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Popular openings amongst amateur online Go players: insights from data-informed analysis

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Abstract

Starting from an empty board, the number of legal positions in a Go game grows exponentially as the number of moves increase. During the early moves, a very large subset of the possible positions have balanced win rates. This suggests that the choice of the opening is not crucial to decide a Go game. Nevertheless it is important for players to know what kind of openings they will most frequently face. To answer this question, we collected half a million games played on Fox Go server from 2013 to 2019 amongst players ranked between 10 kyu and 9 dan. A data-informed methodology was developed to classify and compute the frequency of the different openings before and after the introduction of AI. The most popular first moves are nirensai and hoshi+34. Deeper openings popularity depends on rank. Sanrensei fre-

quency decreases with rank, Chinese opening is most popular below 5 dan and Kobayashi between 3 dan and 7 dan (Fox Go Server ranks). The results also show a change in opening playstyle for players ranked above 4 dan after the rise of Go AI. Up to 2019, a similar change is not observed amongst lower ranked players.

Keywords: Go opening, Data-informed, Fox Go dataset

I. Introduction

As with other strategy games, the opening stage of Go has been the subject of active study. Opening styles have evolved through time, notably in the early and mid 20th century with the Shinfuseki, a revolutionary change brought by Go Seigen and Kitani Minoru (Rapley, 2025). In the end of the 20th century, Takemiya Masaki contributed to the popularity of 4-4 move and Sanrensei opening, while Cho Chikun and Kobayashi Koichi contributed to the rise of the so-called Chinese openings (Beheim, 2025). More recently the value of 3-3 point invasion during opening has been re-evaluated after being frequently chosen by AI (Silver et al., 2017). All in all, the preferences of moves during opening is affected by the player's rank and playstyle, as well as the historical context.

Using computers to find the best Go openings is not a recent topic. A winning opening strategy has been found on 5x5 boards as early as 2003 (van der Werf et al., 2003). Recently, catalogues of most likely optimal opening variations using AI scoring have been compiled for 6x6 up to 9x9 boards (<https://katagobooks.org/>). However, no such study can be envisioned on the standard 19x19 board due to the sheer complexity of the possible openings. Moreover, to the authors knowledge, there has not been a review of modern opening strategy from the perspective of amateur players and across skill ranks.

Thanks to the popularity of online Go play, large datasets of Go games are made available. In this work, two methods have been developed to evaluate popularity of Go openings amongst amateur players across ranks and time using a database of 500,000 games. The first method is based on expert knowledge of traditional openings such as Sanrensei, Kobayashi or Chinese

opening, while the second-one is purely data-driven. By spanning the years before and after the development of AlphaGo, one can address the influence of AI on opening popularity. Since the advent of open source AlphaGo-like AI software for Go games analysis, it became popular to obtain feedback about one's own games thanks to AI. One question addressed in this work is to evaluate if the use of AI changed the opening playstyle of human players of different ranks.

In section II, the database and the two methods are described. The expert driven approach studies established openings while distinguishing moves that are required from moves that are possible variations. The data-driven approach searches for identical openings up to rotations and reflections to identify the most popular opening up to 8 turns deep. In section III, the results about the most popular opening patterns are presented across the player's rank and time.

II. Methods

1. Data

A source dataset of online Go games played on Fox Go Server is used in this study. It contains more than 20 million Go games played between 2013 and 2019 (Featurecat, 2019). The dataset includes every rank from 18k to 9d. Data curation was conducted by selecting evenly matched games of at least 100 moves terminated by scoring or resignation. No games were discarded because of unorthodox openings. 14 ranks are investigated in this work, namely 10k, 8k, 6k, 4k, 2k, 1d, 2d, 3d, 4d, 5d, 6d, 7d, 8d, and 9d. This re-

sults in a curated dataset of half a million games.

