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Chapter 1

dataField: totalPucksRatio (totalPucksRatio)

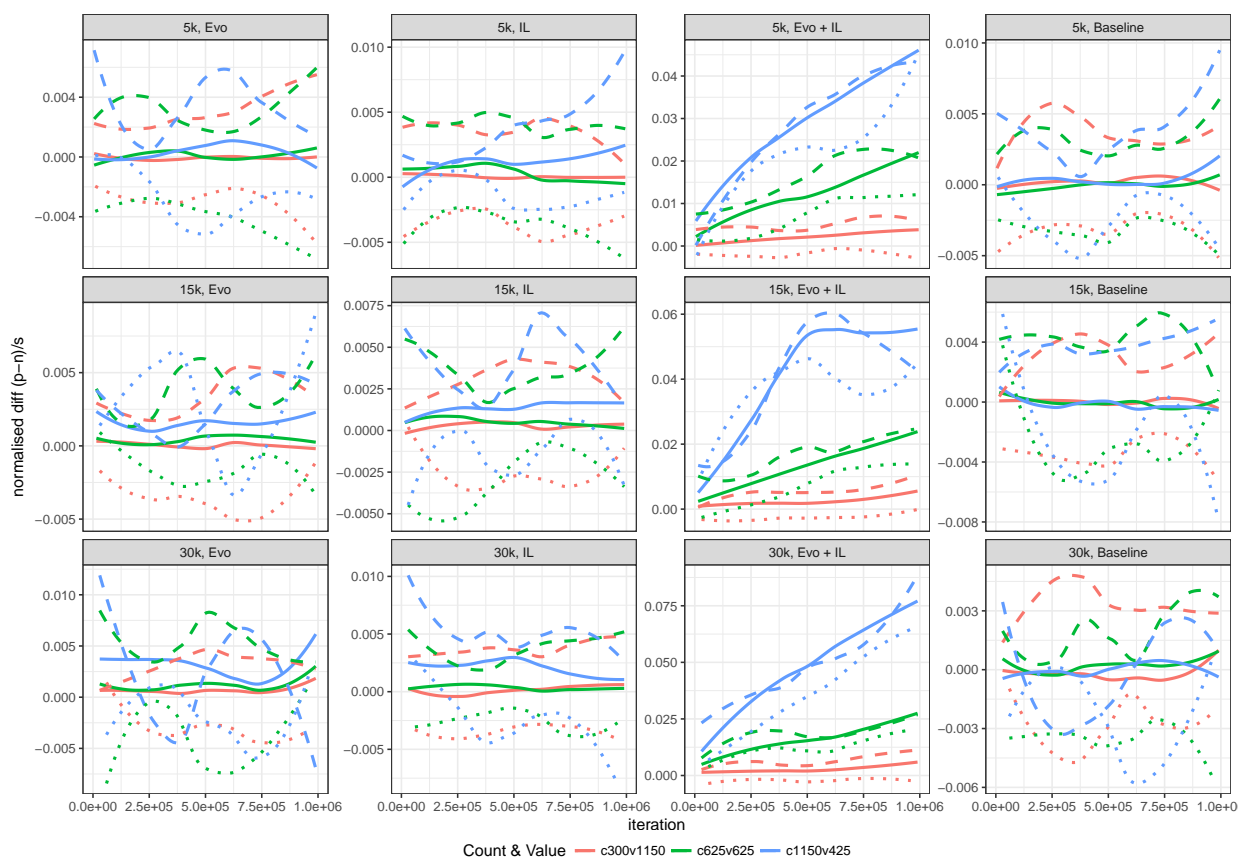
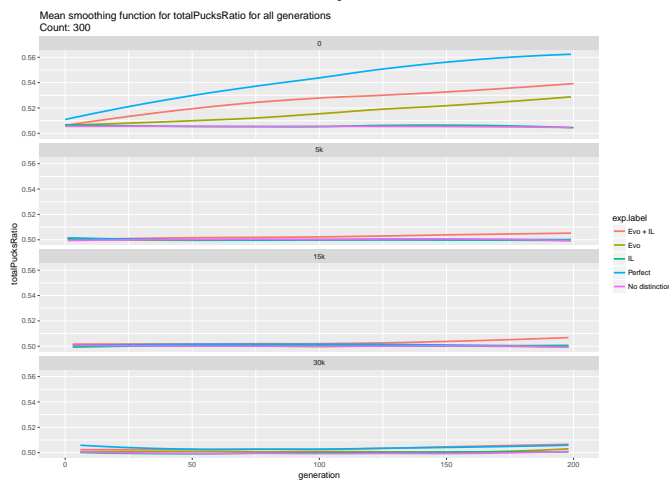
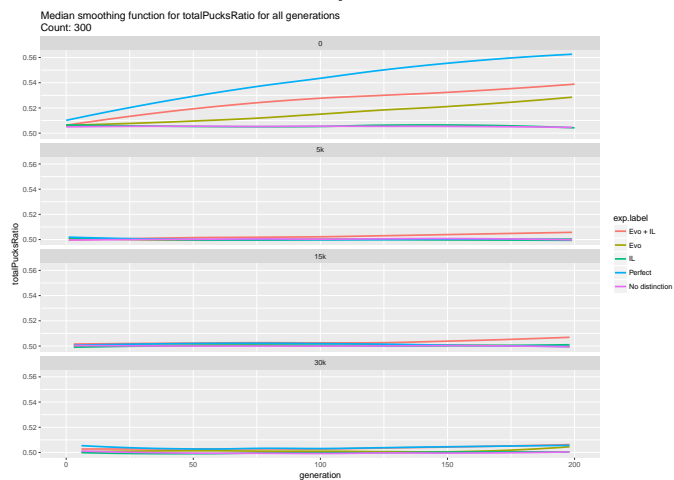
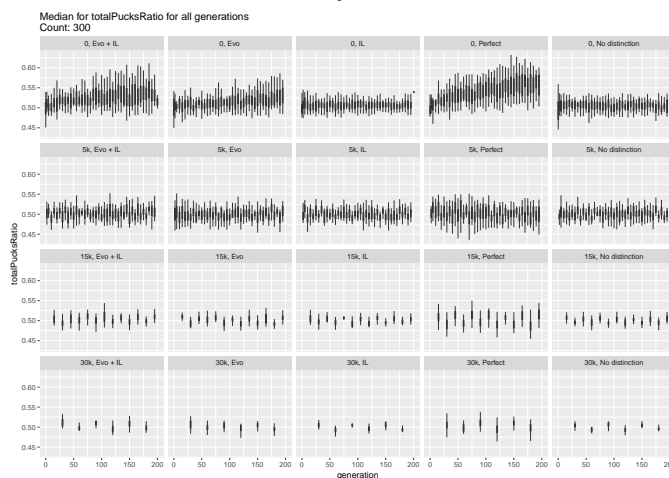
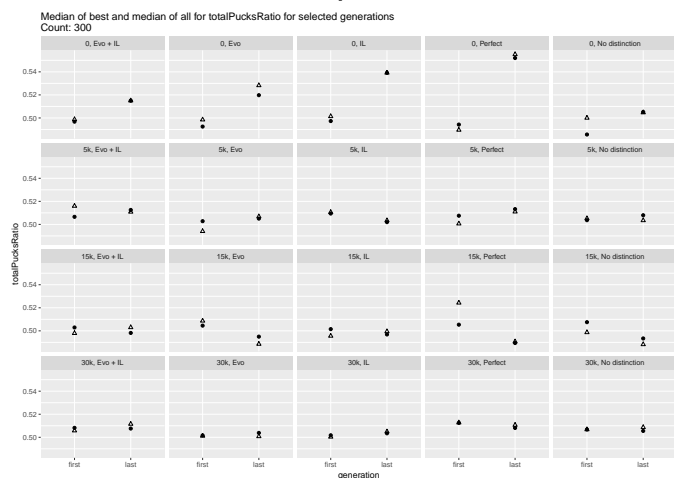
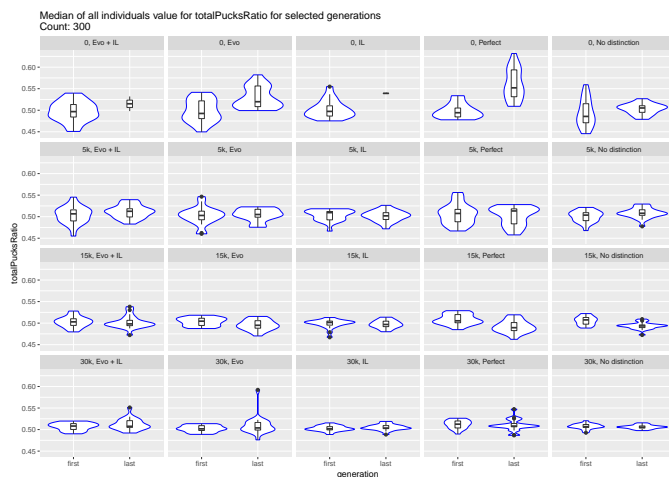
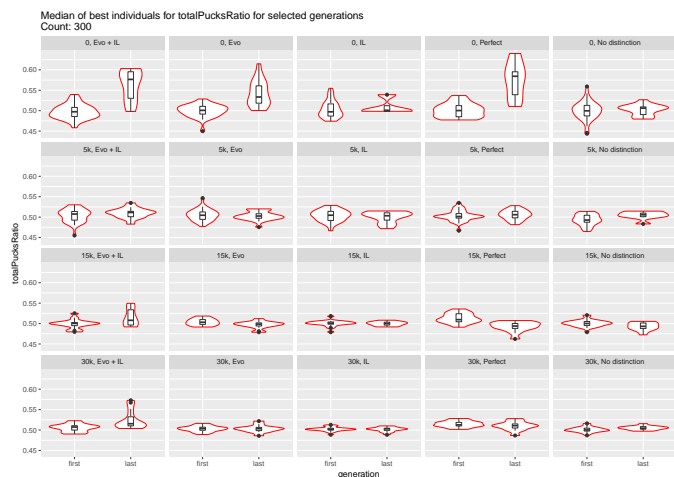


Figure 1.1: Normalised difference between positive and negative tokens collected. Solid line is value combined over all seasons, dashed = season 0, dotted = season 1

