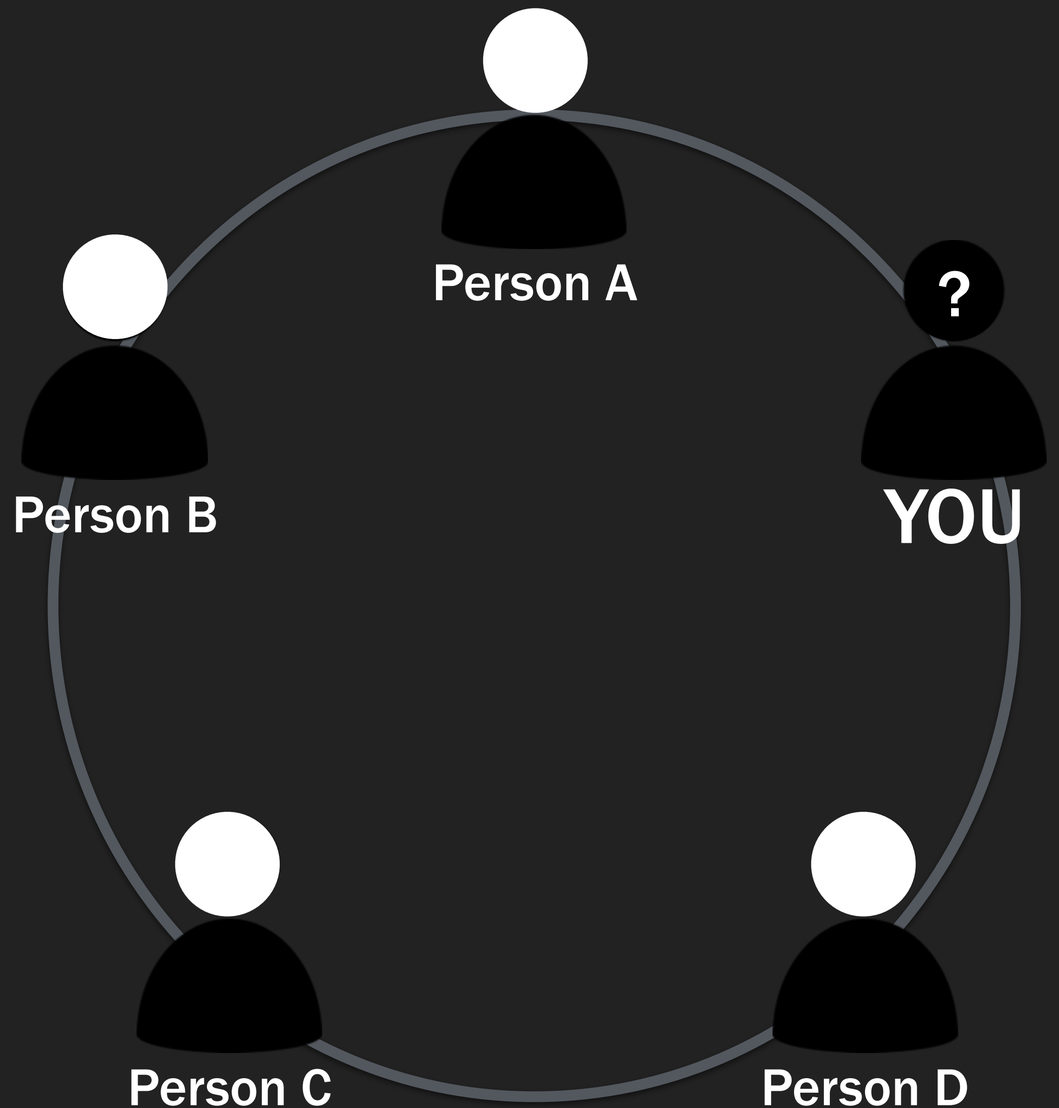
The Proficiency-Congruency Dilemma:
Virtual Team Design and Performance in Multiplayer Online Games

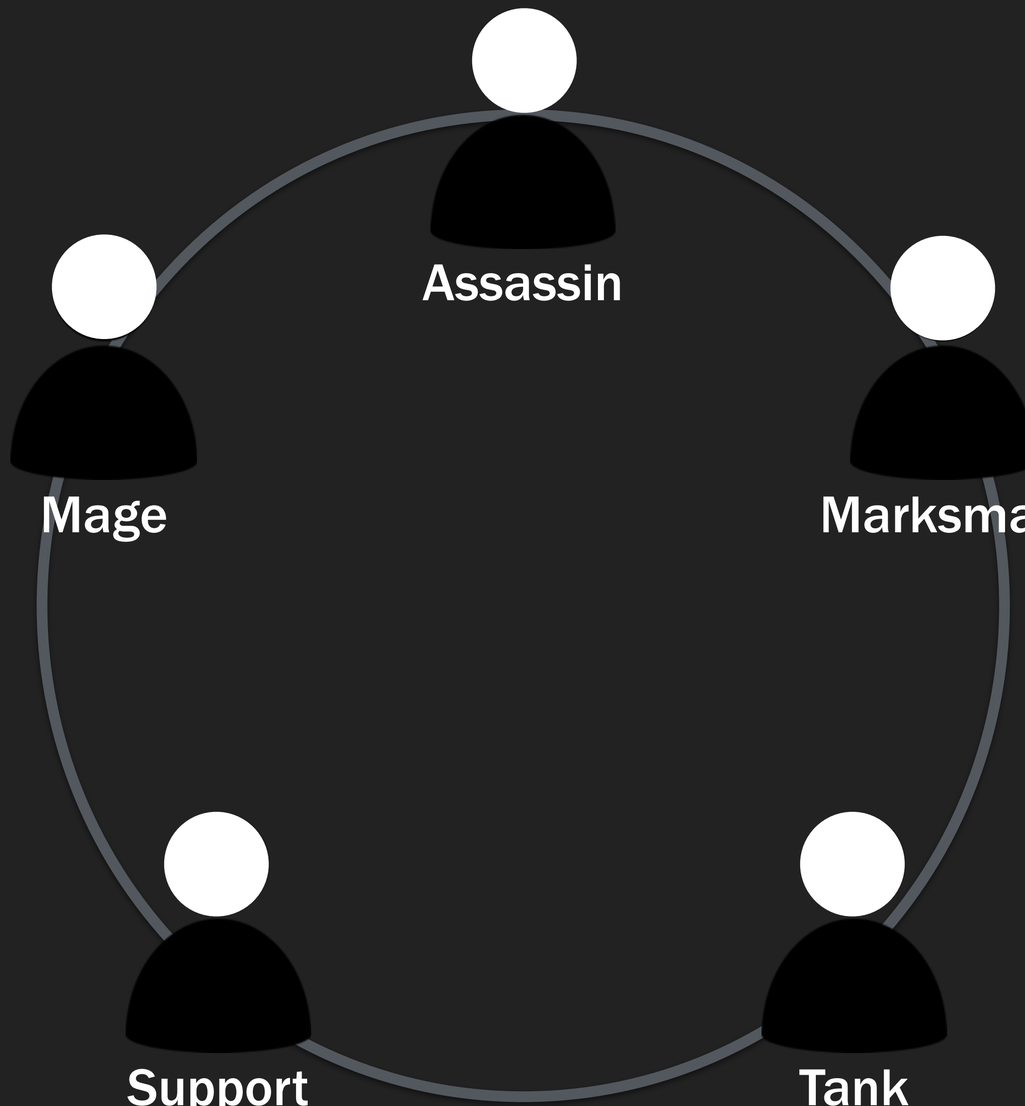
Jooyeon Kim KAIST
Brian Keegan Harvard
Sungjoon Park KAIST
Alice Oh KAIST

In a team setting, members' role selections significantly affect team performance.