2. Expert-informed pattern search

Two approaches were conjointly used to identify the most popular openings. The first approach, called expert-informed, consists in choosing *a priori* a set of common openings, such as Nirensai, Chinese or Kobayashi opening among others. Each opening stone is determined to be intentional or flexible by the expert. An opening thus includes intentional moves, such as moves 1 and 3 in Figure 1a, and patches, represented as transparent black and white rectangles in Figure 1a. The intentional moves are mandatory, they are the essence, the skeleton of the openings. The patches represent areas where a specific opening move could reasonably be placed. Patches allow to include variants of an opening. For instance, move 5 in Figure 1a can be placed at P10 (high Chinese opening), or at Q9 (classical Chinese opening). The variability of the opponent's move can also be modelled by a patch. For instance, move 4 in Figure 1b can be anywhere between 3-3 and 5-5 points without modifying the opening. An additional constraint is applied for openings with several patches of the same player colour: each patch must contain one, and only one, stone.

3. Data-driven pattern search

A second approach, called data-driven, consists in a clustering of the available openings. The clustering procedure is iterative and goes as follows. For a given number of moves starting with the first, all the games are parsed one by one up to a maximum depth of 12 moves. If an opening sequence ending

in a Black player stone placement has not yet been observed, it is added to the Black player opening list and given a count of 1. If the sequence is already in the opening list, its count is incremented. The same is done on the sequences that end in White player stone placements. By ordering the opening list by games count, one obtains the k most popular openings played by Black or White. As an example, the 5 most frequent 8 moves Black and White openings at 1d rank in 2019 are plotted in Figure 2.

Notice that the order of moves is not taken into account and only the final position after a given number of moves is considered for increasing a count. In both expert-informed and data-driven approaches, the rotations and reflections (when the pattern is not chiral) have been accounted for.

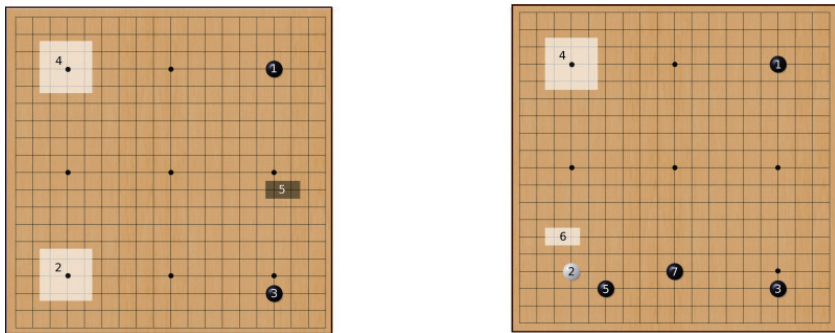


Figure 1: Illustration of the patterns for Chinese (left) and Kobayashi (right) openings. Intentional moves are depicted as stones whereas patches are represented as transparent areas (move order is not considered for analysis, the numbers shown here are only for illustration)

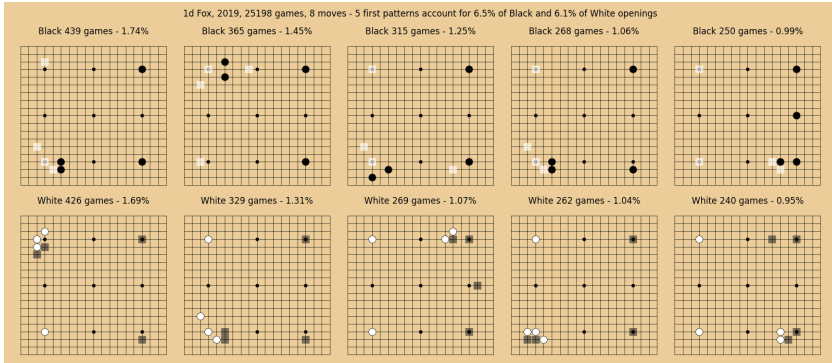


Figure 2: Most frequent Black and White 8 moves openings for 1d players in 2019 (the identified patterns are represented as solid stones, the transparent rectangles show one possible sequence for the opponent).

4. Statistical analysis and uncertainty quantification

In order to study the effect of rank and year on the opening frequency, the dataset is divided into subsets with homogeneous rank and year. Most of the subsets contain between 10,000 and 40,000 games, although the smallest ones contain only a few hundreds of games. Amongst these games, some patterns are very frequent (e.g. $\sim 40\%$ for white Nirensai across all ranks), whereas some others are rare (e.g. $\sim 0.4\%$ for Kobayashi amongst 1d players). Such discrepancies in sample sizes can lead to large uncertainties. In this subsection, the method to estimate opening frequency (and uncertainty) is presented and validated.