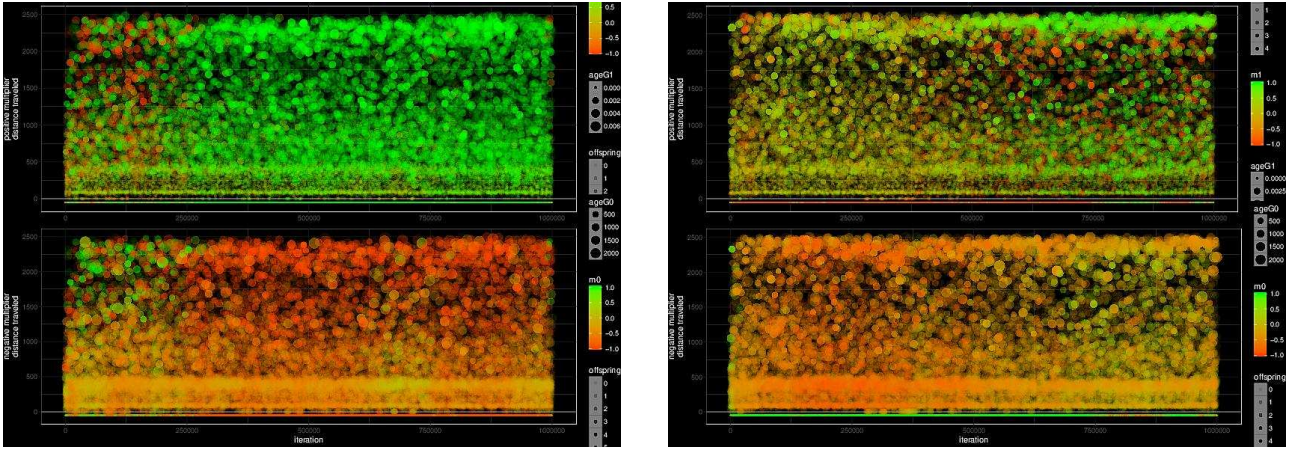
Chapter 2

Count: 300 Value: 1150



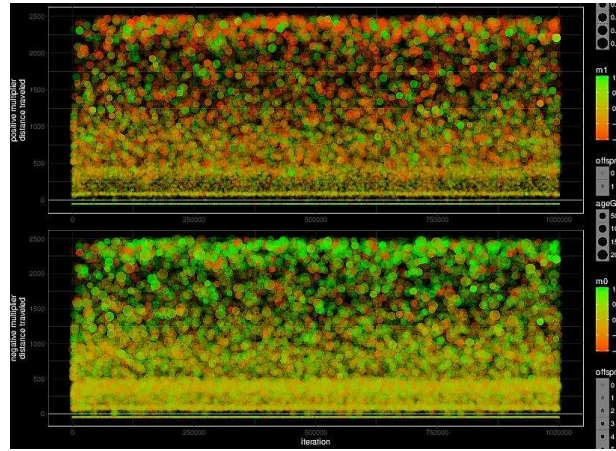
2.1 Experiments by Seasons. Count: 300 Value: 1150

2.1.1 Season: 0, Count: 300 Value: 1150



(a) Evo + IL

(b) Evo



(c) IL

Figure 2.1: The graphs show multiple performance values to compare different adaptation mechanism: evolution combined with individual learning (a), just evolution (b) and just individual learning (c). Data plotted shows 10% of the population (randomly sampled) and is taken from a single randomly selected run of the experiment. Each sub-graph shows the value of a single multiplier (names "positive" and "negative" refer to the initial value of the corresponding token), hence each genome has a data point on each of the sub-graphs. The values end-of-lifetime (x position), reproductive success (transparency; measured in number of offspring), adaptation success (size; measured in negative/positive token avoided/collected per life-time) and distance travelled (y-value) are the same in each sub-graph. The red/green lines below the y-axis is made up of dots, each representing the learning sign LS of the individuals: red=negative and green=positive. Note that LS is negated in the lower sub-graph.

	Evo	IL	Evo + IL	Baseline	Perfect
1	0.5306	0.5301	0.5034	0.5624	0.5029

Table 2.1: Median value of $totalPucksRatio$ over the last 5000 iteration (N:30). Seasonal change every 0 iterations for configuration $count=300$ and $value=1150$.

	IL	Evo + IL	Baseline	Perfect
Evo	> 6.04e-35	= 6.64e-01	> 3.96e-64	< 2.18e-32
IL		< 3.6e-26	= 1.64e-01	< 4.39e-66
Evo + IL			> 1.02e-43	< 1.01e-18
Baseline				< 2.34e-111

Table 2.2: Showing p-values of pairwise comparison of experiments for $totalPucksRatio$ (row vs. column) over the last 5000 iteration (N:30). Seasonal change every 0 iterations for configuration $count=300$ and $value=1150$. The symbols =, \neq , <, >, indicate whether the median values for $totalPucksRatio$ are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

2.1.2 Season: 5k, Count: 300 Value: 1150

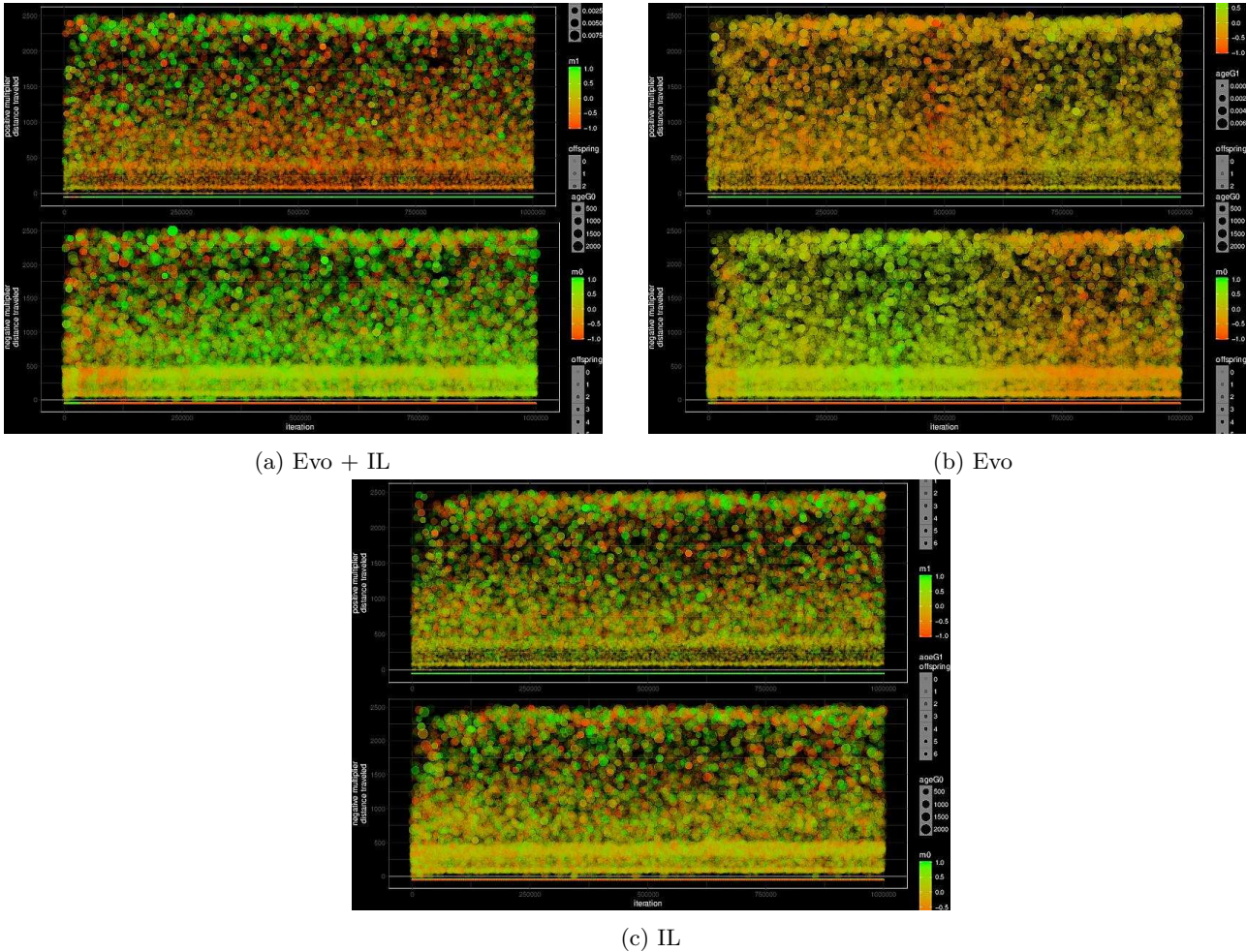


Figure 2.2: The graphs show multiple performance values to compare different adaptation mechanism: evolution combined with individual learning (a), just evolution (b) and just individual learning (c). Data plotted shows 10% of the population (randomly sampled) and is taken from a single randomly selected run of the experiment. Each sub-graph shows the value of a single multiplier (names "positive" and "negative" refer to the initial value of the corresponding token), hence each genome has a data point on each of the sub-graphs. The values end-of-lifetime (x position), reproductive success (transparency; measured in number of offspring), adaptation success (size; measured in negative/positive token avoided/collected per life-time) and distance travelled (y-value) are the same in each sub-graph. The red/green lines below the y-axis is made up of dots, each representing the learning sign LS of the individuals: red=negative and green=positive. Note that LS is negated in the lower sub-graph.

	Evo	IL	Evo + IL	Baseline	Perfect
1	0.5029	0.4995	0.5006	0.5043	0.5013

Table 2.3: Median value of $totalPucksRatio$ over the last 5000 iteration (N:30). Seasonal change every 5k iterations for configuration $count=300$ and $value=1150$.

	IL	Evo + IL	Baseline	Perfect
Evo	= 8.45e-01	< 3.18e-05	= 8.11e-02	= 5.38e-02
IL		< 1.27e-04	= 1.17e-01	< 2.23e-02
Evo + IL			> 2.18e-02	= 1.59e-01
Baseline				= 5.47e-01

Table 2.4: Showing p-values of pairwise comparison of experiments for $totalPucksRatio$ (row vs. column) over the last 5000 iteration (N:30). Seasonal change every 5k iterations for configuration $count=300$ and $value=1150$. The symbols =, ≠, <, >, indicate whether the median values for $totalPucksRatio$ are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