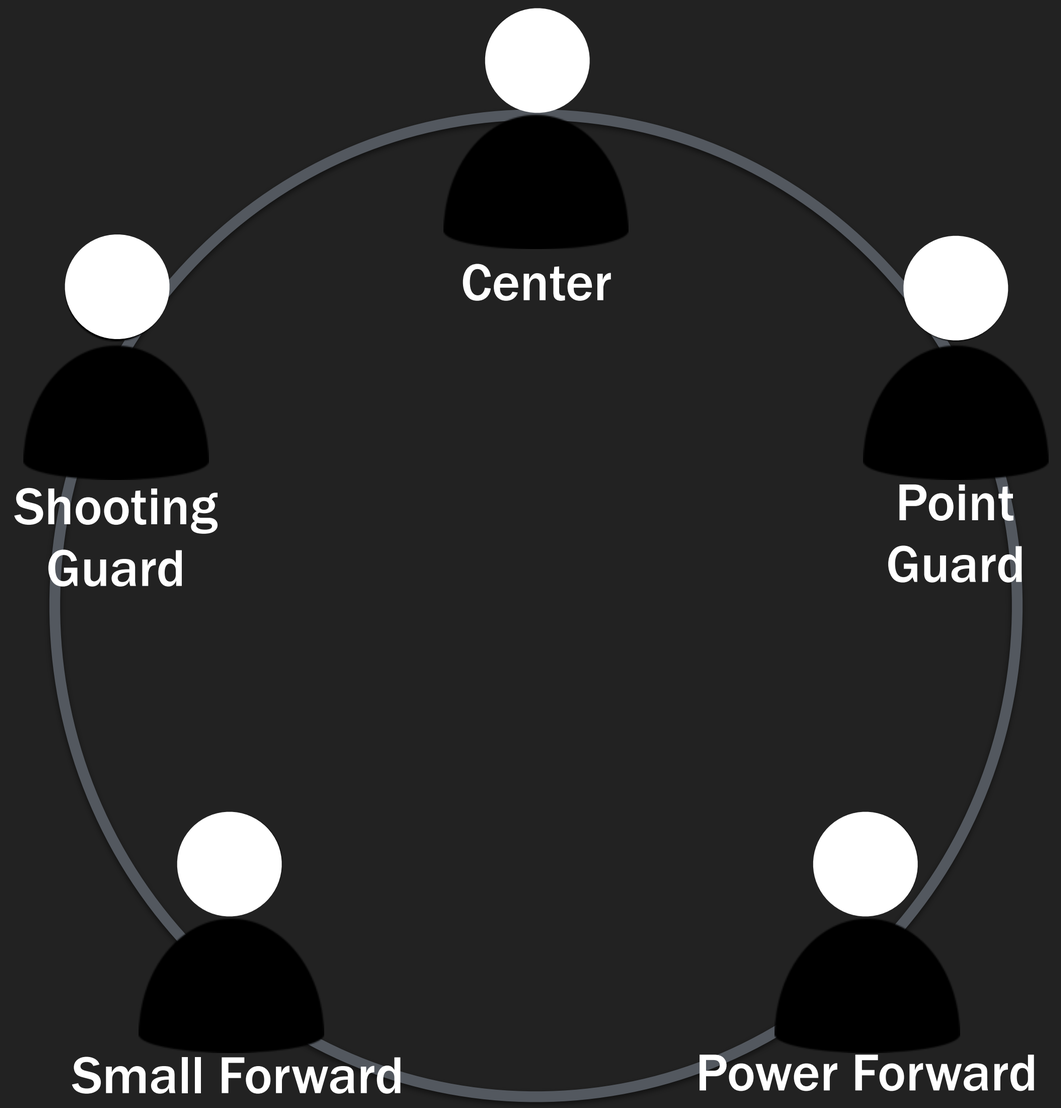
Choosing a Role



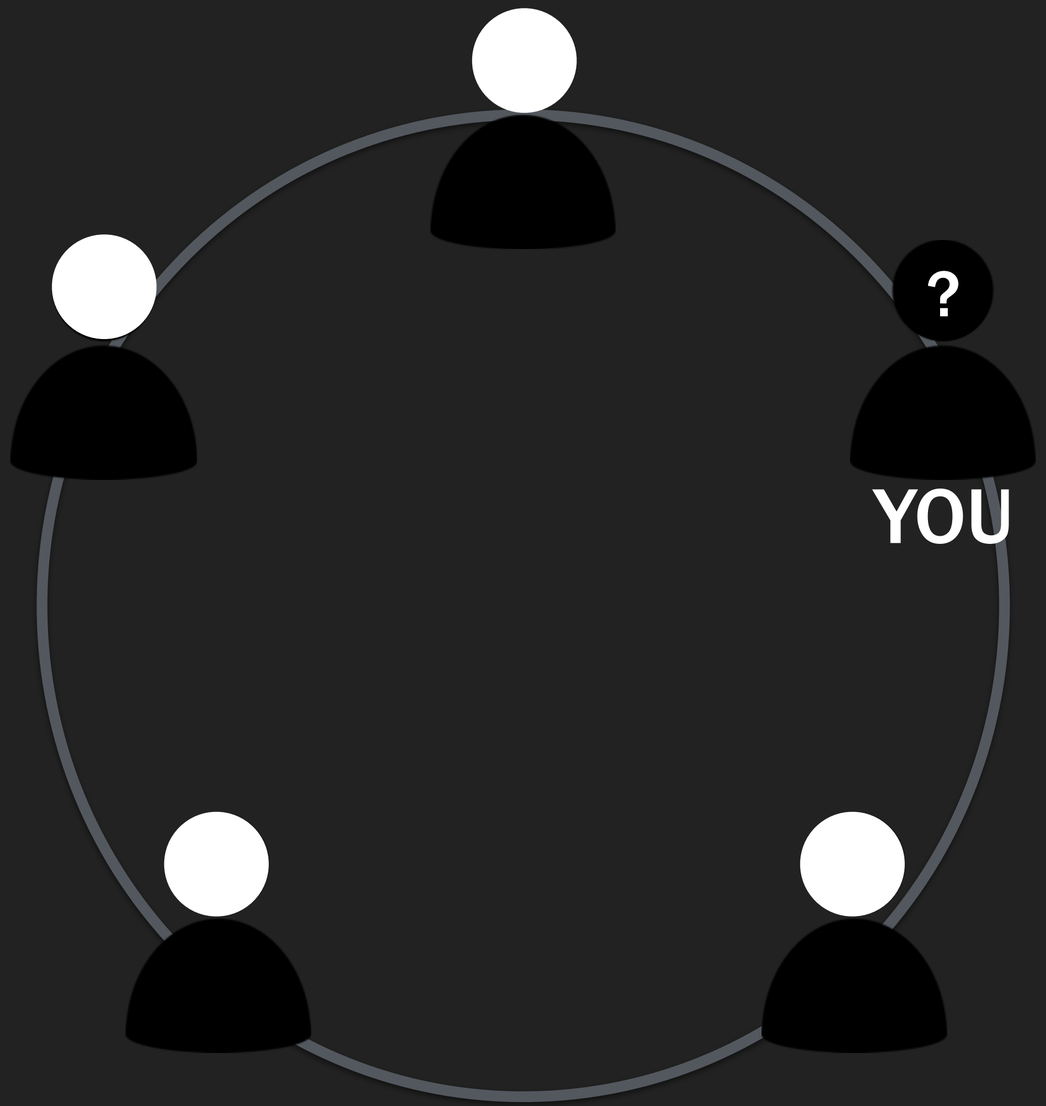
Choosing a Role: League of Legends



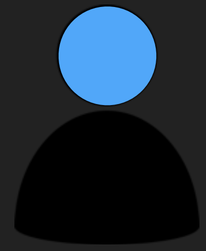
Choosing a Role: Basketball



Choosing a Role That You Are Good At



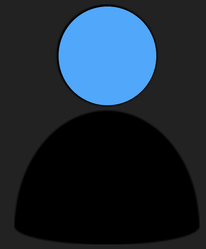
You Usually Play



Shooting Guard

Proficiency:
Choosing a Role That You Are Good At

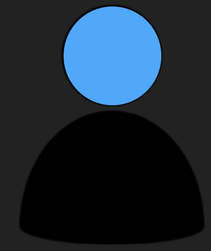
You Usually Play



Shooting Guard

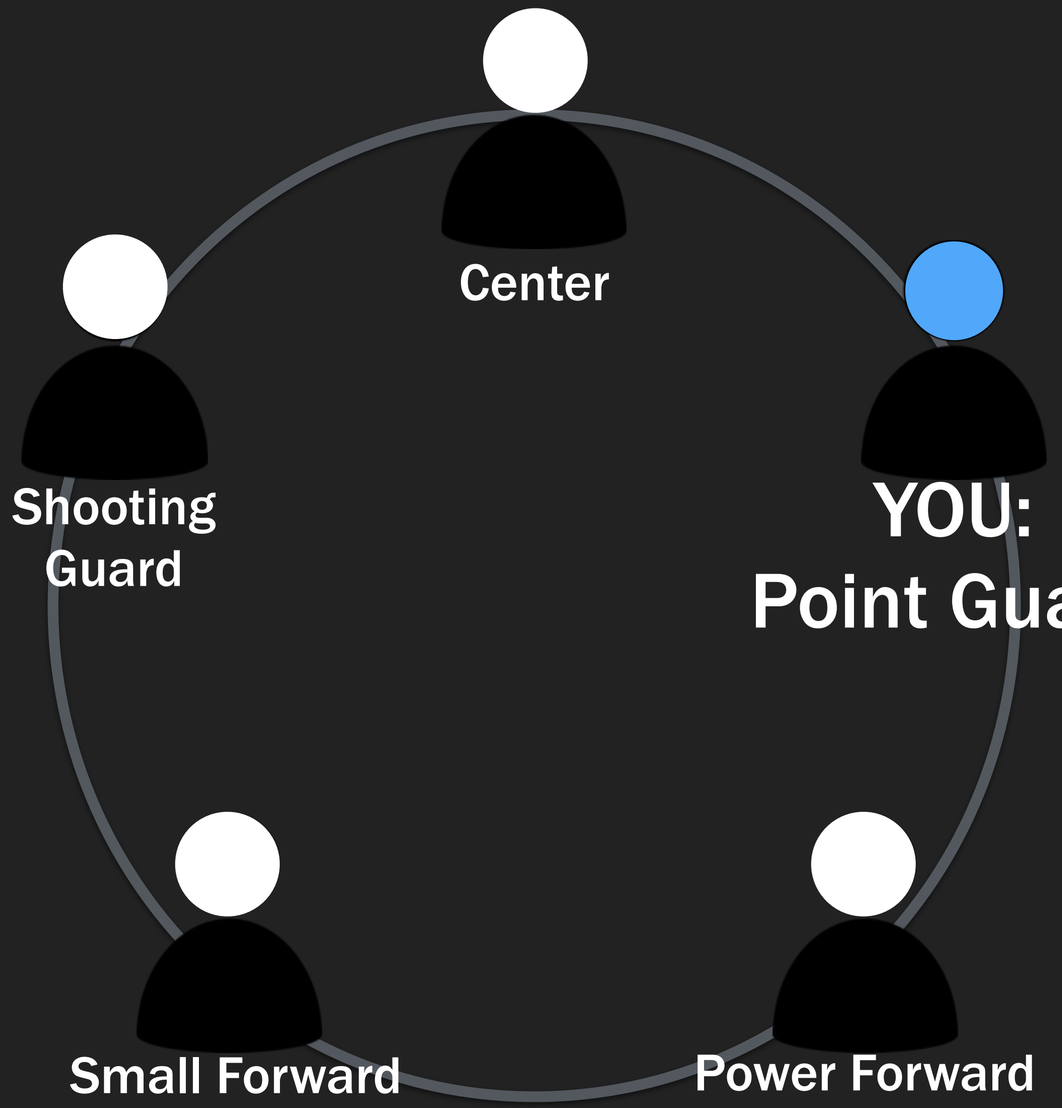
Choosing a Role That Your Team Needs

You Usually Play

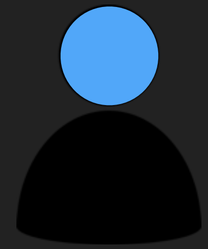


Shooting Guard

Congruency:
Choosing a Role That Your Team Needs



You Usually Play



Shooting Guard

Dilemma

You can either choose a role that you are good at, or that your team needs.

Proficiency vs. Congruency

We find that teams with higher levels of performance negotiate the proficiency-congruency dilemma better than their counterparts.

Research Hypotheses

1. Team members with high proficiency will perform better than their counterparts.
2. Teams with high congruency will perform better than their counterparts.
3. Elite groups are better at optimizing the proficiency-congruency dilemma than novice groups.

What Is MOBA?
(League of Legends?)


0
25.8k
5
21
37.7k
4
25:01
superN0va124
12
hataketommy
9
Starker
11
gon88
15
kriltosroth
14
hataketommy
gon88
Starker
superN0va124
kriltosroth
Sweatyandready3
Hazhee
Admiral Smoker
maggotworm
Nyutrig
1206 / 1294
676 / 782
77
360
83
44
0.74
50
Camera Mode
Directed Camera
[D]
Fog of War
All
1x
LIVE / 25:00
2 / 0 / 0
129
152
0 / 2 / 2
1 / 2 / 3
77
97
2 / 1 / 6
2 / 3 / 1
162
150
2 / 1 / 6
0 / 7 / 0
105
143
14 / 0 / 2
0 / 9 / 3
25
11
3 / 1 / 12