For a subset of N_g games, among which α games exhibit a given opening, the observed frequency of the opening is α/N_g . This value can be considered as a point estimate in a frequentist framework. A common way to evaluate

the uncertainty of this estimate is bootstrapping. Bootstrapping is achieved by resampling b times with replacement N_g games from the original subset. Higher value of b gives a smoother estimation at a larger computational cost. The histogram of expected frequency is shown in Fig.3 for $b=10,000$ (1d games from 2019, $N_g=25,198$). On top of the mean value, which is close to α/N_g , these histograms give an estimation of the uncertainty of the expected frequency. For instance, using Fig.3, the Sanrensei opening expected frequency computed 95% confidence interval is [5.5%-6.1%].

This method gives very satisfactory results, but it is computationally expensive. Given the large dimensionality of our study (~ 15 opening patterns \times ~ 15 ranks \times ~ 5 years), a faster method is preferable. In this work, an analytical Bayesian approach using Beta distributions is used to increase the computational efficiency. The methodology of the proposed Bayesian approach is given in the next paragraph.

Several openings can be present in a single game, for instance Kobayashi is a sub-opening of hoshi+34 (see Fig.4). However, each opening is either present or not in each game, which means only two outcomes are possible. Moreover, the presence of an opening in a given game is independent of its presence in the other games. A sequence of events satisfying these two conditions is called a Bernoulli process. In this study, the parameter π of the Bernoulli process is the expected frequency of a given opening. Beta distributions are conjugate priors for the Bernoulli process, making them a very efficient choice to model π . Before seeing any games, all the values of π are equally probable. This is reflected by using the uniform prior $\text{Beta}(1,1)$. The likelihood of finding the opening α times out of N_g games is given by

$\text{Beta}(\alpha, Ng-\alpha)$. The posterior distribution of π is the product of the prior and the likelihood, which is equal to $\text{Beta}(\alpha+I, Ng-\alpha+I)$. The posterior distribution of π is reported in Fig.3 on top of the histograms obtained using bootstrapping. There is a very good agreement between both predictions, showing the ability of Beta distributions to predict the expected frequency and its uncertainty. The computational cost is much lower: the Bayesian approach is on average 2000 times faster than bootstrapping.

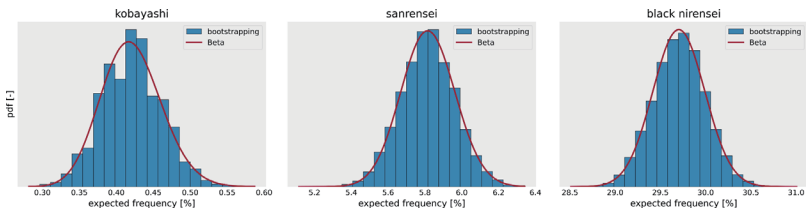


Figure 3: Comparison of bootstrapping ($b=10,000$) and analytical Beta distributions for three opening patterns using 25,198 games played between 1d Fox players in 2019