2.1.3 Season: 15k, Count: 300 Value: 1150

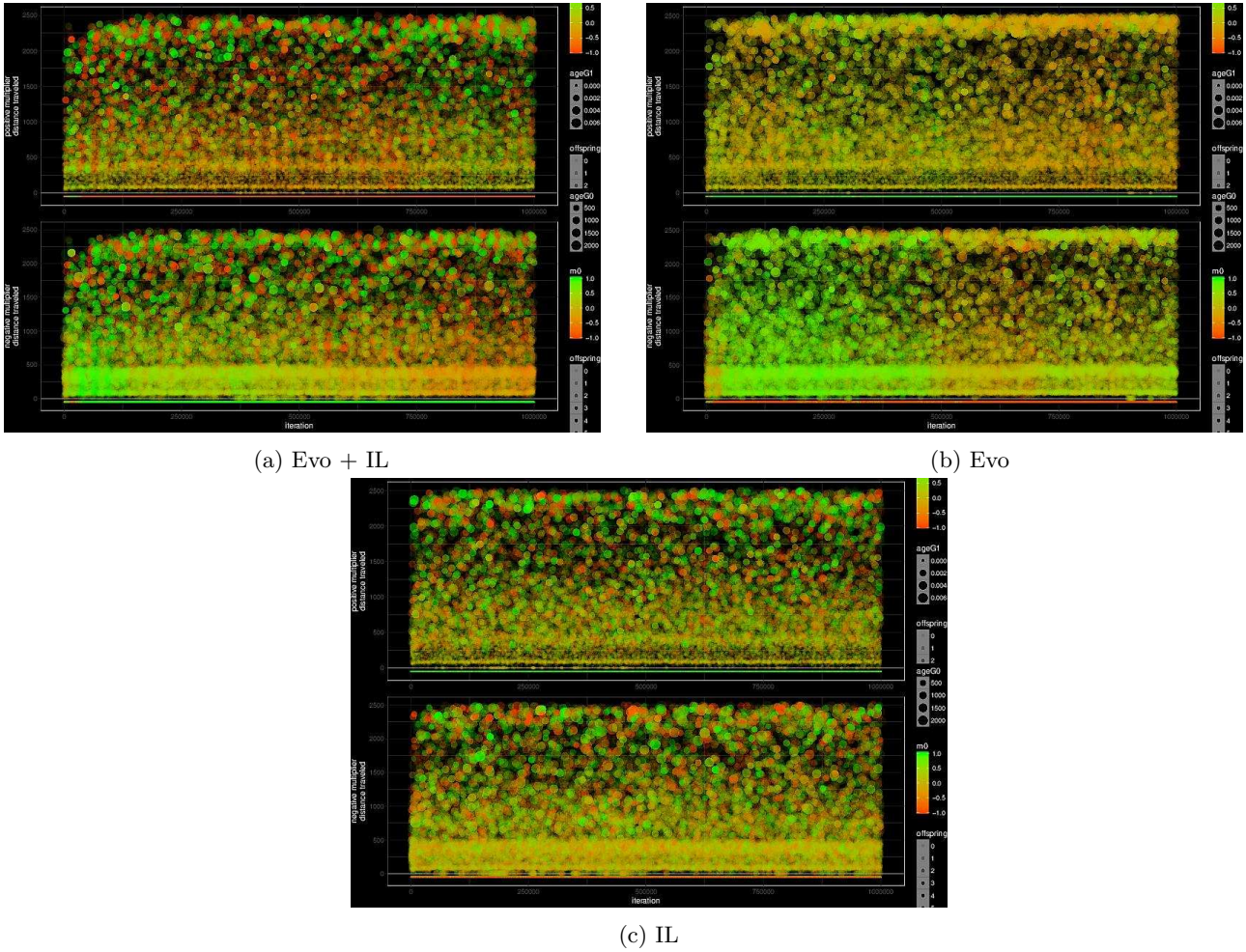


Figure 2.3: The graphs show multiple performance values to compare different adaptation mechanism: evolution combined with individual learning (a), just evolution (b) and just individual learning (c). Data plotted shows 10% of the population (randomly sampled) and is taken from a single randomly selected run of the experiment. Each sub-graph shows the value of a single multiplier (names "positive" and "negative" refer to the initial value of the corresponding token), hence each genome has a data point on each of the sub-graphs. The values end-of-lifetime (x position), reproductive success (transparency; measured in number of offspring), adaptation success (size; measured in negative/positive token avoided/collected per life-time) and distance travelled (y-value) are the same in each sub-graph. The red/green lines below the y-axis is made up of dots, each representing the learning sign LS of the individuals: red=negative and green=positive. Note that LS is negated in the lower sub-graph.

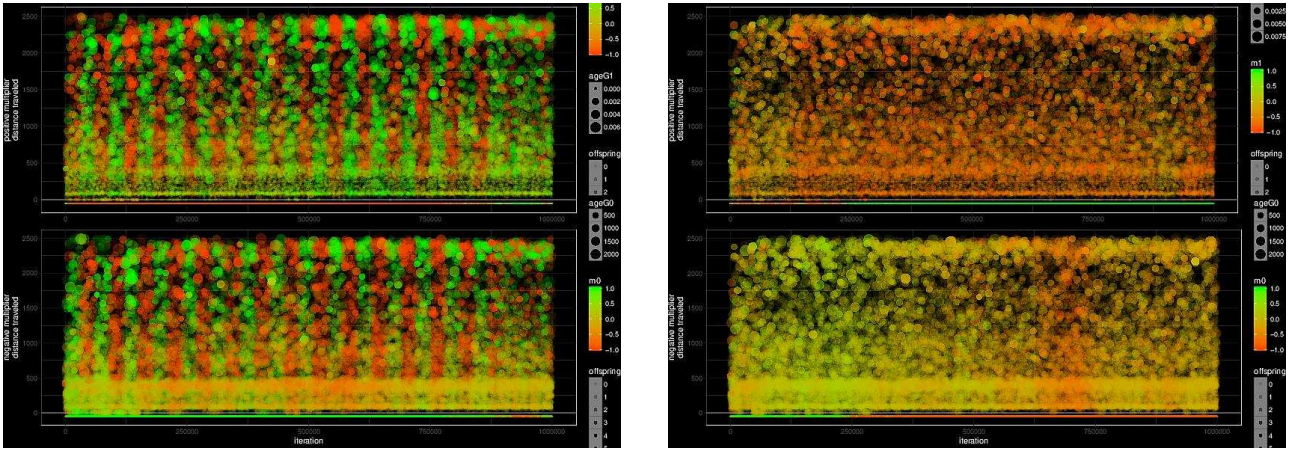
	Evo	IL	Evo + IL	Baseline	Perfect
1	0.4981	0.4960	0.4973	0.4877	0.4929

Table 2.5: Median value of $totalPucksRatio$ over the last 5000 iteration (N:30). Seasonal change every 15k iterations for configuration $count=300$ and $value=1150$.

	IL	Evo + IL	Baseline	Perfect
Evo	= 7.84e-02	< 8.55e-04	> 7.84e-04	> 9.88e-06
IL		= 5.27e-02	> 9.3e-09	> 5.65e-09
Evo + IL			> 1.37e-14	> 3.98e-13
Baseline				= 5.94e-02

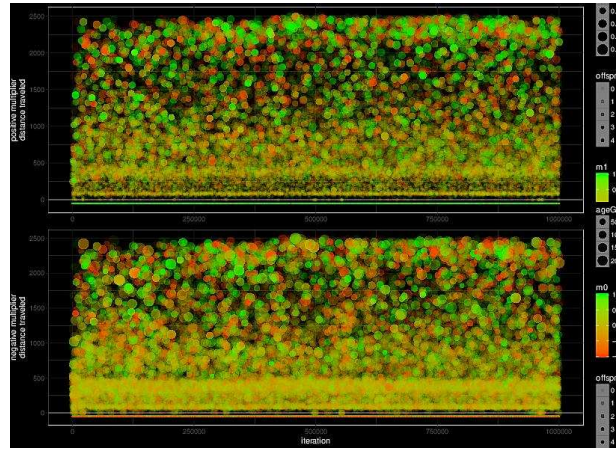
Table 2.6: Showing p-values of pairwise comparison of experiments for $totalPucksRatio$ (row vs. column) over the last 5000 iteration (N:30). Seasonal change every 15k iterations for configuration $count=300$ and $value=1150$. The symbols =, ≠, <, >, indicate whether the median values for $totalPucksRatio$ are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

2.1.4 Season: 30k, Count: 300 Value: 1150



(a) Evo + IL

(b) Evo



(c) IL

Figure 2.4: The graphs show multiple performance values to compare different adaptation mechanism: evolution combined with individual learning (a), just evolution (b) and just individual learning (c). Data plotted shows 10% of the population (randomly sampled) and is taken from a single randomly selected run of the experiment. Each sub-graph shows the value of a single multiplier (names "positive" and "negative" refer to the initial value of the corresponding token), hence each genome has a data point on each of the sub-graphs. The values end-of-lifetime (x position), reproductive success (transparency; measured in number of offspring), adaptation success (size; measured in negative/positive token avoided/collected per life-time) and distance travelled (y-value) are the same in each sub-graph. The red/green lines below the y-axis is made up of dots, each representing the learning sign LS of the individuals: red=negative and green=positive. Note that LS is negated in the lower sub-graph.

	Evo	IL	Evo + IL	Baseline	Perfect
1	0.5093	0.5038	0.5031	0.5079	0.5056

Table 2.7: Median value of $totalPucksRatio$ over the last 5000 iteration (N:30). Seasonal change every 30k iterations for configuration $count=300$ and $value=1150$.

	IL	Evo + IL	Baseline	Perfect
Evo	= 2.3e-01	< 5.07e-09	< 1.13e-02	< 2.88e-03
IL		< 2.47e-16	< 8.09e-07	< 2.68e-06
Evo + IL			> 2.19e-07	> 1.66e-02
Baseline				= 1.18e-01

Table 2.8: Showing p-values of pairwise comparison of experiments for $totalPucksRatio$ (row vs. column) over the last 5000 iteration (N:30). Seasonal change every 30k iterations for configuration $count=300$ and $value=1150$. The symbols =, ≠, <, >, indicate whether the median values for $totalPucksRatio$ are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

2.2 Seasons by Experiments. Count: 300 Value: 1150

2.2.1 Experiment: Evo, Count: 300 Value: 1150

	0	5k	15k	30k
1	0.5301	0.4995	0.4960	0.5038

Table 2.9: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo* for configuration *count*=300 and *value*=1150.

	5k	15k	30k
0	> 9.09e-69	> 6.76e-55	> 1.14e-33
5k		> 1.89e-02	< 3.86e-06
15k			< 8.75e-14

Table 2.10: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo* for configuration *count*=300 and *value*=1150. The symbols =, ≠, <, >, indicate whether the median values for *totalPucksRatio* are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

2.2.2 Experiment: IL, Count: 300 Value: 1150

	0	5k	15k	30k
1	0.5034	0.5006	0.4973	0.5031

Table 2.11: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *IL* for configuration *count*=300 and *value*=1150.

	5k	15k	30k
0	> 2.54e-05	> 6.93e-09	= 5.56e-01
5k		= 7.61e-02	< 6.88e-05
15k			< 8.5e-09

Table 2.12: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *IL* for configuration *count*=300 and *value*=1150. The symbols =, ≠, <, >, indicate whether the median values for *totalPucksRatio* are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

2.2.3 Experiment: Evo + IL, Count: 300 Value: 1150

	0	5k	15k	30k
1	0.5306	0.5029	0.4981	0.5093

Table 2.13: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo + IL* for configuration *count*=300 and *value*=1150.

	5k	15k	30k
0	> 2.82e-35	> 1.37e-31	> 3.24e-16
5k		> 1.7e-02	< 2.96e-11
15k			< 1.14e-18

Table 2.14: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo + IL* for configuration *count*=300 and *value*=1150. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

2.2.4 Experiment: Baseline, Count: 300 Value: 1150

	0	5k	15k	30k
1	0.5029	0.5013	0.4929	0.5056

Table 2.15: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Baseline* for configuration *count*=300 and *value*=1150.

	5k	15k	30k
0	= 6.66e-02	> 2.53e-33	< 6.54e-06
5k		> 9.38e-17	< 1.24e-08
15k			< 1.78e-52

Table 2.16: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Baseline* for configuration *count*=300 and *value*=1150. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