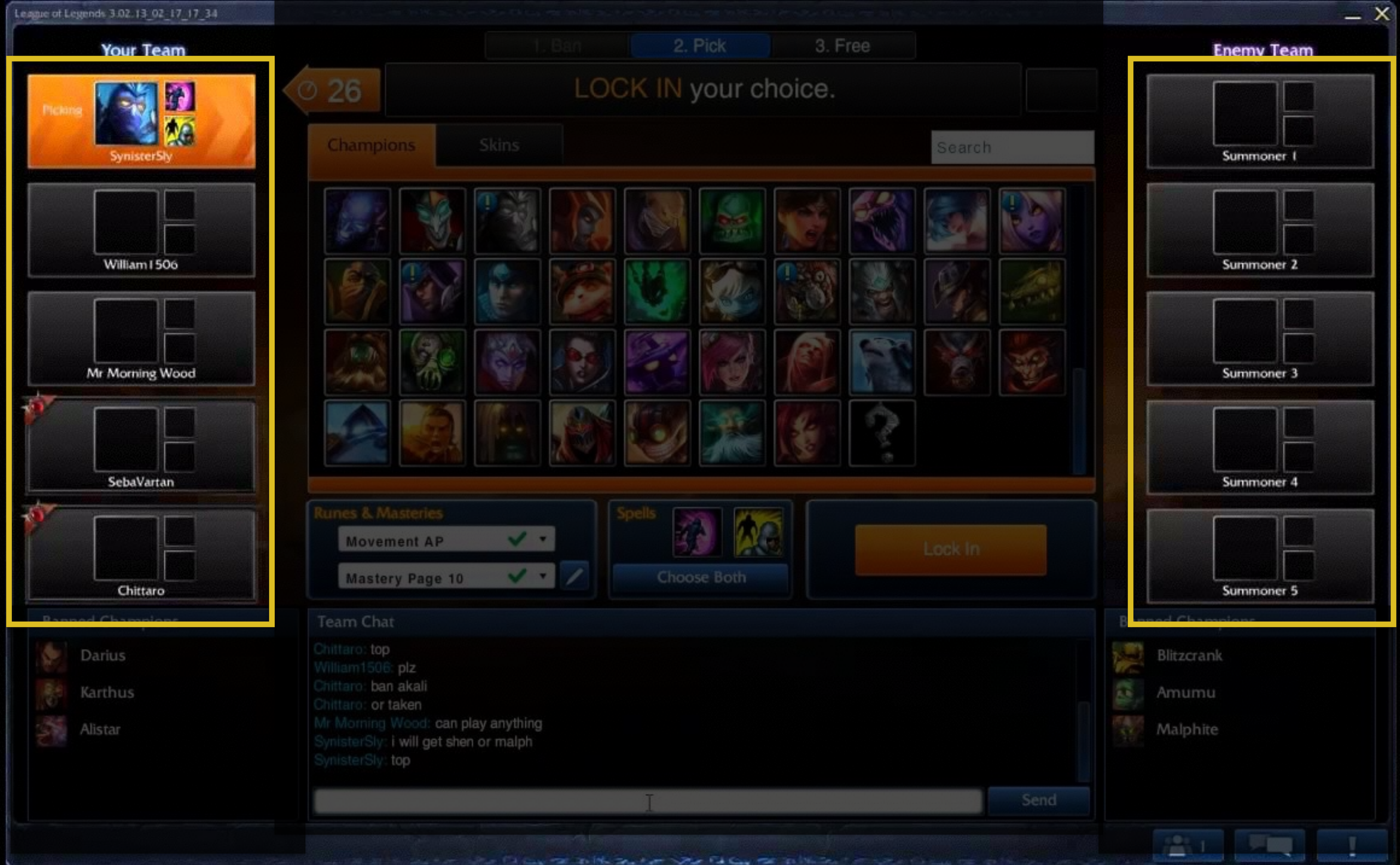
League of Legends

Five-on-five, random team formation

League of Legends

Five-on-five, random team formation

- Virtual, temporary, self-assembled teams

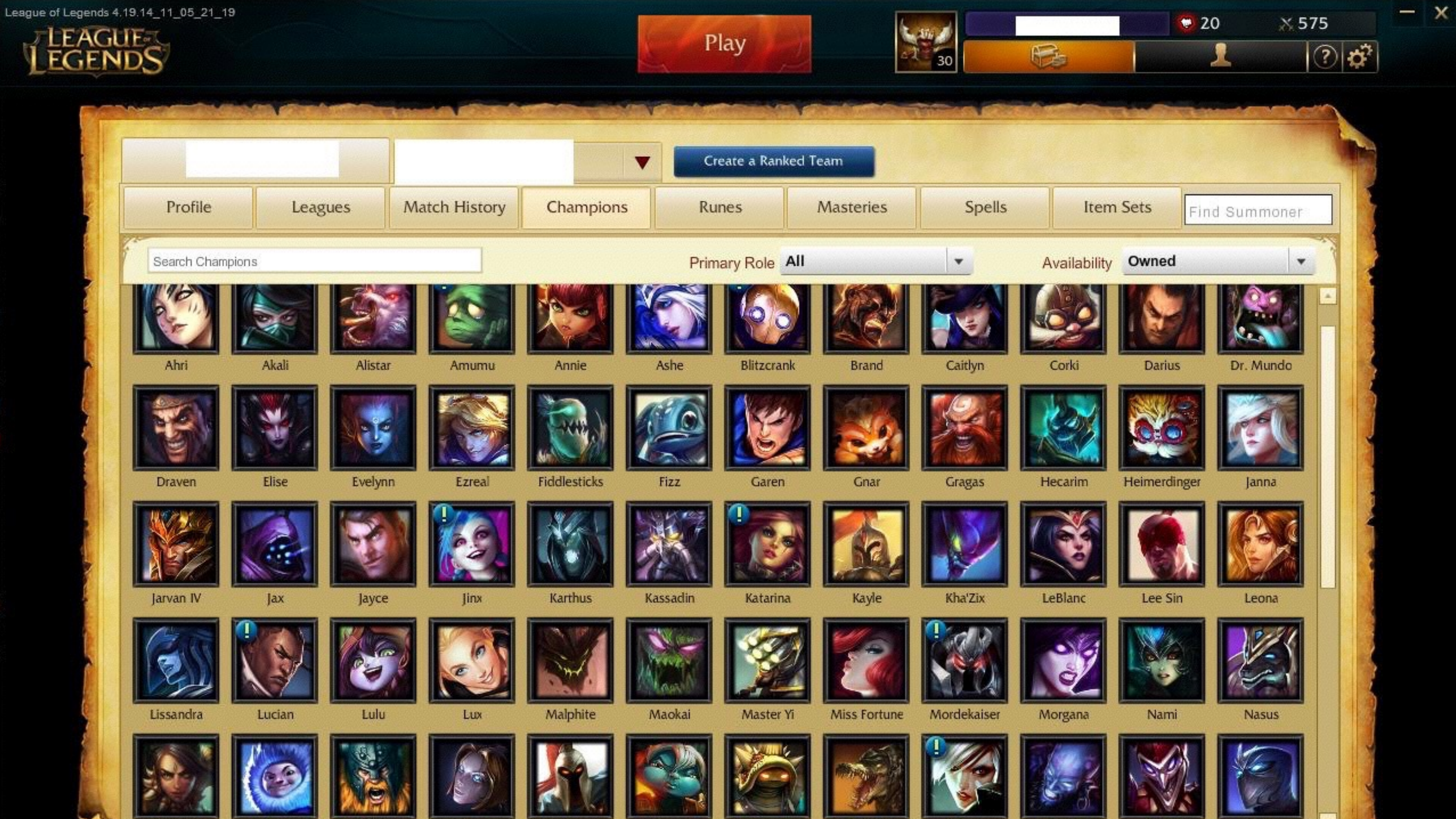

League of Legends 3.02.13_02_17_17_34
Your Team
1. Ban
2. Pick
3. Free
Enemy Team
Picking
SynisterSly
26
LOCK IN your choice.
Champions
Skins
Search
William1506
Mr Morning Wood
SebaVartan
Chittaro
Summoner 1
Summoner 2
Summoner 3
Summoner 4
Summoner 5
Runes & Masteries
Movement AP
Mastery Page 10
Spells
Choose Both
Lock In
Team Chat
Chittaro: top
William1506: plz
Chittaro: ban akali
Chittaro: or taken
Mr Morning Wood: can play anything
SynisterSly: i will get shen or malph
SynisterSly: top
Send
Darius
Karthus
Alistar
Blitzcrank
Amumu
Malphite