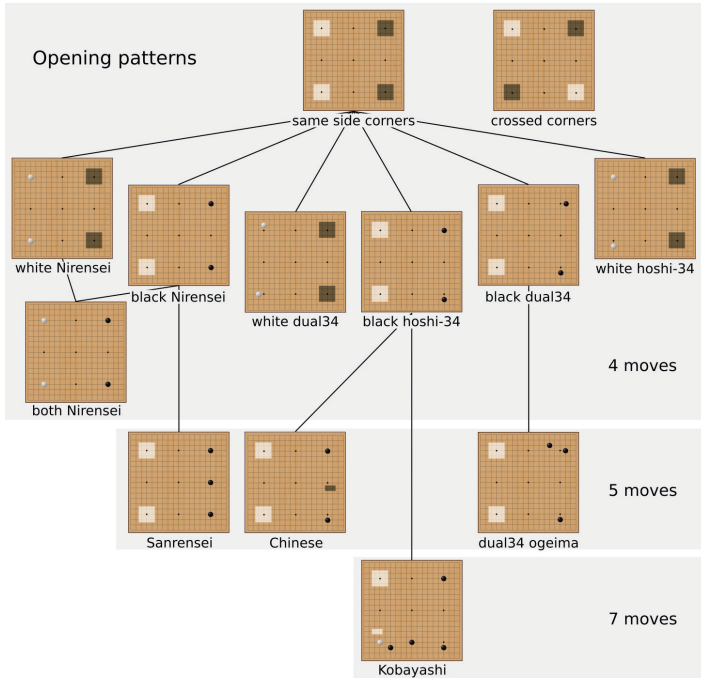


Figure 4: Expert-informed opening patterns - Intentional moves are depicted as stones whereas transparent areas indicate the range of the opponent’s possible moves

III. Results

1. Corner is gold (4 moves openings)

One of the first proverb a beginner might hear about Go opening is “corner is gold, side is silver, center is grass” (金角银边草肚皮). Thus, it is not a surprise to observe that the very large majority of 4 moves opening consist of

a stone played in each corner. When looking more closely, 5 patterns represent 86% of Black openings across all ranks. These patterns, shown in Fig.5 amongst 1d games, are:

- Nirensai, two 4-4 points on the same side
- hoshi+34, one 4-4 point and one 3-4 facing the 4-4
- hoshi+43, one 4-4 point and one 3-4 facing the opponent's side
- dual34, two asymmetric 3-4 points
- crossed Nirensai, two 4-4 points in diagonally opposed corners

Looking at Fig.5, notice that these patterns are not equally popular, Nirensai and hoshi+34 being roughly 10 times more popular than crossed Nirensai. The expected frequency of each pattern depends on the players' rank and is plotted in Fig.6 for games played in 2019. At low amateur level, the most popular Black opening is Nirensai, which appears in more than 35% of games, followed by hoshi+34 (15%). The popularity of hoshi+34 rises steadily with the players' rank, while Nirensai popularity decreases. Amongst 1d players, both openings are equally popular (~ 30%), and hoshi-34 is the most popular amongst 6d players (almost 35% vs 25% for Nirensai). Interestingly, the trend reverses for players ranked 7d and above. The opening dual34 is less frequent, starting around 7% at 10k and increasing steadily until around 10% at 9d. Crossed corners is more frequent amongst lower ranked players, with a frequency around 10% below 1k and around 5% above.

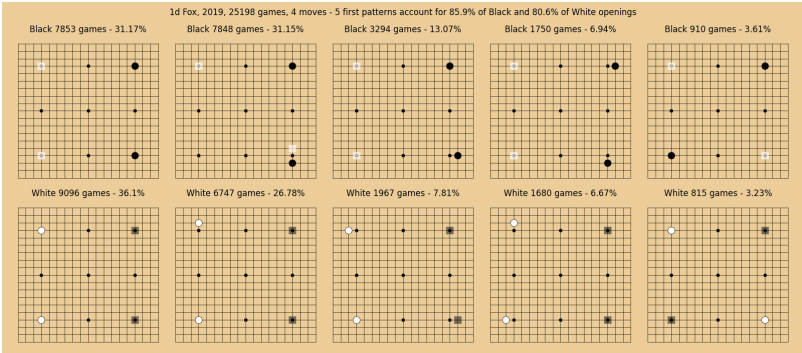


Figure 5: Five most frequent Black and White 4 move openings for 1d players in 2019 (the identified patterns are represented as solid stones, the transparent rectangles show one possible sequence for the opponent).

Looking at White perspective openings, the five most frequent patterns at 1d fox level is the same than for Black, as can be seen in Fig.5. These five openings account for 81% of White 4 moves opening, a slightly lower figure than for Black. But when looking more closely, one can see that the frequency of each opening differs. Nirensai is 5% more frequent for White than for Black. Hoshi+34 and hoshi+43 openings are 4% less frequent for White than for Black.