2.2.5 Experiment: Perfect, Count: 300 Value: 1150

	0	5k	15k	30k
1	0.5624	0.5043	0.4877	0.5079

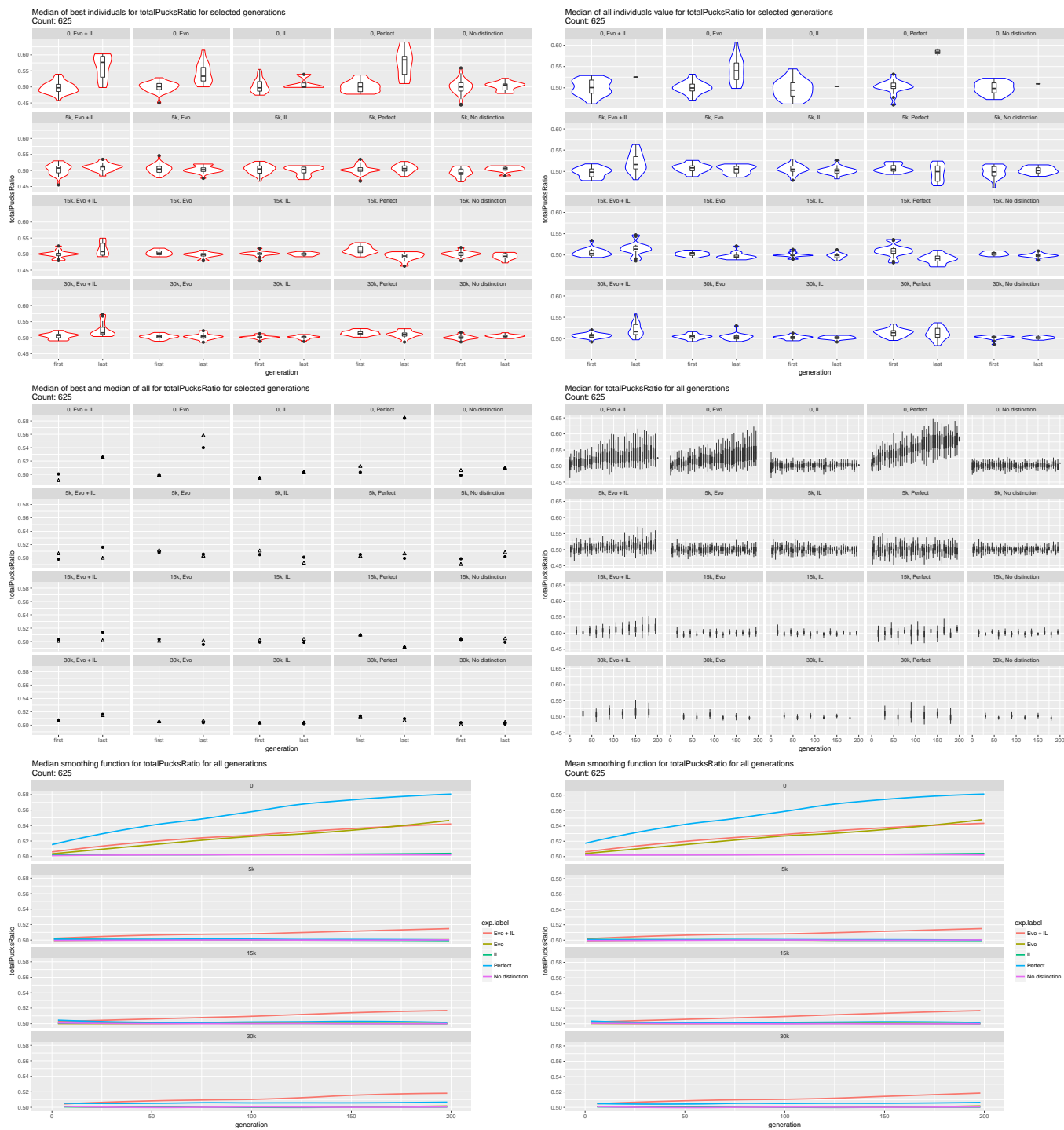
Table 2.17: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Perfect* for configuration *count*=300 and *value*=1150.

	5k	15k	30k
0	> 1.18e-101	> 8.48e-85	> 2.59e-66
5k		> 1.49e-12	< 5.78e-05
15k			< 1.6e-33

Table 2.18: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Perfect* for configuration *count*=300 and *value*=1150. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

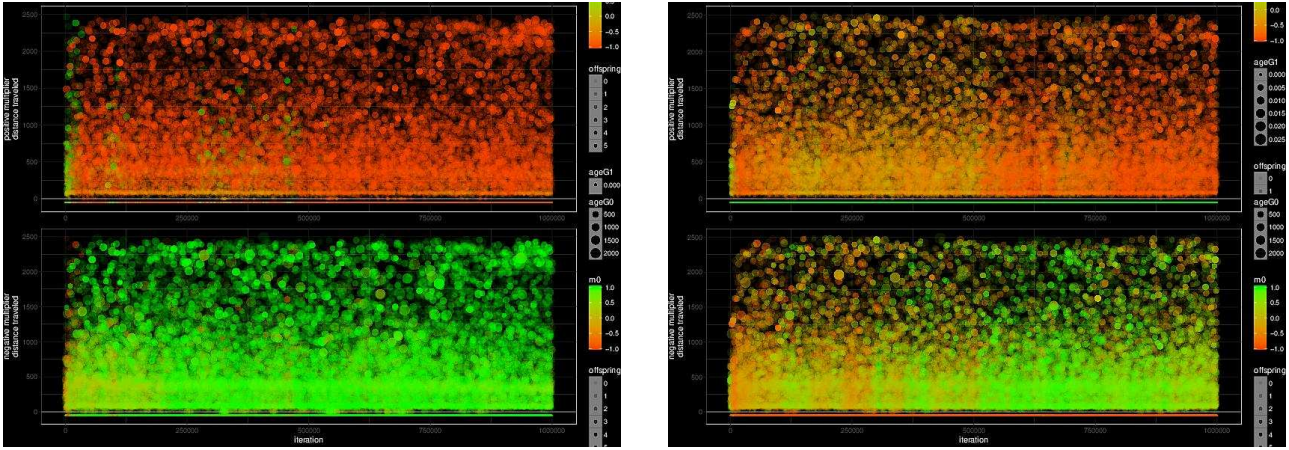
Chapter 3

Count: 625 Value: 625



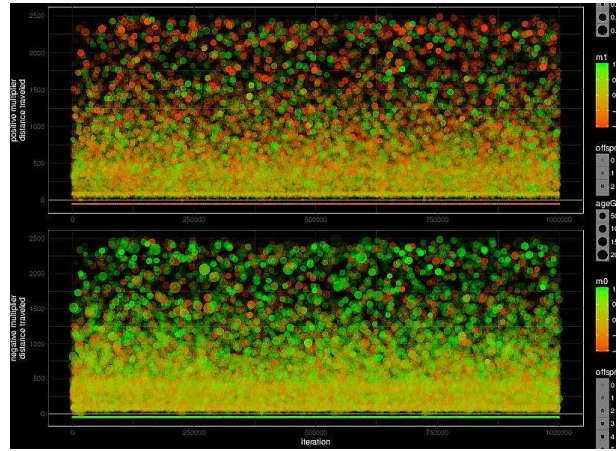
3.1 Experiments by Seasons. Count: 625 Value: 625

3.1.1 Season: 0, Count: 625 Value: 625



(a) Evo + IL

(b) Evo



(c) IL

Figure 3.1: The graphs show multiple performance values to compare different adaptation mechanism: evolution combined with individual learning (a), just evolution (b) and just individual learning (c). Data plotted shows 10% of the population (randomly sampled) and is taken from a single randomly selected run of the experiment. Each sub-graph shows the value of a single multiplier (names "positive" and "negative" refer to the initial value of the corresponding token), hence each genome has a data point on each of the sub-graphs. The values end-of-lifetime (x position), reproductive success (transparency; measured in number of offspring), adaptation success (size; measured in negative/positive token avoided/collected per life-time) and distance travelled (y-value) are the same in each sub-graph. The red/green lines below the y-axis is made up of dots, each representing the learning sign LS of the individuals: red=negative and green=positive. Note that LS is negated in the lower sub-graph.

	Evo	IL	Evo + IL	Baseline	Perfect
1	0.5388	0.5411	0.5056	0.5868	0.5055

Table 3.1: Median value of $totalPucksRatio$ over the last 5000 iteration (N:30). Seasonal change every 0 iterations for configuration $count=625$ and $value=625$.

	IL	Evo + IL	Baseline	Perfect
Evo	> 8.51e-77	= 4.32e-01	> 2.59e-74	< 6.72e-52
IL		< 6.66e-59	= 1.31e-01	< 1.94e-81
Evo + IL			> 5.52e-59	< 2.6e-34
Baseline				< 1.88e-78

Table 3.2: Showing p-values of pairwise comparison of experiments for $totalPucksRatio$ (row vs. column) over the last 5000 iteration (N:30). Seasonal change every 0 iterations for configuration $count=625$ and $value=625$. The symbols =, ≠, <, >, indicate whether the median values for $totalPucksRatio$ are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

3.1.2 Season: 5k, Count: 625 Value: 625

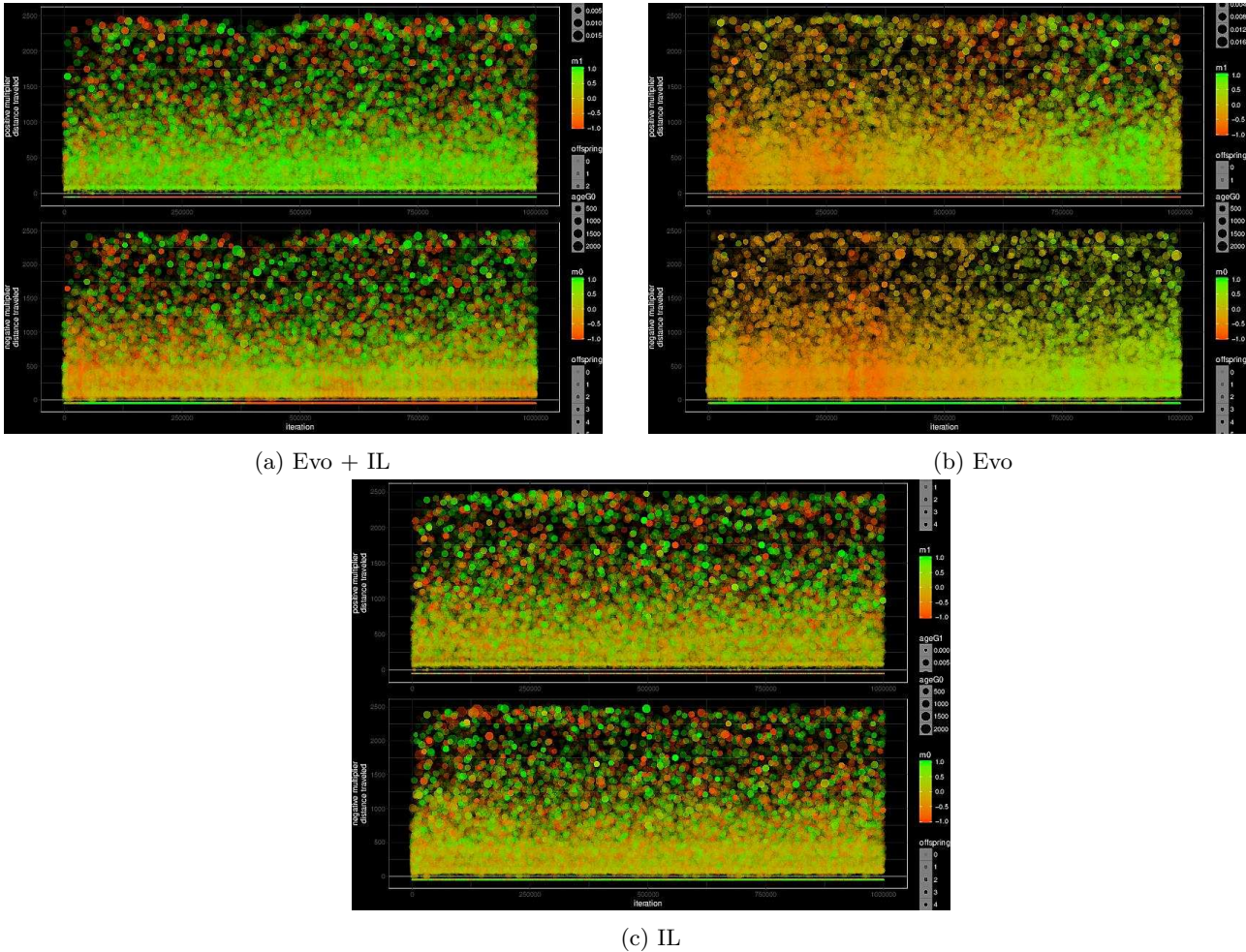


Figure 3.2: The graphs show multiple performance values to compare different adaptation mechanism: evolution combined with individual learning (a), just evolution (b) and just individual learning (c). Data plotted shows 10% of the population (randomly sampled) and is taken from a single randomly selected run of the experiment. Each sub-graph shows the value of a single multiplier (names "positive" and "negative" refer to the initial value of the corresponding token), hence each genome has a data point on each of the sub-graphs. The values end-of-lifetime (x position), reproductive success (transparency; measured in number of offspring), adaptation success (size; measured in negative/positive token avoided/collected per life-time) and distance travelled (y-value) are the same in each sub-graph. The red/green lines below the y-axis is made up of dots, each representing the learning sign LS of the individuals: red=negative and green=positive. Note that LS is negated in the lower sub-graph.

