.500000	0.600000	0.000000	1.000000	0.400000
2	CG3	CG	0	1.0	0.0	1.0	1.0	0.0	1.0	0.0	...	1.500000	1.000000	1.000000	0.000000	0.000000
3	CG4	CG	1	1.0	0.0	1.0	1.0	1.0	1.0	1.0	...	1.500000	1.000000	0.833333	0.305556	0.066667
4	CG5	CG	1	1.0	0.0	0.0	0.0	1.0	1.0	1.0	...	0.555556	0.133333	0.500000	0.750000	0.200000

5 rows × 107 columns

In [3]:
```python
# ---- Significance level / CI settings ----
ALPHA = 0.05          # 0.05 for 95% CI, 0.10 for 90% CI, etc.
CI_LEVEL = 100 * (1 - ALPHA)

print(f"Using alpha = {ALPHA:.2f}, so CI level = {CI_LEVEL:.0f}%")
```

```
Using alpha = 0.05, so CI level = 95%
```

In [4]:
```python
AVAILABLE_SCORES = {
    "accuracy": "accuracy",
    "abs": "total_abs",
    "cws": "total_cws",
}

for label, dv_col in AVAILABLE_SCORES.items():
    print(f"\n=== {label.upper()} ({dv_col}) ===")
    display(group_descriptives(df, dv_col))
    print(independent_t(df, dv_col))
```

```
=== ACCURACY (accuracy) ===
```

	group	n	mean	sd	se
0	CG	21	0.554762	0.147398	0.032165
1	EG	21	0.492857	0.135357	0.029537

```
{'dv': 'accuracy', 'group1': 'CG', 'group2': 'EG', 'mean1': np.float64(0.5547619047619048), 'mean2': np.float64(0.4928571428571428), 't': np.float
64(1.4175727442134127), 'p': np.float64(0.16411428526384836), 'cohens_d': np.float64(0.4374724464941704), 'n1': 21, 'n2': 21}

=== ABS (total_abs) ===
```

	group	n	mean	sd	se
0	CG	21	21.531746	2.119106	0.462427
1	EG	21	20.882275	2.188563	0.477584

```
{'dv': 'total_abs', 'group1': 'CG', 'group2': 'EG', 'mean1': np.float64(21.53174603174603), 'mean2': np.float64(20.882275132275133), 't': np.float
64(0.9769798880762011), 'p': np.float64(0.33445712468125477), 'cohens_d': np.float64(0.3015025391514949), 'n1': 21, 'n2': 21}

=== CWS (total_cws) ===
```

	group	n	mean	sd	se
0	CG	21	12.288889	1.876798	0.409551
1	EG	21	11.326984	1.885843	0.411525

```
{'dv': 'total_cws', 'group1': 'CG', 'group2': 'EG', 'mean1': np.float64(12.288888888888891), 'mean2': np.float64(11.326984126984128), 't': np.floa
t64(1.6567719951747502), 'p': np.float64(0.10539040883048943), 'cohens_d': np.float64(0.5112909379576854), 'n1': 21, 'n2': 21}
```

In [5]:
```python
for label, dv_col in AVAILABLE_SCORES.items():
    print(f"\n=== {label.upper()} ({dv_col}) ===")
    display(group_descriptives(df, dv_col))
    print(independent_t(df, dv_col))
```

```
=== ACCURACY (accuracy) ===
```

	group	n	mean	sd	se
0	CG	21	0.554762	0.147398	0.032165
1	EG	21	0.492857	0.135357	0.029537

```
{'dv': 'accuracy', 'group1': 'CG', 'group2': 'EG', 'mean1': np.float64(0.5547619047619048), 'mean2': np.float64(0.4928571428571428), 't': np.float
64(1.4175727442134127), 'p': np.float64(0.16411428526384836), 'cohens_d': np.float64(0.4374724464941704), 'n1': 21, 'n2': 21}

=== ABS (total_abs) ===
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	group	n	mean	sd	se
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64(0.9769798880762011), 'p': np.float64(0.33445712468125477), 'cohens_d': np.float64(0.3015025391514949), 'n1': 21, 'n2': 21}

=== CWS (total_cws) ===
```