As these results are only valid at 1d Fox level, the frequency of the five most popular openings is plotted across rank in Fig.7. The frequency of Nirensai follows the same shape for White and Black: it is higher at ranks lower than 1d and higher than 7d than between 1d and 7d. However, while it is competing with hoshi+34 as Black's most popular opening, Nirensai is always White's most popular opening, reaching a maximum of 55% at 9d Fox

level. Hoshi+34 is always the second most popular opening, reaching a maximum of 30% frequency between 3d and 6d Fox levels. The three remaining openings follow a decreasing trend when rank increases. This results in a lower diversity of openings at high ranks compared to low ranks, whereas the diversity of Black openings was more or less constant across rank.

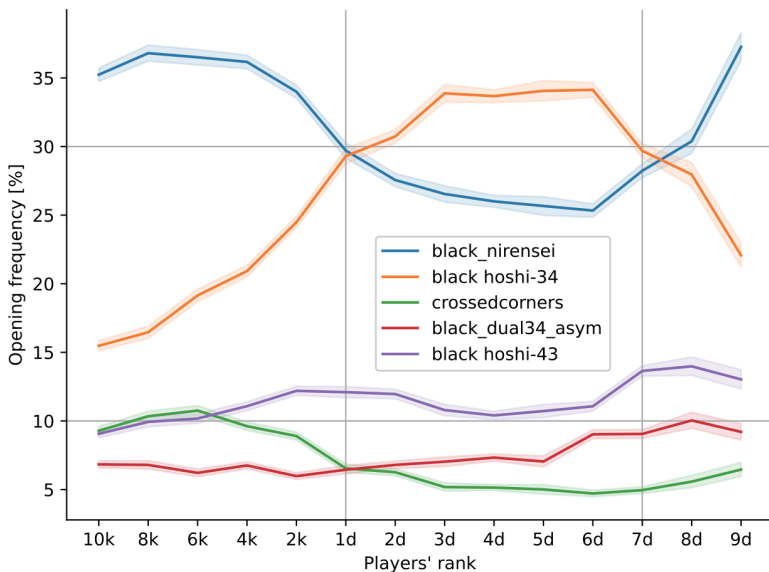


Figure 6: Frequency variation of five Black 4 moves openings (games played in 2019 on Fox Go server)

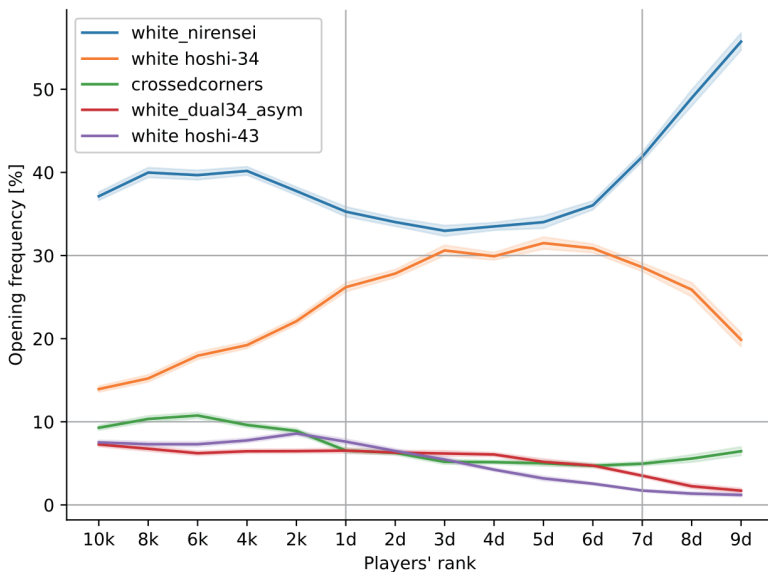


Figure 7: Frequency variation of five White 4 moves openings (games played in 2019 on Fox Go server)

2. Side is silver (5+ moves openings)

Within the next two moves (5 and 6 moves openings), two specific openings appear, both focusing on side development: Sanrensei and Chinese opening. Sanrensei consists of occupying the three hoshi on one side (4-4, 4-10, and 4-16). Sanrensei is a possible follow-up of the Nirensai opening. On the other hand, Chinese openings are possible follow-ups of the hoshi+34 opening. Several variants exist, in this study we considered the two most frequent ones: the low and high Chinese openings, represented on the left side of Fig. 1. Although Sanrensei is sometimes played by White, only the Black openings are studied in this section. Another 5 move opening, called here

dual34ogeima, consists of a dual34 opening followed by a corner enclosure, in this particular case an ogeima in the direction of the opponents' stones (see Fig.4).