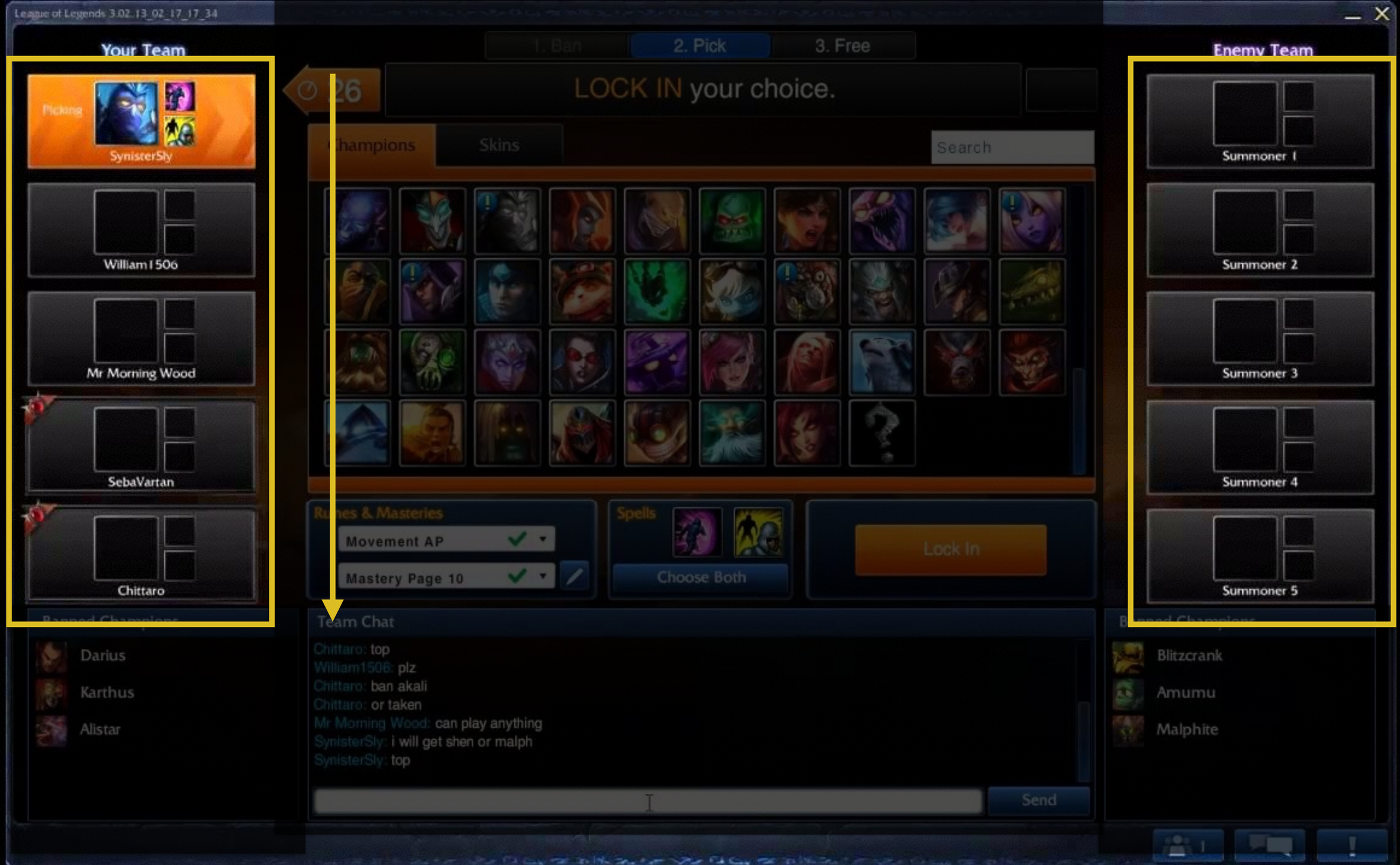
League of Legends

Five-on-five, random team formation

Champion selection before game

- 126 champions
- One by one champion selection
- 1st pick player → … → 5th pick


League of Legends 4.19.14_11_05_21_19
LEAGUE OF LEGENDS
Play
30
20
575
Create a Ranked Team
Profile
Leagues
Match History
Champions
Runes
Masteries
Spells
Item Sets
Find Summoner
Search Champions
Primary Role
All
Availability
Owned
Ahri
Akali
Alistar
Amumu
Annie
Ashe
Blitzcrank
Brand
Caitlyn
Corki
Darius
Dr. Mundo
Draven
Elise
Evelynn
Ezreal
Fiddlesticks
Fizz
Garen
Gnar
Gragas
Hecarim
Heimerdinger
Janna
Jarvan IV
Jax
Jayce
Jinx
Karthus
Kassadin
Katarina
Kayle
Kha'Zix
LeBlanc
Lee Sin
Leona
Lissandra
Lucian
Lulu
Lux
Malphite
Maokai
Master Yi
Miss Fortune
Mordekaiser
Morgana
Nami
Nasus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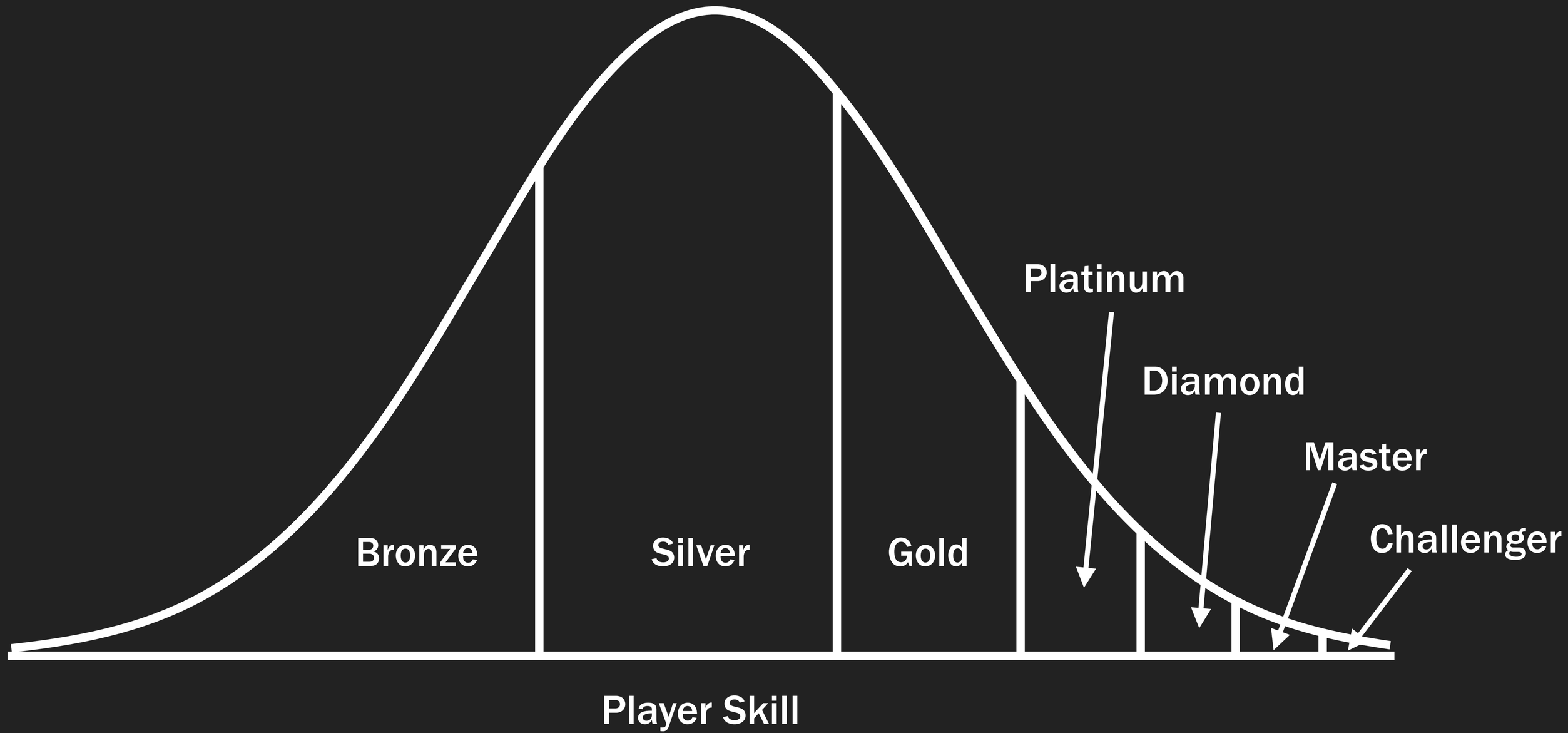
Karthus
Alistar
Blitzcrank
Amumu
Malphite

League of Legends

Five-on-five, random team formation

Champion selection before game

Discrete user levels from Bronze to Challenger


Platinum
Diamond
Master
Challenger
Bronze
Silver
Gold
Player Skill

Dataset & Methodology

Dataset

Data collection using game API*

3.4 M players, 1.9 M matches

Evenly distributed player & team size throughout tiers (from Bronze to Diamond)