	group	n	mean	sd	se
0	CG	21	12.288889	1.876798	0.409551
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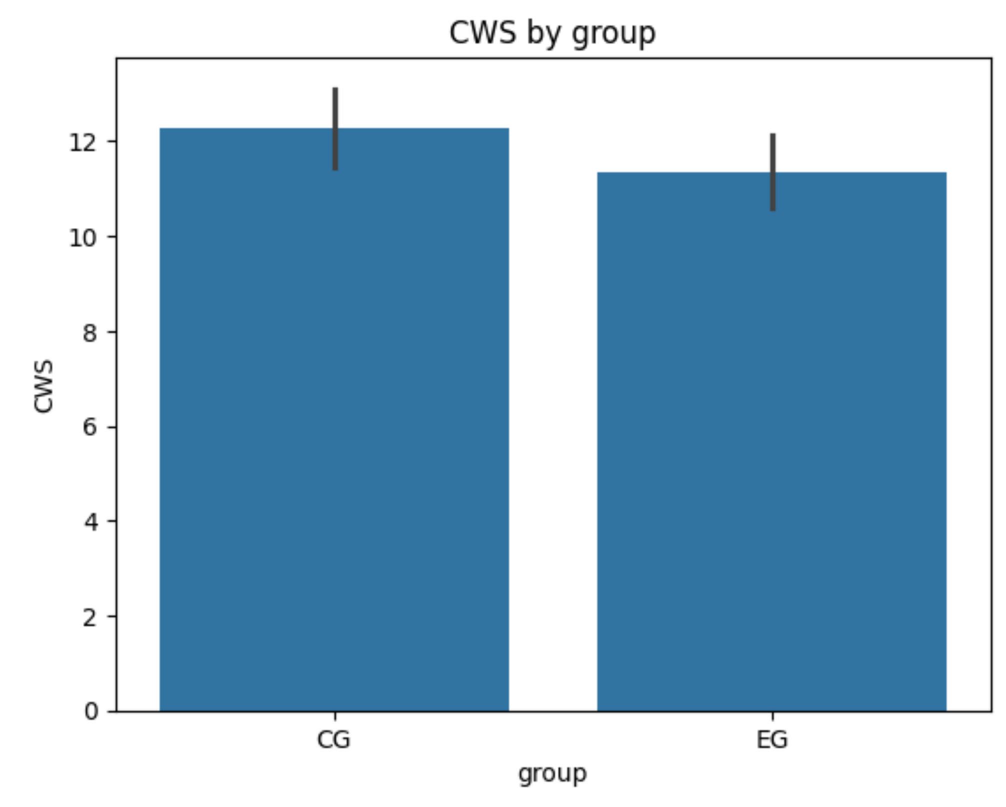
```
{'dv': 'total_cws', 'group1': 'CG', 'group2': 'EG', 'mean1': np.float64(12.288888888888891), 'mean2': np.float64(11.326984126984128), 't': np.floa
t64(1.6567719951747502), 'p': np.float64(0.10539040883048943), 'cohens_d': np.float64(0.5112909379576854), 'n1': 21, 'n2': 21}
```

In [6]:
```python
SCORING_METHOD = "cws"   # or "accuracy", "abs", "cws"
DV = AVAILABLE_SCORES[SCORING_METHOD]

print(group_descriptives(df, DV))
print(independent_t(df, DV))

sns.barplot(data=df, x="group", y=DV, errorbar=('ci', CI_LEVEL))
plt.title(f"{SCORING_METHOD.upper()} by group")
plt.ylabel(SCORING_METHOD.upper())
plt.show()
```

```
  group   n       mean        sd        se
0    CG  21  12.288889  1.876798  0.409551
1    EG  21  11.326984  1.885843  0.411525
{'dv': 'total_cws', 'group1': 'CG', 'group2': 'EG', 'mean1': np.float64(12.288888888888891), 'mean2': np.float64(11.326984126984128), 't': np.floa
t64(1.6567719951747502), 'p': np.float64(0.10539040883048943), 'cohens_d': np.float64(0.5112909379576854), 'n1': 21, 'n2': 21}
```



In [7]:
```python
results = []

for label, dv_col in AVAILABLE_SCORES.items():
    res = independent_t(df, dv_col)   # this returns two-tailed p
    res["label"] = label

    # --- convert to one-tailed for H1: CG > EG ---
    p_two = res["p"]
    mean1 = res["mean1"]   # CG mean (group 1)
    mean2 = res["mean2"]   # EG mean (group 2)

    if mean1 > mean2:
        # effect is in hypothesised direction (CG > EG)
        p_one = p_two / 2
        direction = "CG > EG (hypothesised)"
    else:
        # opposite direction
        p_one = 1 - p_two / 2
        direction = "CG ≤ EG (opposite)"

    res["p_one_tailed"] = p_one
    res[f"sig_alpha_{ALPHA}"] = p_one < ALPHA
    res["direction"] = direction

    results.append(res)

results_df = pd.DataFrame(results)[
    ["label", "dv", "mean1", "mean2", "t", "p", "p_one_tailed",
     f"sig_alpha_{ALPHA}", "cohens_d", "n1", "n2", "direction"]
]

results_df
```

Out[7]:

	label	dv	mean1	mean2	t	p	p_one_tailed	sig_alpha_0.05	cohens_d	n1	n2	direction
0	accuracy	accuracy	0.554762	0.492857	1.417573	0.164114	0.082057	False	0.437472	21	21	CG > EG (hypothesised)
1	abs	total_abs	21.531746	20.882275	0.976980	0.334457	0.167229	False	0.301503	21	21	CG > EG (hypothesised)
2	cws	total_cws	12.288889	11.326984	1.656772	0.105390	0.052695	False	0.511291	21	21	CG > EG (hypothesised)

In [8]:
```python
import os

# Create figures directory if it doesn't exist
os.makedirs("./figures", exist_ok=True)

for label, dv_col in AVAILABLE_SCORES.items():
    plt.figure()
    sns.barplot(data=df, x="group", y=dv_col, errorbar=('ci', CI_LEVEL))
    plt.title(f"{label.upper()} by group")
    plt.ylabel(label.upper())
    plt.savefig(f"./figures/{label}_by_group.png", dpi=300, bbox_inches="tight")
    plt.show()
```