Within two more moves (7 and 8 moves openings), the Kobayashi opening appears, a deeper hoshi+34 follow-up than the Chinese opening. The mandatory stones and the possible opponent's response for the Kobayashi opening are plotted on the right side of Fig. 1. The frequency of Sanrensei, Chinese, dual34ogeima and Kobayashi openings are plotted across rank in Fig. 8. Sanrensei is very popular amongst 10k to 4k players (8% opening frequency), but its popularity decreases sharply with rank for players above 4k. At 8d level and above, its opening frequency is well below 1%. Chinese, dual34ogeima and Kobayashi openings all show a bell-shaped curve, with a maximum frequency close to 3% around 2k-1d for the Chinese opening, 2% around 7d-8d for the dual34ogeima and almost 4% around 5d-6d for the Kobayashi. Notice that the Chinese opening's bell curve is quite wide, reaching a larger pool of players' ranks. Kobayashi's maximum frequency of 4% is remarkable given that it is a 7 moves opening, in contrast with Sanrensei, Chinese and dual34ogeima which are 5 moves openings (see Fig. 4).

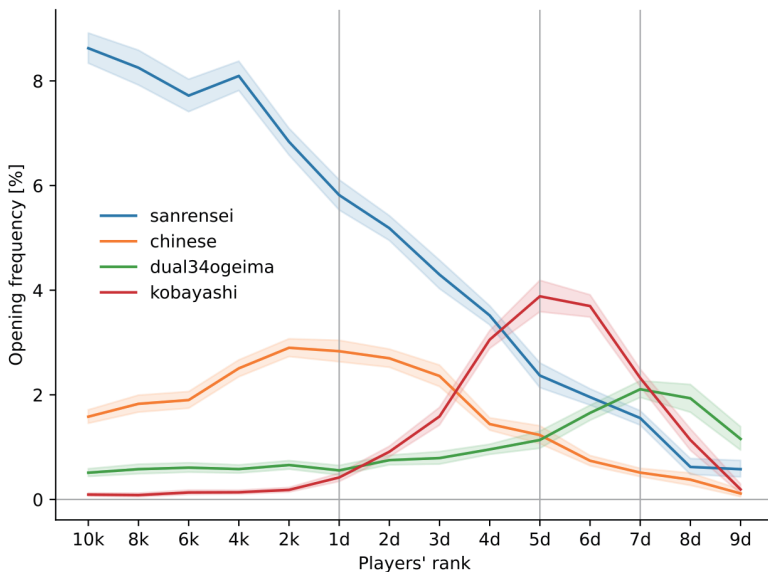


Figure 8: Frequency variation of four Black 5+ moves openings (games played in 2019 on Fox Go server)

3. Influence of AI on popular openings

The rise of AI after the match of Lee Sedol and AlphaGo in 2016 (Silver et al., 2016) saw a change in Go opening practice. One of the most striking features of this change is the early san-san invasion which was considered a bad move before but was frequently played by AlphaGo Master (Silver et al., 2017). These AI expert systems are now available to all players thanks to the release of open source software for AI analysis of Go games. Two examples are Leela Zero initially released in 2017 and KataGo initially released in

2019. The question we are addressing in this section is whether the rise of AI influenced the popularity of Go openings.

A first analysis is performed for 9d Fox players since we have a large dataset of game records across all years from 2013 to 2019. Four different openings are considered: crossed corners and Nirensai played by Black, White, or both players. The resulting opening frequencies are plotted in Fig.9. White Nirensai has always been popular over the studied period, ranging between 25 and 40% before 2017, and between 30 and 55% after 2017. On the other hand, Black Nirensai was a rare sight before 2015, accounting for less than 3% of openings, whereas it reached 37% of openings in 2019. Games with both sides playing Nirensai also saw a large increase, from less than 1% before 2015 to 24% in 2019. On the other hand, crossed corners opening, which is neither favored nor unfavored by AI, saw a relatively constant opening frequency across the years. These results clearly demonstrate a sudden change in Go openings popularity amongst the highest ranked players after the advent of AI.