https://developer.riotgames.com/

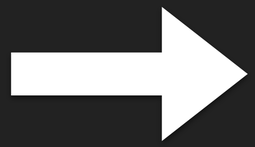
Proficiency - Quantification

You usually Play

Tank

You Choose

Tank



High Proficiency

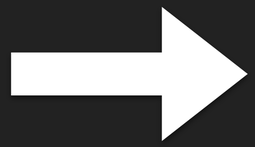
Proficiency - Quantification

You usually Play

Tank

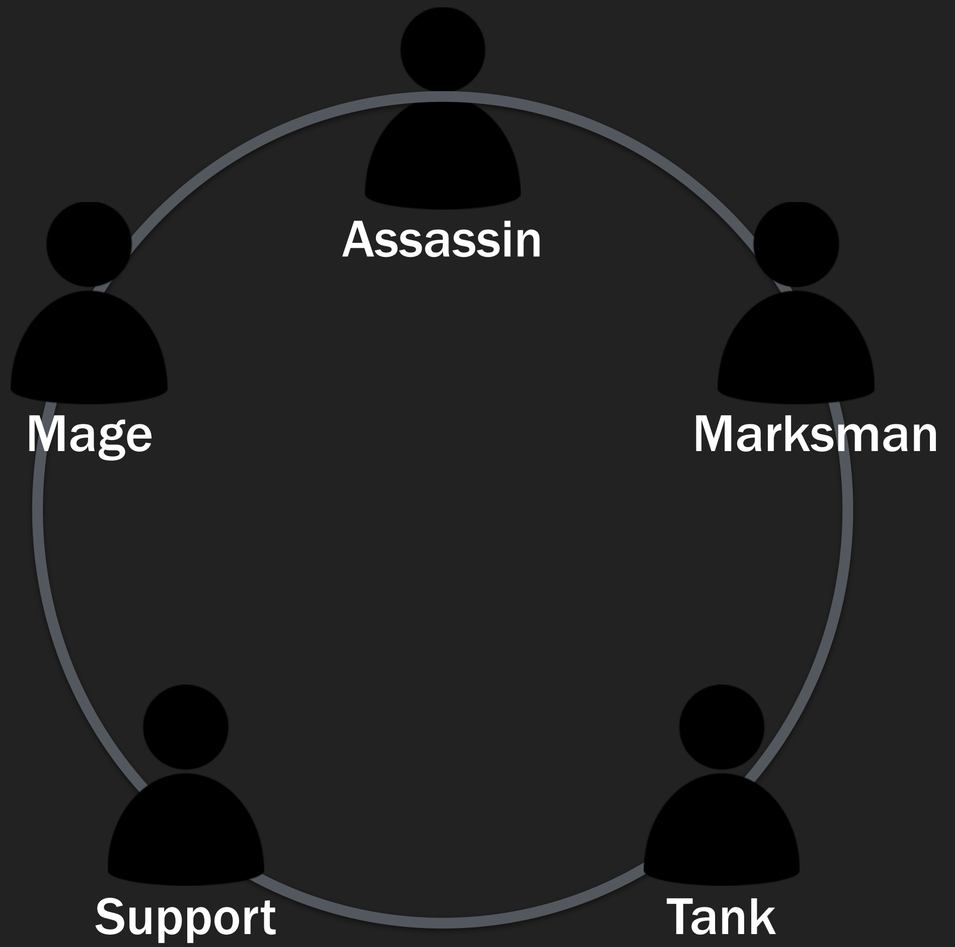
You Choose

Mage



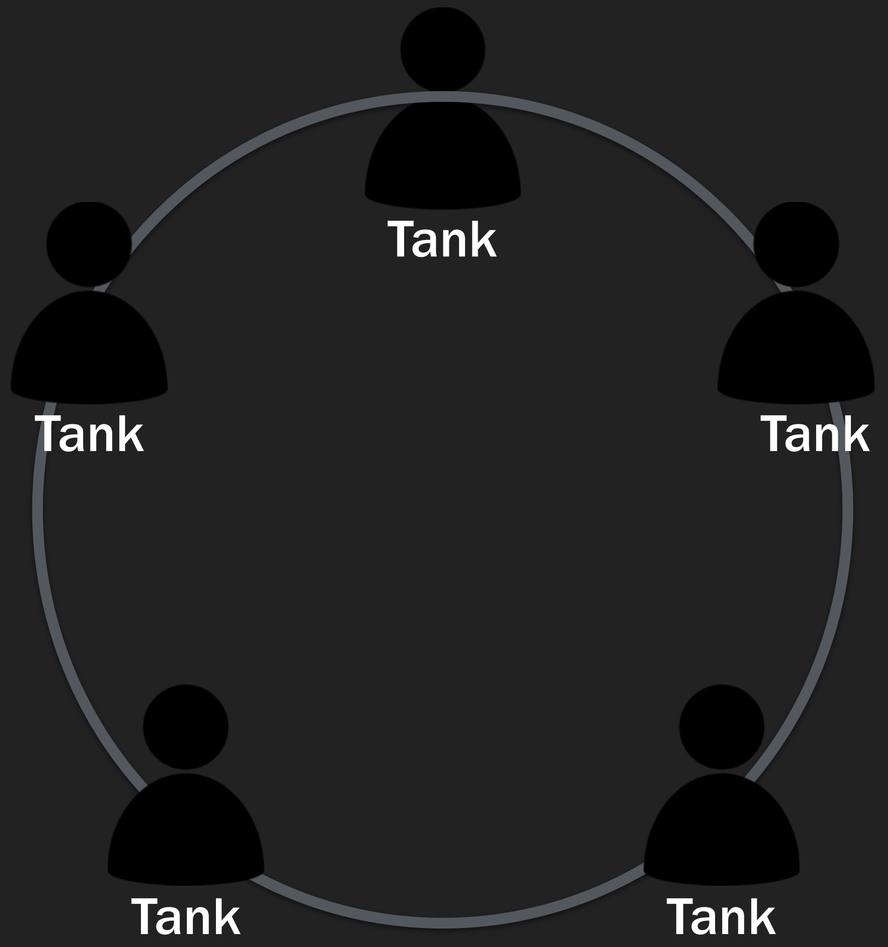
Low Proficiency

Congruency - Quantification



→ High Congruency

Congruency - Quantification



→ **Low** Congruency

Champion Similarity Space