	Evo	IL	Evo + IL	Baseline	Perfect
1	0.5134	0.4982	0.4975	0.4995	0.5004

Table 3.3: Median value of $totalPucksRatio$ over the last 5000 iteration (N:30). Seasonal change every 5k iterations for configuration $count=625$ and $value=625$.

	IL	Evo + IL	Baseline	Perfect
Evo	> 4.42e-06	< 3.36e-55	= 1.18e-01	= 9.62e-01
IL		< 3.6e-70	< 1.72e-10	< 2.41e-02
Evo + IL			> 3.6e-52	> 1.09e-37
Baseline				= 3.05e-01

Table 3.4: Showing p-values of pairwise comparison of experiments for $totalPucksRatio$ (row vs. column) over the last 5000 iteration (N:30). Seasonal change every 5k iterations for configuration $count=625$ and $value=625$. The symbols =, ≠, <, >, indicate whether the median values for $totalPucksRatio$ are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

3.1.3 Season: 15k, Count: 625 Value: 625

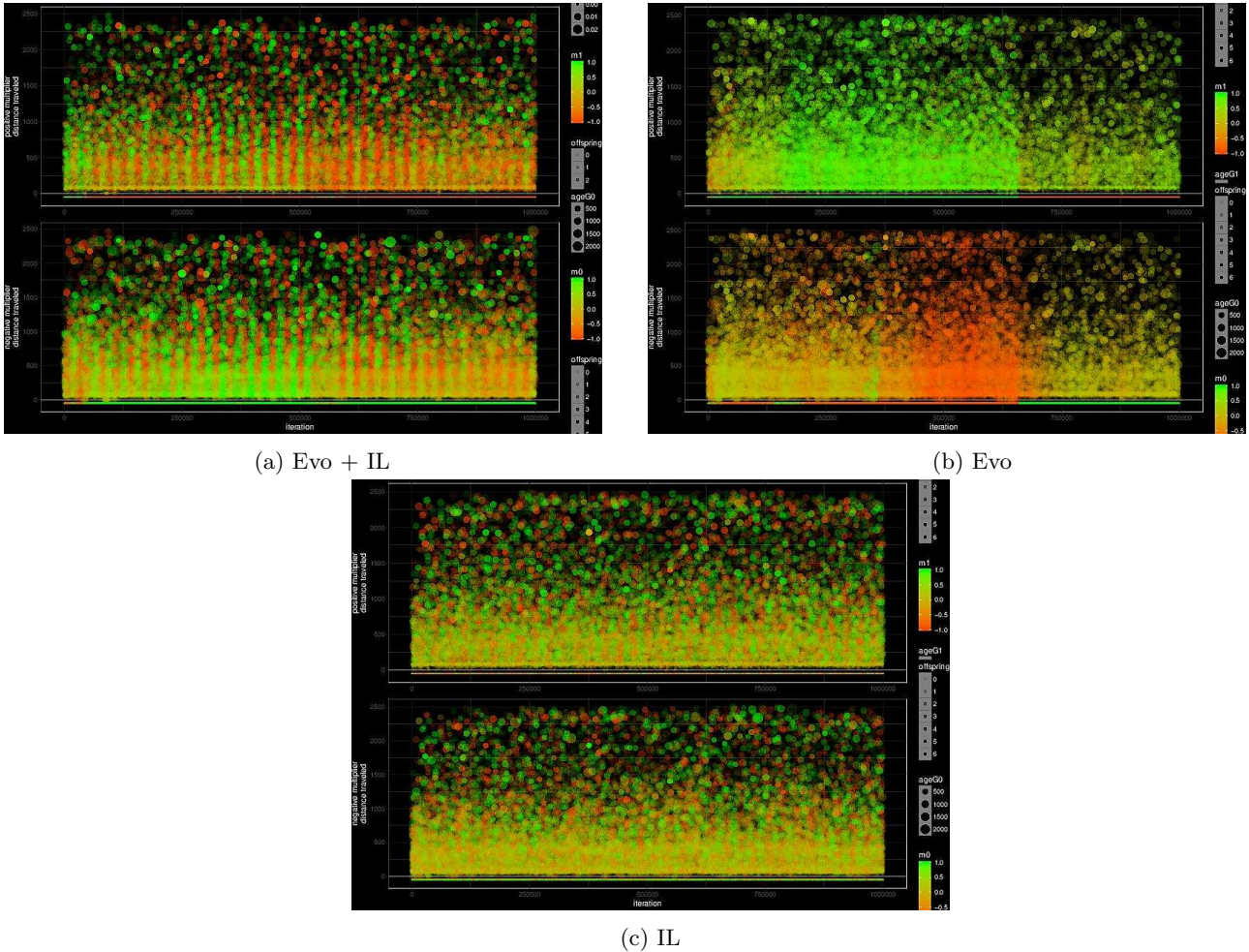


Figure 3.3: The graphs show multiple performance values to compare different adaptation mechanism: evolution combined with individual learning (a), just evolution (b) and just individual learning (c). Data plotted shows 10% of the population (randomly sampled) and is taken from a single randomly selected run of the experiment. Each sub-graph shows the value of a single multiplier (names "positive" and "negative" refer to the initial value of the corresponding token), hence each genome has a data point on each of the sub-graphs. The values end-of-lifetime (x position), reproductive success (transparency; measured in number of offspring), adaptation success (size; measured in negative/positive token avoided/collected per life-time) and distance travelled (y-value) are the same in each sub-graph. The red/green lines below the y-axis is made up of dots, each representing the learning sign LS of the individuals: red=negative and green=positive. Note that LS is negated in the lower sub-graph.

	Evo	IL	Evo + IL	Baseline	Perfect
1	0.5136	0.4950	0.4993	0.4924	0.4990

Table 3.5: Median value of $totalPucksRatio$ over the last 5000 iteration (N:30). Seasonal change every 15k iterations for configuration $count=625$ and $value=625$.

	IL	Evo + IL	Baseline	Perfect
Evo	< 7.4e-03	< 1.09e-41	< 2.11e-07	> 1.07e-07
IL		< 5.83e-42	= 2.01e-01	> 1.36e-07
Evo + IL			> 1.04e-44	> 1.51e-50
Baseline				> 3.37e-12

Table 3.6: Showing p-values of pairwise comparison of experiments for $totalPucksRatio$ (row vs. column) over the last 5000 iteration (N:30). Seasonal change every 15k iterations for configuration $count=625$ and $value=625$. The symbols =, ≠, <, >, indicate whether the median values for $totalPucksRatio$ are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

3.1.4 Season: 30k, Count: 625 Value: 625

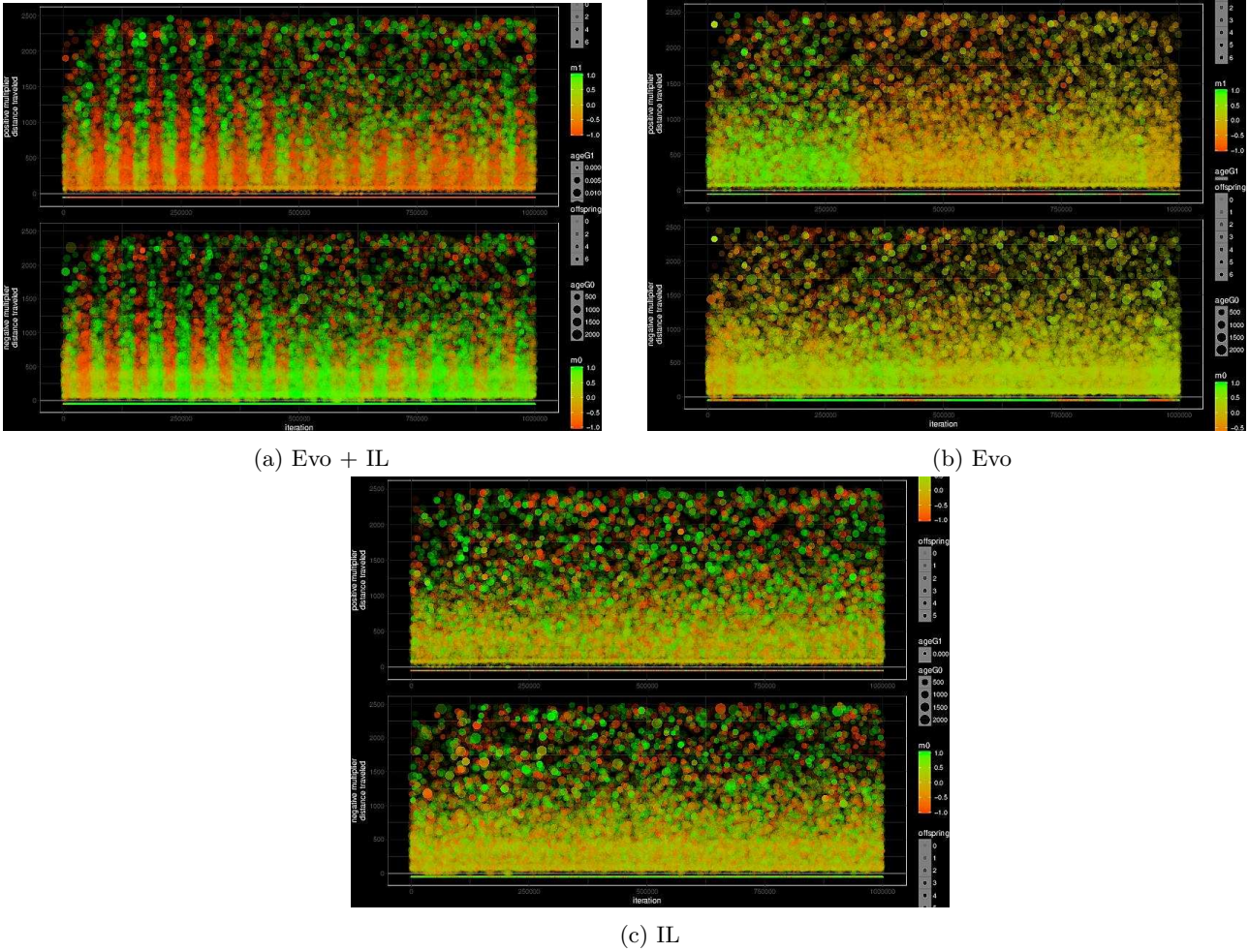


Figure 3.4: The graphs show multiple performance values to compare different adaptation mechanism: evolution combined with individual learning (a), just evolution (b) and just individual learning (c). Data plotted shows 10% of the population (randomly sampled) and is taken from a single randomly selected run of the experiment. Each sub-graph shows the value of a single multiplier (names "positive" and "negative" refer to the initial value of the corresponding token), hence each genome has a data point on each of the sub-graphs. The values end-of-lifetime (x position), reproductive success (transparency; measured in number of offspring), adaptation success (size; measured in negative/positive token avoided/collected per life-time) and distance travelled (y-value) are the same in each sub-graph. The red/green lines below the y-axis is made up of dots, each representing the learning sign LS of the individuals: red=negative and green=positive. Note that LS is negated in the lower sub-graph.

	Evo	IL	Evo + IL	Baseline	Perfect
1	0.5159	0.5056	0.5012	0.5087	0.5015

Table 3.7: Median value of $totalPucksRatio$ over the last 5000 iteration (N:30). Seasonal change every 30k iterations for configuration $count=625$ and $value=625$.