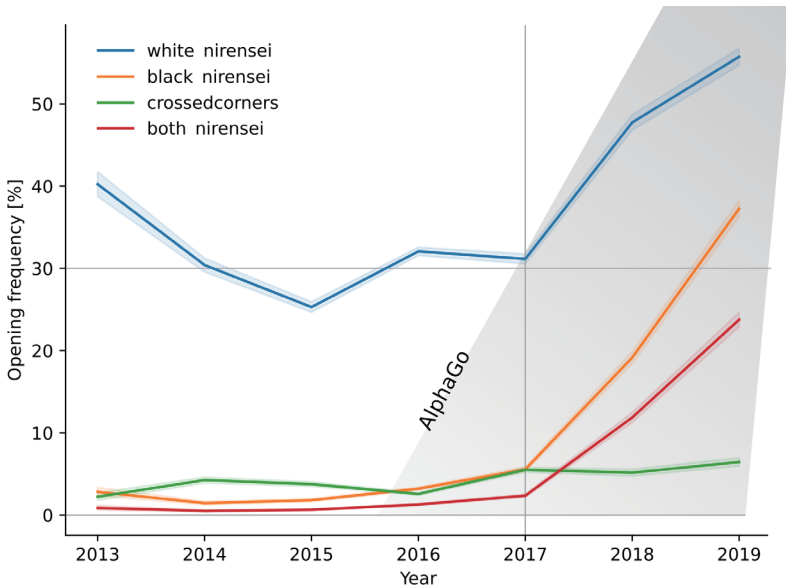


Figure 9: Black and White Nirensai and crossed corners opening frequency from 2013 to 2019 for 9d Fox players (the grey shaded area is a qualitative representation of the increase in AI usage since AlphaGo demonstration games in 2016 until the release of open source software such as Leela Zero in 2017 and Katago in 2019)

A natural follow-up question is to know if the AI also influenced the opening popularity amongst amateur players of lower ranks. While it is clear that playing the best opening can lead to a significant advantage at professional level, we have shown that the opening has a weaker impact on the game outcome at lower ranks (Rendu, 2023). The database is more sparsely populated for games played before 2019 at lower ranks, hence only games played in 2015 and 2017 are collected. The opening frequency of Black Nirensai is plotted across players' rank in Fig.10. In 2015 and 2017, Black Nirensai

frequency decreased almost linearly with players rank. In 2019, it first decreases, then shows a plateau and finally increases again for players above 6d. Overall, the frequency is the same across all years for players below 4d, slightly higher for 2019 games between 4d and 6d, and largely superior for players above 6d in 2019.

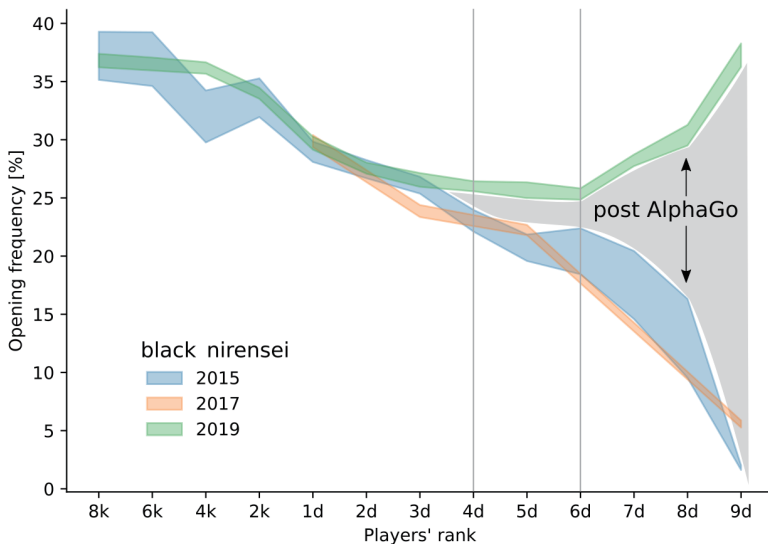


Figure 10: Frequency of black Nirensai opening across rank for games played on Fox Go server before (2015, 2017) and after (2019) the widespread use of AI Go analysis software