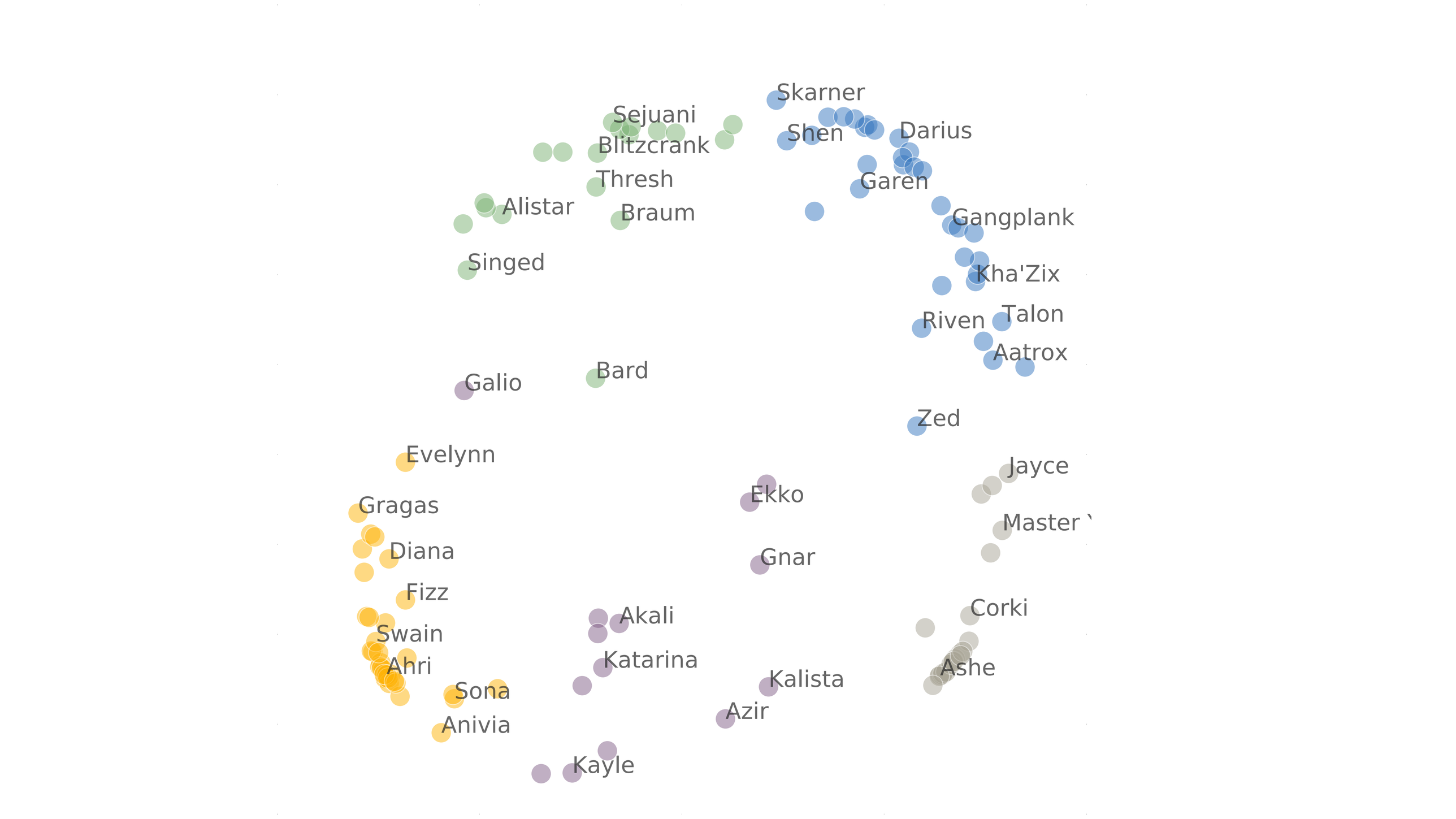
174-dimension champion statistics data

- Ex) Skill range, attack damage, movement speed

Dimensionality reduction using PCA

Champion distance using cosine distance

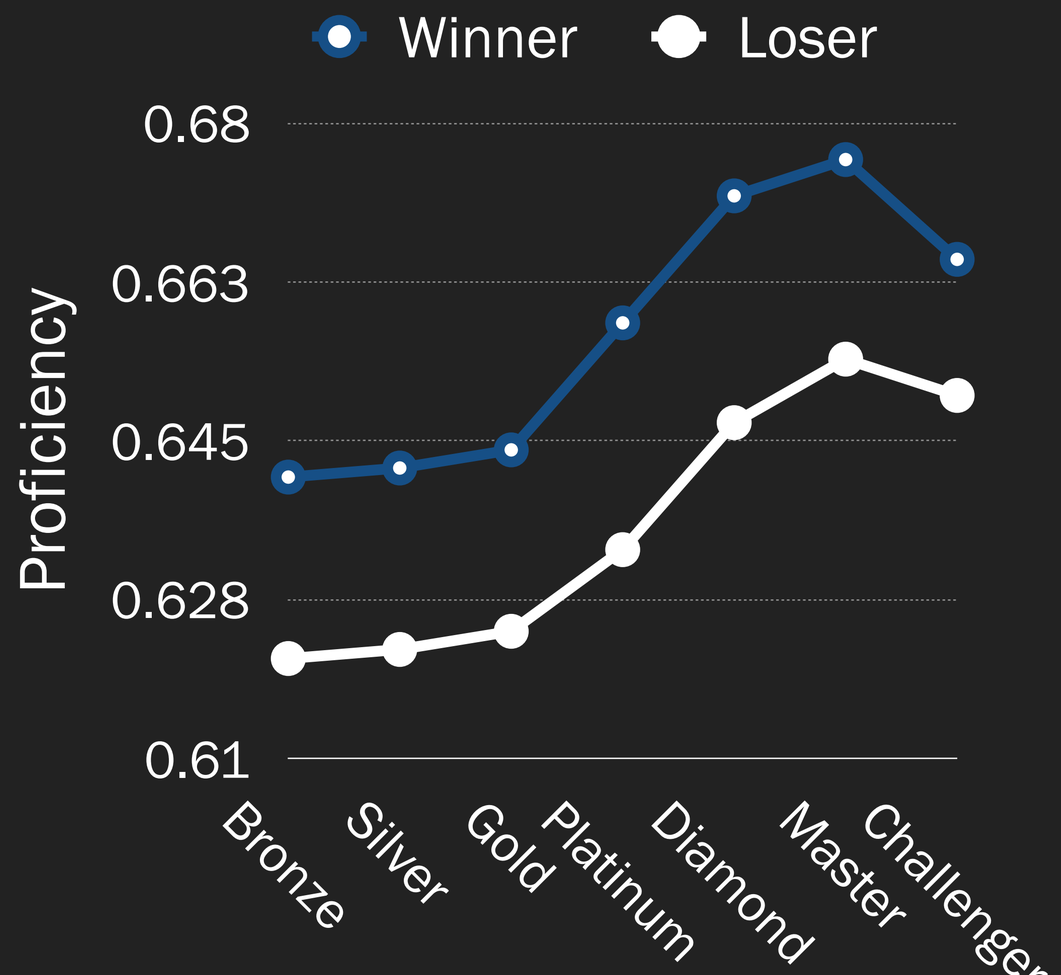
Champion partitioning using K-means


Skarner
Sejuani
Shen
Darius
Blitzcrank
Thresh
Garen
Alistar
Braum
Gangplank
Singed
Kha'Zix
Talon
Riven
Aatrox
Bard
Galio
Zed
Evelynn
Jayce
Ekko
Gragas
Master
Diana
Gnar
Fizz
Corki
Akali
Swain
Katarina
Ahri
Ashe
Kalista
Sona
Azir
Anivia
Kayle