	IL	Evo + IL	Baseline	Perfect
Evo	> 2.33e-06	< 8.79e-43	> 2.82e-08	< 1.01e-09
IL		< 1.33e-65	= 9.15e-01	< 1.78e-21
Evo + IL			> 3.52e-74	> 8.02e-15
Baseline				< 2.77e-25

Table 3.8: Showing p-values of pairwise comparison of experiments for $totalPucksRatio$ (row vs. column) over the last 5000 iteration (N:30). Seasonal change every 30k iterations for configuration $count=625$ and $value=625$. The symbols =, ≠, <, >, indicate whether the median values for $totalPucksRatio$ are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

3.2 Seasons by Experiments. Count: 625 Value: 625

3.2.1 Experiment: Evo, Count: 625 Value: 625

	0	5k	15k	30k
1	0.5411	0.4982	0.4950	0.5056

Table 3.9: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo* for configuration *count*=625 and *value*=625.

	5k	15k	30k
0	> 1.2e-131	> 4.34e-99	> 7.43e-74
5k		> 1.67e-05	< 1.43e-12
15k			< 1.35e-31

Table 3.10: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo* for configuration *count*=625 and *value*=625. The symbols =, ≠, <, >, indicate whether the median values for *totalPucksRatio* are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

3.2.2 Experiment: IL, Count: 625 Value: 625

	0	5k	15k	30k
1	0.5056	0.4975	0.4993	0.5012

Table 3.11: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *IL* for configuration *count*=625 and *value*=625.

	5k	15k	30k
0	> 4.05e-27	> 4.43e-20	> 3.9e-06
5k		= 8.51e-02	< 2.14e-16
15k			< 9.85e-14

Table 3.12: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *IL* for configuration *count*=625 and *value*=625. The symbols =, ≠, <, >, indicate whether the median values for *totalPucksRatio* are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

3.2.3 Experiment: Evo + IL, Count: 625 Value: 625

	0	5k	15k	30k
1	0.5388	0.5134	0.5136	0.5159

Table 3.13: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo + IL* for configuration *count*=625 and *value*=625.

	5k	15k	30k
0	> 1.76e-32	> 4.15e-32	> 7.06e-18
5k		= 4.38e-01	< 1.57e-07
15k			< 6.91e-07

Table 3.14: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo + IL* for configuration *count*=625 and *value*=625. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

3.2.4 Experiment: Baseline, Count: 625 Value: 625

	0	5k	15k	30k
1	0.5055	0.5004	0.4990	0.5015

Table 3.15: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Baseline* for configuration *count*=625 and *value*=625.

	5k	15k	30k
0	> 3.21e-07	> 7.35e-18	> 1.24e-05
5k		> 4.61e-04	< 1.39e-02
15k			< 4.54e-15

Table 3.16: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Baseline* for configuration *count*=625 and *value*=625. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

3.2.5 Experiment: Perfect, Count: 625 Value: 625

	0	5k	15k	30k
1	0.5868	0.4995	0.4924	0.5087

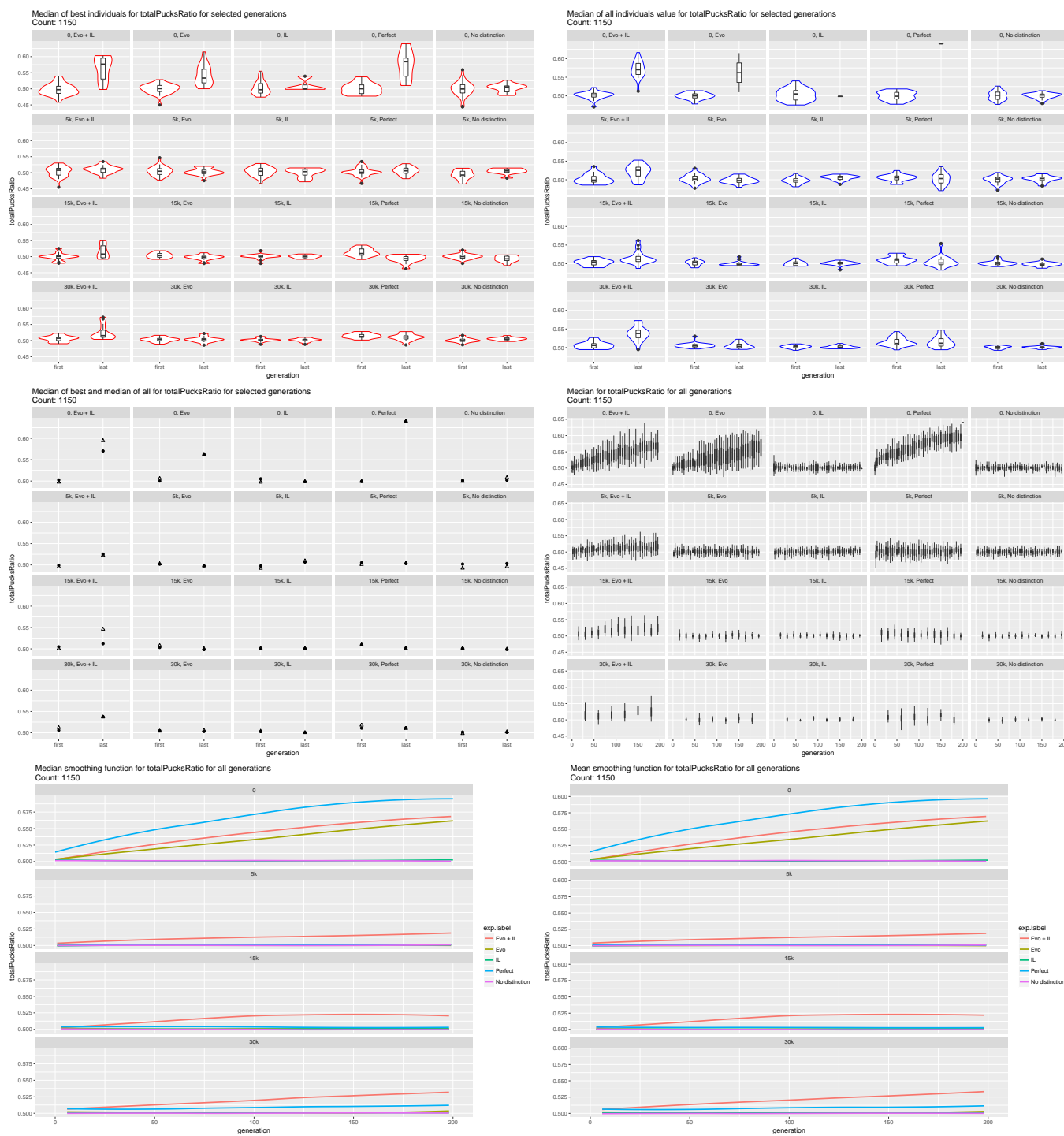
Table 3.17: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Perfect* for configuration *count*=625 and *value*=625.

	5k	15k	30k
0	> 1.58e-98	> 6.55e-82	> 2.09e-76
5k		> 1.94e-06	< 6.84e-15
15k			< 2.06e-35

Table 3.18: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Perfect* for configuration *count*=625 and *value*=625. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

Chapter 4

Count: 1150 Value: 425



4.1 Experiments by Seasons. Count: 1150 Value: 425

4.1.1 Season: 0, Count: 1150 Value: 425

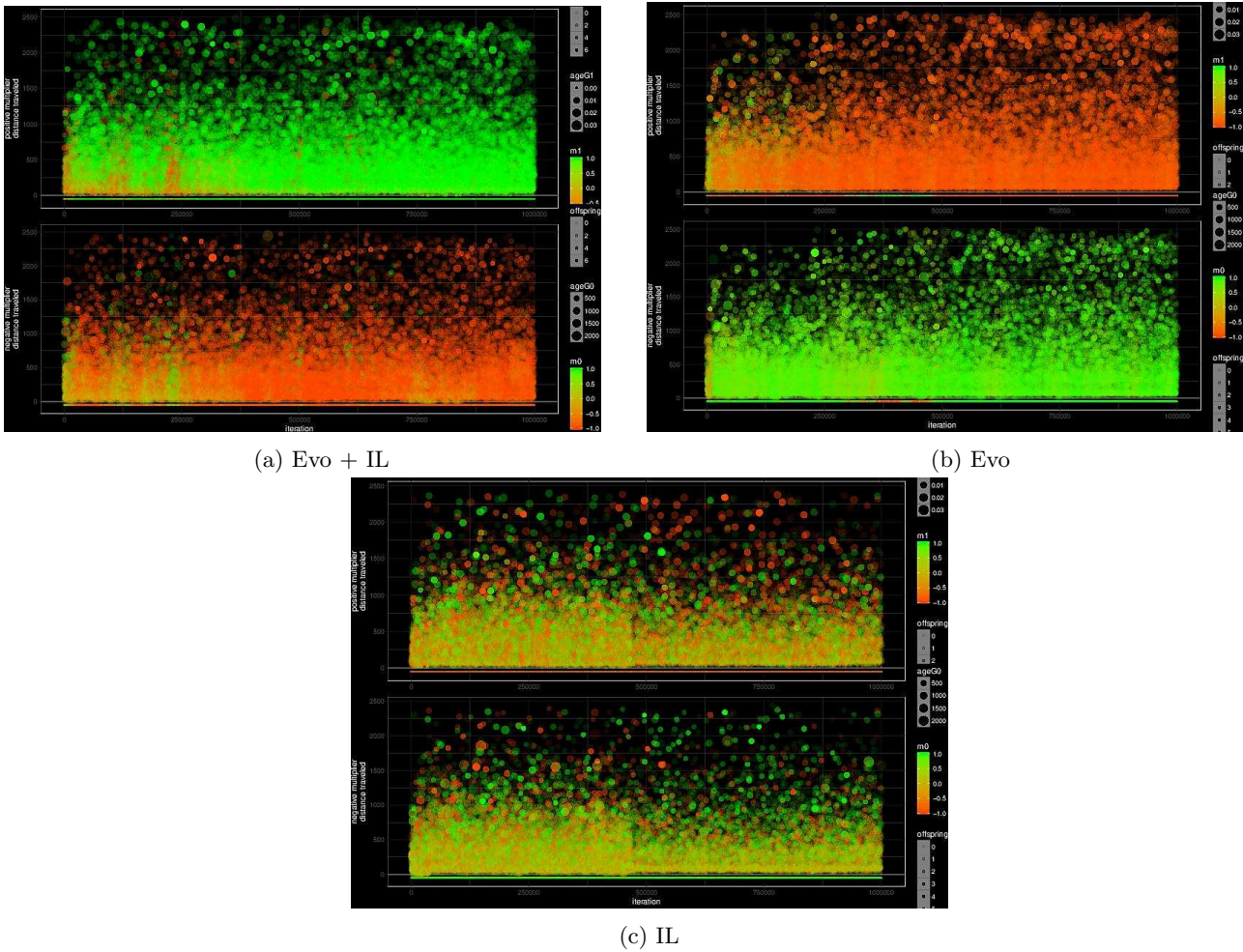


Figure 4.1: The graphs show multiple performance values to compare different adaptation mechanism: evolution combined with individual learning (a), just evolution (b) and just individual learning (c). Data plotted shows 10% of the population (randomly sampled) and is taken from a single randomly selected run of the experiment. Each sub-graph shows the value of a single multiplier (names "positive" and "negative" refer to the initial value of the corresponding token), hence each genome has a data point on each of the sub-graphs. The values end-of-lifetime (x position), reproductive success (transparency; measured in number of offspring), adaptation success (size; measured in negative/positive token avoided/collected per life-time) and distance travelled (y-value) are the same in each sub-graph. The red/green lines below the y-axis is made up of dots, each representing the learning sign LS of the individuals: red=negative and green=positive. Note that LS is negated in the lower sub-graph.