These results indicate a change in opening frequency only for the strongest players. Two hypotheses can explain this behavior. The first one relies on the link between score in the opening and game outcome. A previous study

showed that a given score advantage translates into higher winning rate for stronger players (Rendu, 2023). Hence lower ranks might not benefit from an optimised opening strategy. A second hypothesis relies on the time lag between the availability of AI and the change in Go openings. As shown in Fig.9, the rise of Black Nirensai popularity is spread across three years for the strongest players. One could argue that the strongest players have a higher awareness about AI's influence on Go opening, as well as a faster ability to change their style of playing. Under that hypothesis, lower ranked players might also experience a change in opening strategy but across a longer time-frame. This hypothesis could be evaluated by analysing more recent games, unfortunately not available in the current source dataset.

IV. Discussion

Our findings show that the vast majority of games follow a small diversity of openings, with 5 openings accounting for 80% of the games after 4 moves. Amongst these, Nirensai is very popular across all ranks. Although Nirensai popularity feels natural today, it was seldom played a century ago, before the Shinfuseki revolution (Rapley, 2025). This demonstrates the fluctuating popularity of Go openings through time. A recent study (Beheim, 2025) investigated the frequency of the first two moves from 1600 to 2024. It could be extended to deeper openings such as Nirensai, Sanrensei, Chinese and Kobayashi openings to evaluate their popularity over time.

Until 2016, changes in opening popularity have been driven by professional Go players experimenting with new strategies. One recent example is

the Sanrensei opening, part of Takemiya Masaki “natural style” (also termed “cosmic style”), which is now one of the most popular openings amongst low rank amateur players. Since 2016, the rise of superhuman-level AI Go engines led to a more objective evaluation of moves value, improving human understanding of the game (Choi et al., 2025 ; Kim et al., 2021). The re-evaluation of openings and common sequences such as 3-3 invasion impacted the style of professional go players. This is clearly seen in our results on the frequency of Nirensai vs Nirensai opening amongst 9 dan Fox players, which accounted for less than 1% of the games in 2015 and for around 24% in 2019.

An open question is whether and how the rise of AI will affect the popularity of Go openings amongst lower rank players. On the one hand, an advantage of a few points in the opening is not decisive for lower rank players (Rendu, 2023). On the other hand, from the first author’s own experience, openings involving 3-3 moves and 3-3 invasion have been very popular amongst lower rank players in the last few years. Go AI also confirmed that midgame is the decisive stage of a Go game, and that most moves are good moves in the opening (Rendu, 2025). Rather than limiting our options, AI might have revealed a large uncharted territory for creative playstyle in Go openings – a territory yet to be explored.

V. Conclusions

Go opening patterns of games played by amateur players on Fox Go Server were analyzed using a data-informed framework. The games were played

from 2013 to 2019 across ranks ranging from 10 kyu to 9 dan. Standard opening Go theory which favors the development of corners in the first moves and then the sides is observed across all ranks. In the first four moves, 5 openings account for 80% of the game, with Nirensai and hoshi-34 being the most popular openings across all ranks for both Black and White players.

Considering famous opening strategies, Black Sanrensei is the most popular one but its frequency decreases with the player's rank. Chinese openings are most popular amongst 1 dan players and then decrease with rank. Above 1 dan, Chinese openings are roughly twice less frequent than Sanrensei. Kobayashi is the most popular opening for players between 4 dan and 7 dan, showing a significant frequency given that it's a deeper opening.

When comparing games played before and after the introduction of Alpha-Go, a large increase in the frequency of Nirensai openings is observed for players ranked 4 dan and above. This indicates a significant impact of AI on professional Go players' opening style. Lower ranks are not affected as of 2019, but could be in more recent games. Alternatively it could be that lower rank players benefit minimally from an advantage in the opening strategy due to larger mistakes in midgame and endgame.

These results could be of use to customize training of Go openings depending on the student rank. We hope it will be relevant for players and educators of Go, as well as for readers interested in the impact of AI on players' decisions.

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