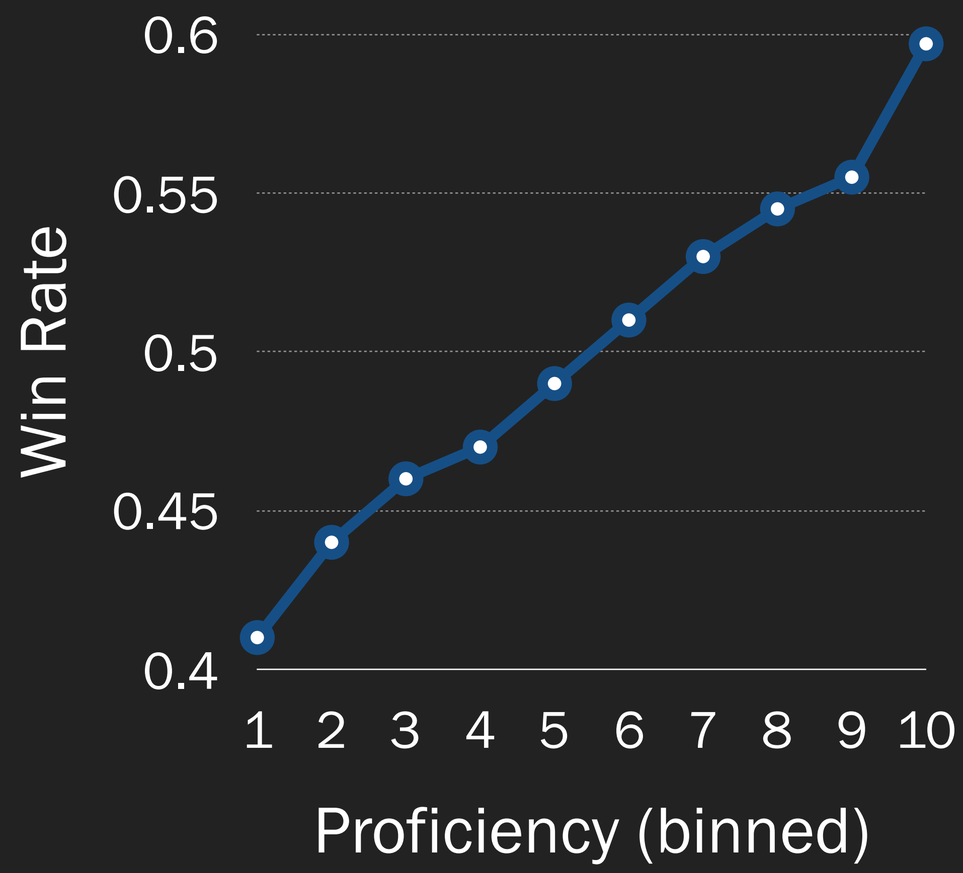
Results

1 Team members with high proficiency will perform better than their counterparts.

1 ↑ Proficiency → ↑ Performance



1 ↑ Proficiency → ↑ Performance



1 ↑ Proficiency → ↑ Performance

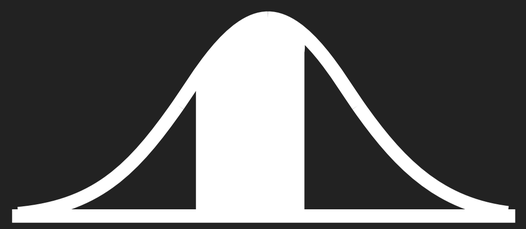
“You will realize which lane you are good at, regardless of what you like, as your tier gets higher. If you play just what you like, you will probably lose because opponent player on your lane may be very good at that lane… then you will lose.”

(P1, Diamond)

1 ↑ Proficiency → ↑ Performance

“Since winning the lane fight is important, it’s better to pick a familiar champ.”

(P13, Silver)

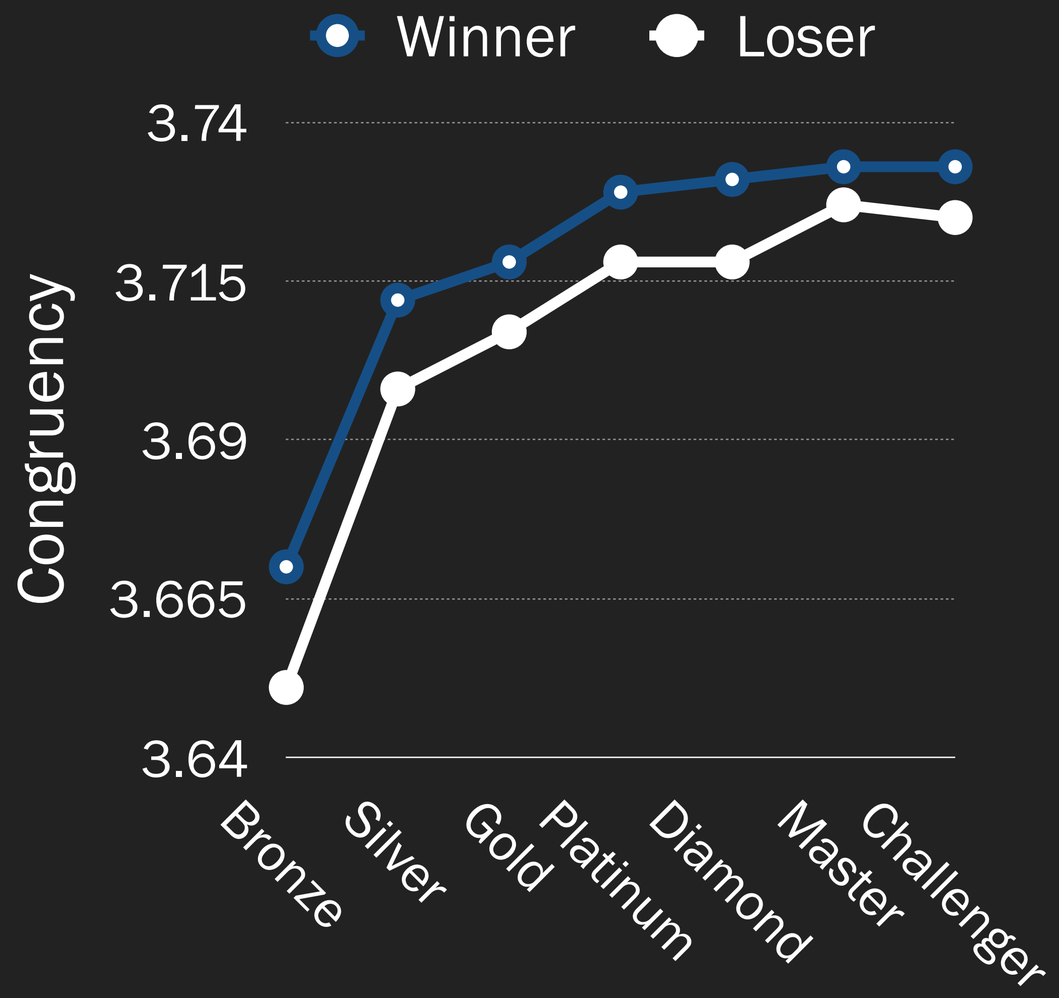


1 Team members with high proficiency will perform better than their counterparts.

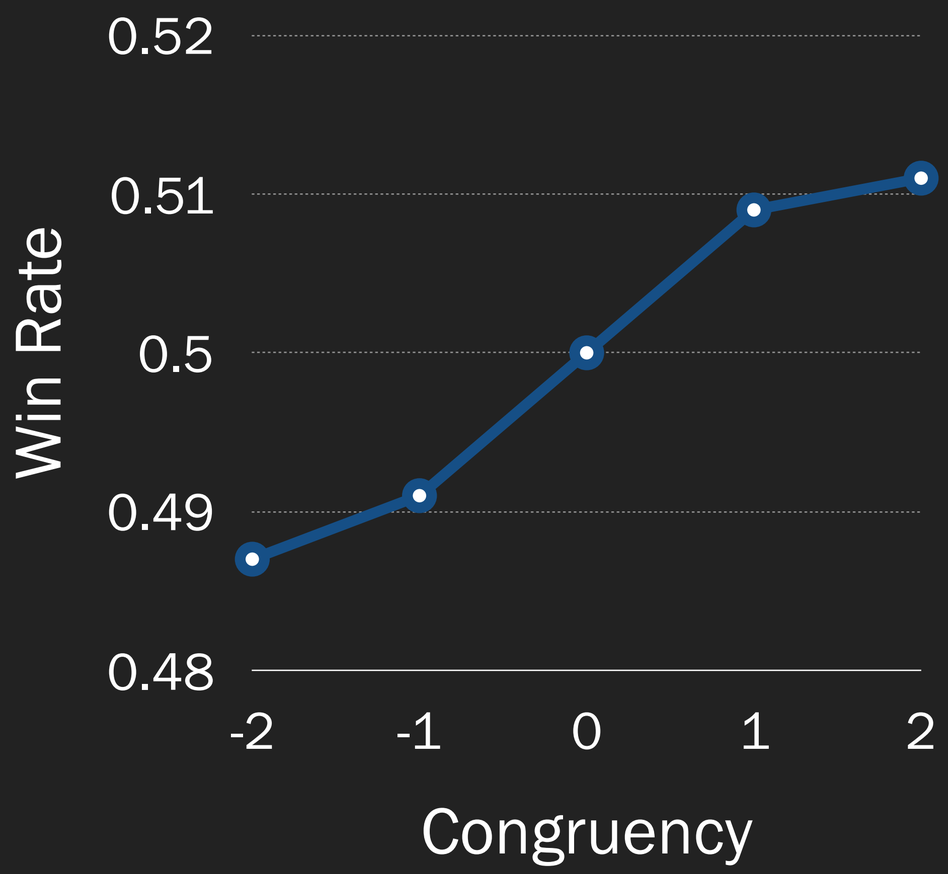
Supported

2 Teams with high congruency will perform better than their counterparts.

2 ↑ Congruency → ↑ Performance



2 ↑ Congruency → ↑ Performance



2 ↑ Congruency → ↑ Performance

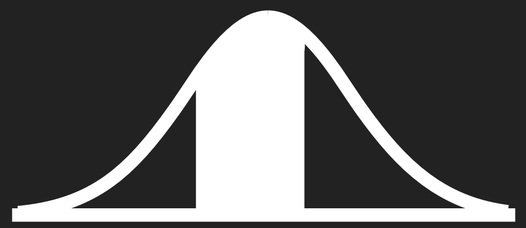
“As my tier gets higher, I trust my team members and pick what is needed… then even if I don’t do something special, I can win.”