	Evo	IL	Evo + IL	Baseline	Perfect
1	0.5705	0.5662	0.4997	0.5982	0.5008

Table 4.1: Median value of $totalPucksRatio$ over the last 5000 iteration (N:30). Seasonal change every 0 iterations for configuration $count=1150$ and $value=425$.

	IL	Evo + IL	Baseline	Perfect
Evo	> 4.44e-82	< 1.5e-03	> 1.51e-114	< 1.2e-51
IL		< 6.7e-150	= 3.43e-01	< 1.79e-111
Evo + IL			> 5.84e-234	< 2.95e-63
Baseline				< 8.2e-152

Table 4.2: Showing p-values of pairwise comparison of experiments for $totalPucksRatio$ (row vs. column) over the last 5000 iteration (N:30). Seasonal change every 0 iterations for configuration $count=1150$ and $value=425$. The symbols =, \neq , <, >, indicate whether the median values for $totalPucksRatio$ are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

4.1.2 Season: 5k, Count: 1150 Value: 425

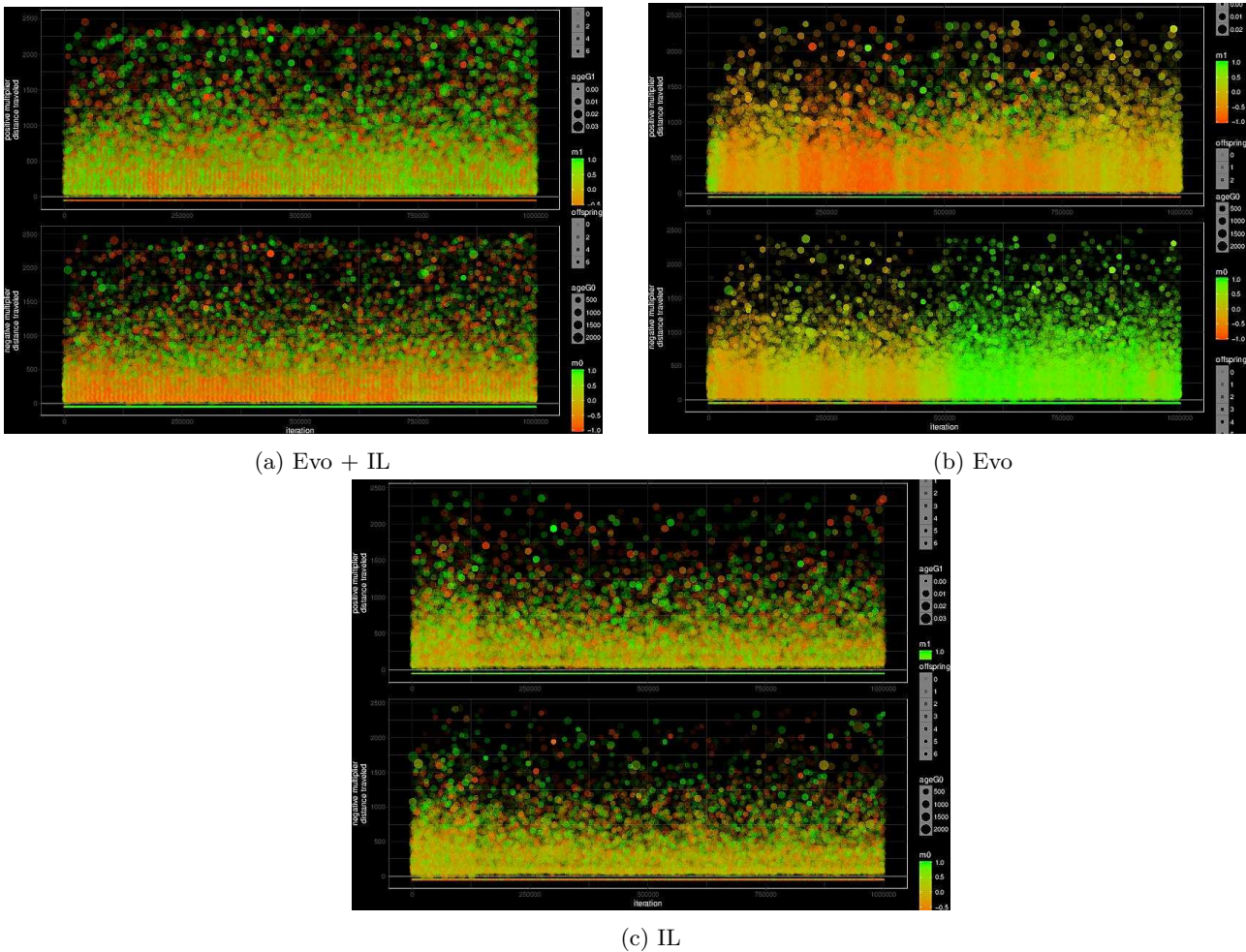


Figure 4.2: The graphs show multiple performance values to compare different adaptation mechanism: evolution combined with individual learning (a), just evolution (b) and just individual learning (c). Data plotted shows 10% of the population (randomly sampled) and is taken from a single randomly selected run of the experiment. Each sub-graph shows the value of a single multiplier (names "positive" and "negative" refer to the initial value of the corresponding token), hence each genome has a data point on each of the sub-graphs. The values end-of-lifetime (x position), reproductive success (transparency; measured in number of offspring), adaptation success (size; measured in negative/positive token avoided/collected per life-time) and distance travelled (y-value) are the same in each sub-graph. The red/green lines below the y-axis is made up of dots, each representing the learning sign LS of the individuals: red=negative and green=positive. Note that LS is negated in the lower sub-graph.

	Evo	IL	Evo + IL	Baseline	Perfect
1	0.5191	0.4989	0.5023	0.5034	0.5003

Table 4.3: Median value of $totalPucksRatio$ over the last 5000 iteration (N:30). Seasonal change every 5k iterations for configuration $count=1150$ and $value=425$.

	IL	Evo + IL	Baseline	Perfect
Evo	< 4.22e-15	< 9.94e-122	< 5.77e-05	< 3.73e-07
IL		< 2.9e-80	> 2.92e-06	= 8.85e-01
Evo + IL			> 1.2e-102	> 3.14e-72
Baseline				< 5.28e-03

Table 4.4: Showing p-values of pairwise comparison of experiments for $totalPucksRatio$ (row vs. column) over the last 5000 iteration (N:30). Seasonal change every 5k iterations for configuration $count=1150$ and $value=425$. The symbols =, ≠, <, >, indicate whether the median values for $totalPucksRatio$ are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

4.1.3 Season: 15k, Count: 1150 Value: 425

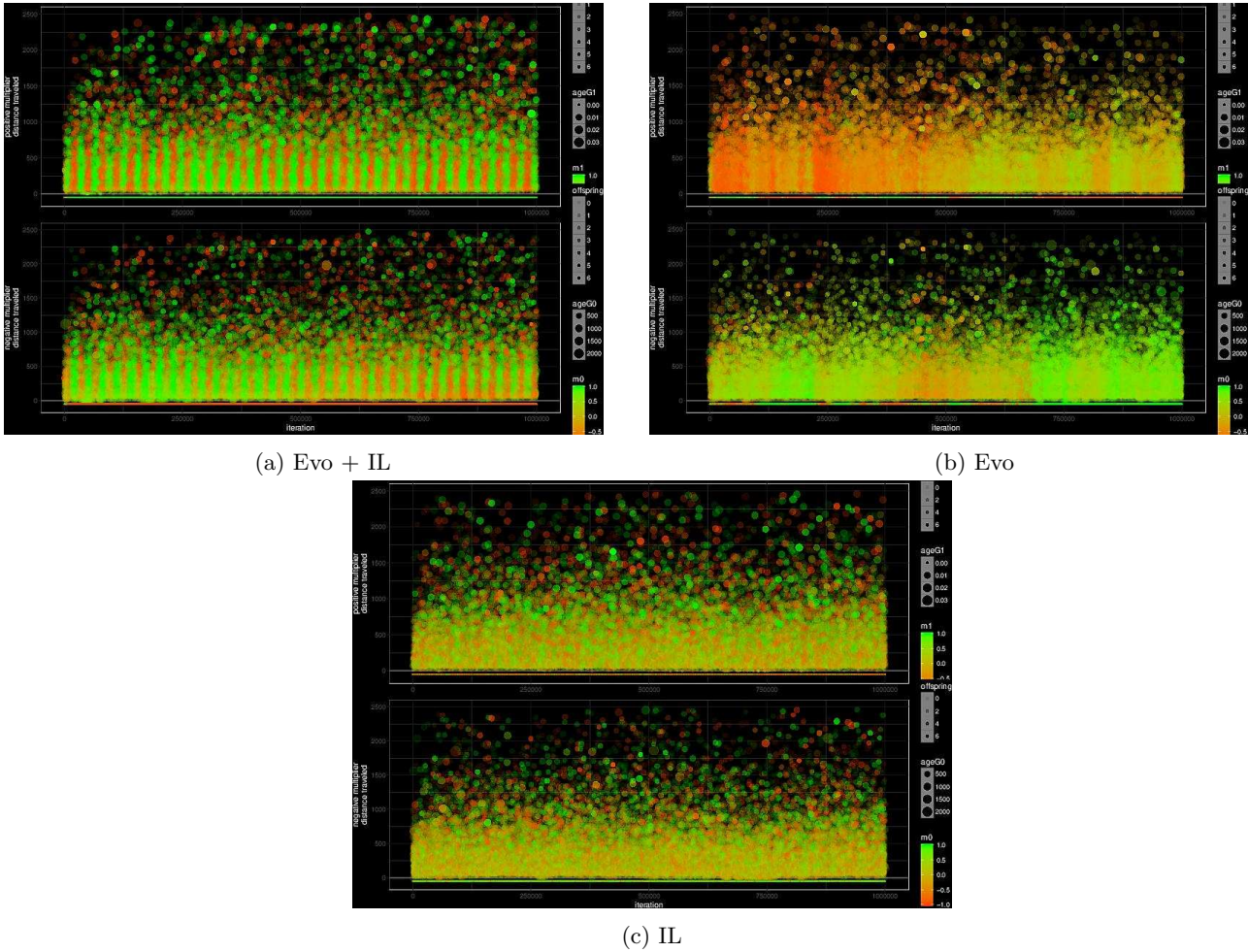


Figure 4.3: The graphs show multiple performance values to compare different adaptation mechanism: evolution combined with individual learning (a), just evolution (b) and just individual learning (c). Data plotted shows 10% of the population (randomly sampled) and is taken from a single randomly selected run of the experiment. Each sub-graph shows the value of a single multiplier (names "positive" and "negative" refer to the initial value of the corresponding token), hence each genome has a data point on each of the sub-graphs. The values end-of-lifetime (x position), reproductive success (transparency; measured in number of offspring), adaptation success (size; measured in negative/positive token avoided/collected per life-time) and distance travelled (y-value) are the same in each sub-graph. The red/green lines below the y-axis is made up of dots, each representing the learning sign LS of the individuals: red=negative and green=positive. Note that LS is negated in the lower sub-graph.

	Evo	IL	Evo + IL	Baseline	Perfect
1	0.5121	0.4981	0.5011	0.5032	0.5001

Table 4.5: Median value of $totalPucksRatio$ over the last 5000 iteration (N:30). Seasonal change every 15k iterations for configuration $count=1150$ and $value=425$.