(P6, Platinum)

2 ↑ Congruency → ↑ Performance

“I have a few champions for each position I can do… Instead of playing ’Mid’ again and again, just picking Thresh when I have to play a Supporter, …

(P15, Silver)

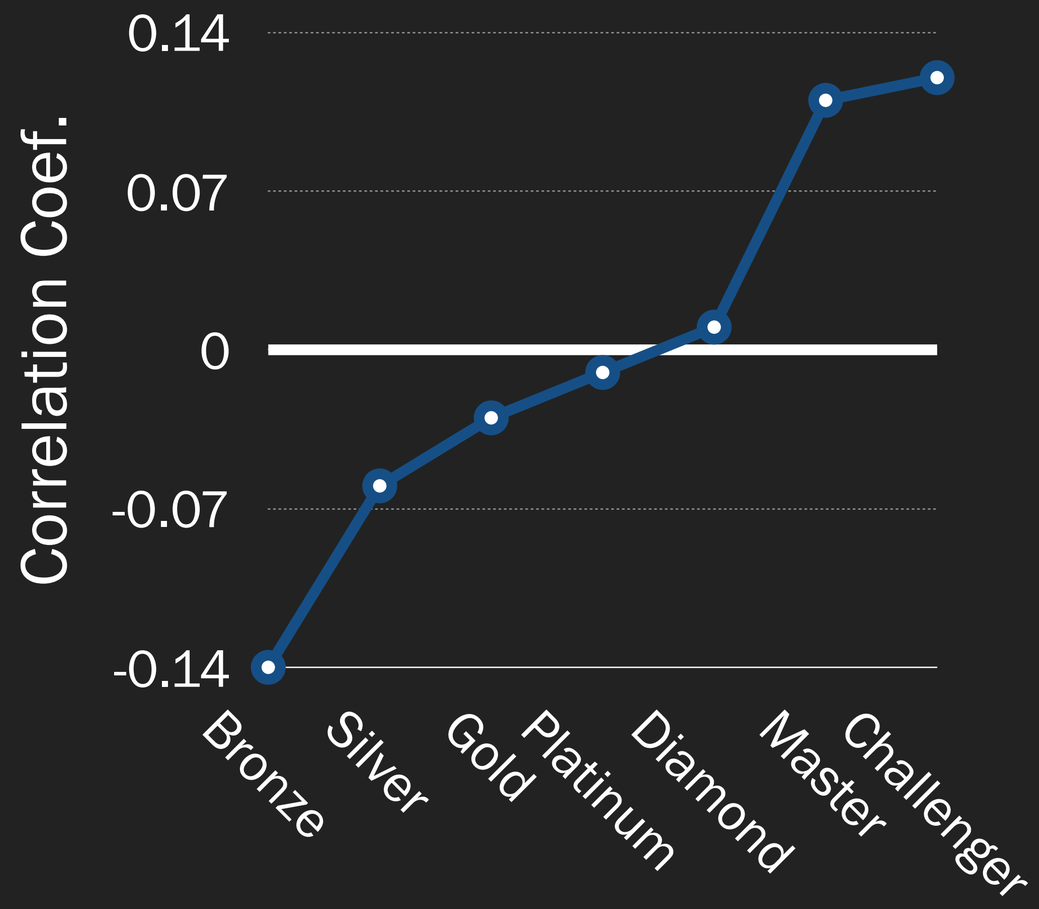


2 Teams with high congruency will perform better than their counterparts.

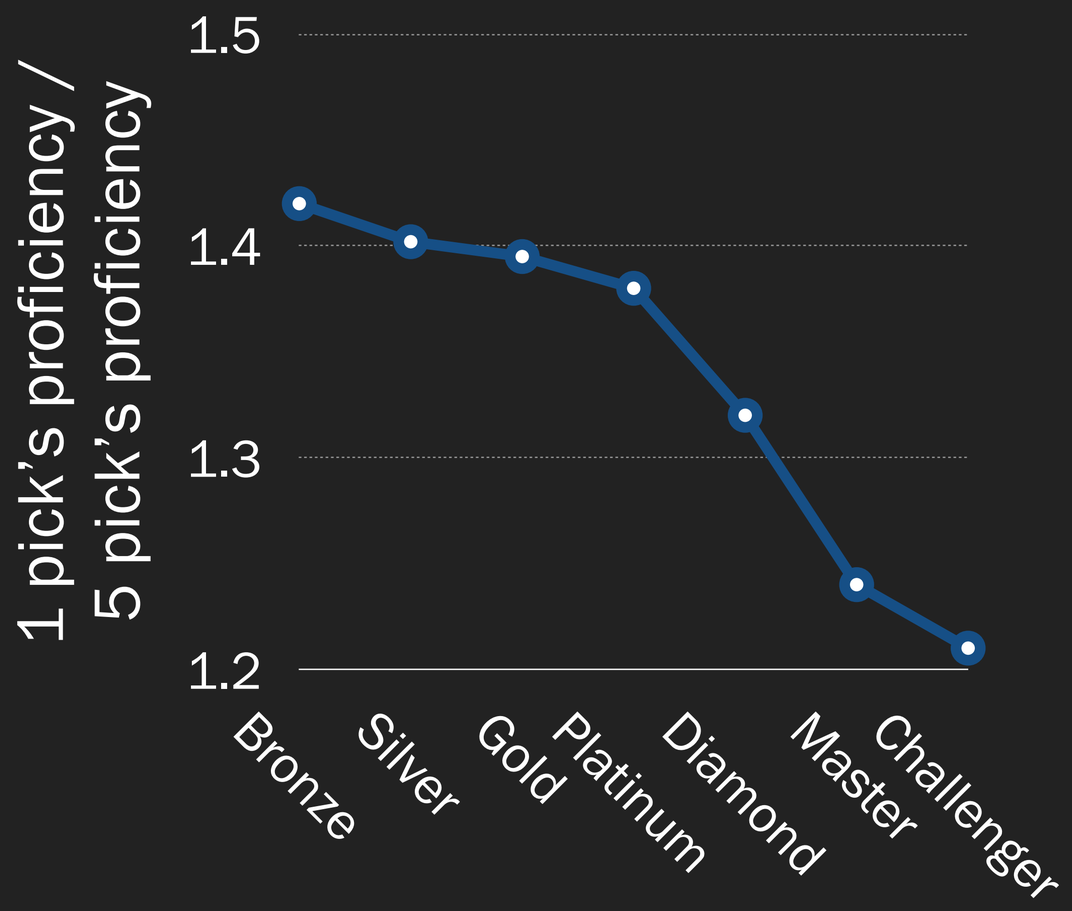
Supported

3 Elite groups are better at optimizing the proficiency-congruency dilemma than novice groups.

3 Proficiency-Congruency Dilemma



3 Proficiency-Congruency Dilemma



3 Proficiency-Congruency Dilemma

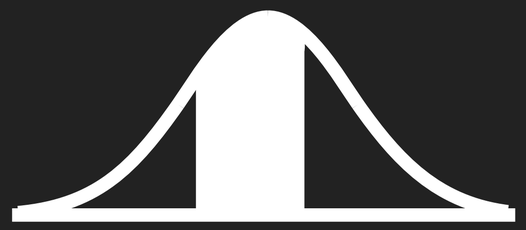
“I think the combination (of bot duo) is crucial. I have played Lucian only for a few times, I was sorry for selecting that, but it’s good combination with [the other champion]…so I selected it.”

(P3, Platinum 4)

3 Proficiency-Congruency Dilemma

“We should have talked to each other for the position assignment… Because it was not determined earlier, I had to hurry for picking my champ.”

(P19, Silver 5)



3 Elite groups are better at optimizing the proficiency-congruency dilemma than novice groups.

Supported

Summary - Proficiency

Skill familiarity, expertise

For virtual teams: individual self-efficacy

Related with better team performance

Goodman, P. (1992), Huckman, R. (2008), Johnson, S. (2009), Staples, D. (2007)

Summary - Congruency

Cohesion, teamwork

For virtual teams: varying play style based on the context

Related with better team performance

Huang, J. (2013), Eggert, C. (2015), Insup, A. (2014), Johnson, D. (2015), Ong, H. (2015), Shores, K. (2014)

Summary

Large-scale analysis on team virtual team design and performance using game data and user interviews

Study on how indiv. proficiency, team congruency, and their relationship affects performance