	IL	Evo + IL	Baseline	Perfect
Evo	< 1.28e-08	< 3.11e-77	= 5.2e-01	< 4.33e-16
IL		< 2.23e-72	> 2.2e-10	< 1.97e-06
Evo + IL			> 1.84e-91	> 2.24e-28
Baseline				< 6.09e-20

Table 4.6: Showing p-values of pairwise comparison of experiments for $totalPucksRatio$ (row vs. column) over the last 5000 iteration (N:30). Seasonal change every 15k iterations for configuration $count=1150$ and $value=425$. The symbols =, ≠, <, >, indicate whether the median values for $totalPucksRatio$ are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

4.1.4 Season: 30k, Count: 1150 Value: 425

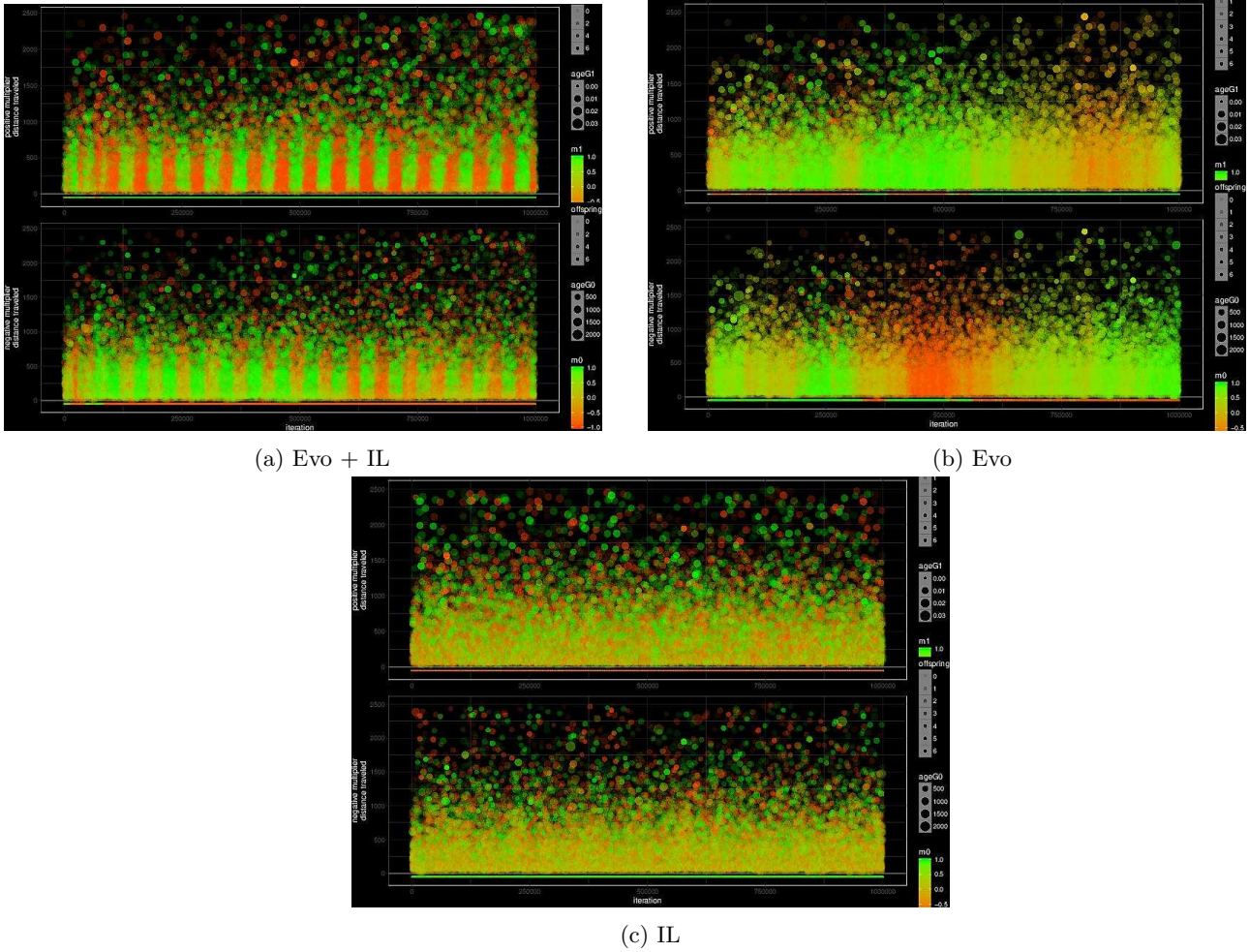


Figure 4.4: The graphs show multiple performance values to compare different adaptation mechanism: evolution combined with individual learning (a), just evolution (b) and just individual learning (c). Data plotted shows 10% of the population (randomly sampled) and is taken from a single randomly selected run of the experiment. Each sub-graph shows the value of a single multiplier (names "positive" and "negative" refer to the initial value of the corresponding token), hence each genome has a data point on each of the sub-graphs. The values end-of-lifetime (x position), reproductive success (transparency; measured in number of offspring), adaptation success (size; measured in negative/positive token avoided/collected per life-time) and distance travelled (y-value) are the same in each sub-graph. The red/green lines below the y-axis is made up of dots, each representing the learning sign LS of the individuals: red=negative and green=positive. Note that LS is negated in the lower sub-graph.

	Evo	IL	Evo + IL	Baseline	Perfect
1	0.5334	0.5032	0.5003	0.5130	0.5003

Table 4.7: Median value of $totalPucksRatio$ over the last 5000 iteration (N:30). Seasonal change every 30k iterations for configuration $count=1150$ and $value=425$.

	IL	Evo + IL	Baseline	Perfect
Evo	> 8.82e-14	< 7.94e-74	> 9.45e-15	< 3.28e-33
IL		< 7.58e-82	= 9.59e-01	< 4.58e-64
Evo + IL			> 5.74e-77	> 1.08e-27
Baseline				< 1.41e-58

Table 4.8: Showing p-values of pairwise comparison of experiments for $totalPucksRatio$ (row vs. column) over the last 5000 iteration (N:30). Seasonal change every 30k iterations for configuration $count=1150$ and $value=425$. The symbols =, ≠, <, >, indicate whether the median values for $totalPucksRatio$ are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

4.2 Seasons by Experiments. Count: 1150 Value: 425

4.2.1 Experiment: Evo, Count: 1150 Value: 425

	0	5k	15k	30k
1	0.5662	0.4989	0.4981	0.5032

Table 4.9: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo* for configuration *count*=1150 and *value*=425.

	5k	15k	30k
0	> 6.91e-120	> 9.94e-88	> 5.28e-79
5k		< 6.04e-03	< 5.82e-36
15k			< 1.14e-27

Table 4.10: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo* for configuration *count*=1150 and *value*=425. The symbols =, ≠, <, >, indicate whether the median values for *totalPucksRatio* are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

4.2.2 Experiment: IL, Count: 1150 Value: 425

	0	5k	15k	30k
1	0.4997	0.5023	0.5011	0.5003

Table 4.11: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *IL* for configuration *count*=1150 and *value*=425.

	5k	15k	30k
0	= 1.03e-01	= 7.08e-01	= 3.65e-01
5k		> 8.33e-03	> 3e-02
15k			= 5.26e-01

Table 4.12: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *IL* for configuration *count*=1150 and *value*=425. The symbols =, ≠, <, >, indicate whether the median values for *totalPucksRatio* are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

4.2.3 Experiment: Evo + IL, Count: 1150 Value: 425

	0	5k	15k	30k
1	0.5705	0.5191	0.5121	0.5334

Table 4.13: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo + IL* for configuration *count*=1150 and *value*=425.

	5k	15k	30k
0	> 3.41e-178	> 3.54e-118	> 2.16e-85
5k		= 7.19e-01	< 1.87e-25
15k			< 3.75e-22

Table 4.14: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo + IL* for configuration *count*=1150 and *value*=425. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

4.2.4 Experiment: Baseline, Count: 1150 Value: 425

	0	5k	15k	30k
1	0.5008	0.5003	0.5001	0.5003

Table 4.15: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Baseline* for configuration *count*=1150 and *value*=425.

	5k	15k	30k
0	= 2.33e-01	> 1.53e-06	= 8.36e-01
5k		> 5.33e-03	= 1.6e-01
15k			< 2.24e-08

Table 4.16: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Baseline* for configuration *count*=1150 and *value*=425. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

4.2.5 Experiment: Perfect, Count: 1150 Value: 425

	0	5k	15k	30k
1	0.5982	0.5034	0.5032	0.5130

Table 4.17: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Perfect* for configuration *count*=1150 and *value*=425.

	5k	15k	30k
0	> 6e-153	> 3.08e-119	> 2.33e-124
5k		< 1.14e-04	< 2.97e-53
15k			< 1.93e-28

Table 4.18: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Perfect* for configuration *count*=1150 and *value*=425. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

Chapter 5

Count by Experiments. Season: 0 -

5.1 Season: 0 -

5.1.1 Experiment: Evo, Season: 0 -

	300	625	1150
1	0.5301	0.5411	0.5662

Table 5.1: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo* for seasonal change every 0 iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	< 1.24e-07	< 3.02e-27
count:625 value:625		< 9.37e-16

Table 5.2: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo* for seasonal change every 0 iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.1.2 Experiment: IL, Season: 0 -

	300	625	1150
1	0.5034	0.5056	0.4997

Table 5.3: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *IL* for seasonal change every 0 iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	= 5.78e-01	> 7.33e-05
count:625 value:625		> 7.87e-11

Table 5.4: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *IL* for seasonal change every 0 iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.1.3 Experiment: Evo + IL, Season: 0 -

	300	625	1150
1	0.5306	0.5388	0.5705

Table 5.5: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo + IL* for seasonal change every 0 iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	< 3.27e-02	< 1.44e-40
count:625 value:625		< 1.33e-32

Table 5.6: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo + IL* for seasonal change every 0 iterations. The symbols =, ≠, <, >, indicate whether the median values for *totalPucksRatio* are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.1.4 Experiment: Baseline, Season: 0 -

	300	625	1150
1	0.5029	0.5055	0.5008

Table 5.7: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Baseline* for seasonal change every 0 iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	= 2.53e-01	> 8.47e-07
count:625 value:625		> 3.72e-11

Table 5.8: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Baseline* for seasonal change every 0 iterations. The symbols =, ≠, <, >, indicate whether the median values for *totalPucksRatio* are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.1.5 Experiment: Perfect, Season: 0 -

	300	625	1150
1	0.5624	0.5868	0.5982

Table 5.9: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Perfect* for seasonal change every 0 iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	< 3.81e-13	< 2.8e-44
count:625 value:625		< 1.91e-09

Table 5.10: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Perfect* for seasonal change every 0 iterations. The symbols =, ≠, <, >, indicate whether the median values for *totalPucksRatio* are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.2 Season: 5k -

5.2.1 Experiment: Evo, Season: 5k -

	300	625	1150
1	0.4995	0.4982	0.4989

Table 5.11: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo* for seasonal change every 5k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	= 4.55e-01	= 3.08e-01
count:625 value:625		> 1.22e-03

Table 5.12: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo* for seasonal change every 5k iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.2.2 Experiment: IL, Season: 5k -

	300	625	1150
1	0.5006	0.4975	0.5023

Table 5.13: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *IL* for seasonal change every 5k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	> 7.89e-05	< 1.99e-02
count:625 value:625		< 1.81e-17

Table 5.14: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *IL* for seasonal change every 5k iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.2.3 Experiment: Evo + IL, Season: 5k -

	300	625	1150
1	0.5029	0.5134	0.5191

Table 5.15: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo + IL* for seasonal change every 5k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	< 3.87e-19	< 1.5e-32
count:625 value:625		< 5.88e-04

Table 5.16: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo + IL* for seasonal change every 5k iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.2.4 Experiment: Baseline, Season: 5k -

	300	625	1150
1	0.5013	0.5004	0.5003

Table 5.17: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Baseline* for seasonal change every 5k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	= 5.98e-01	> 4.72e-02
count:625 value:625		> 1.27e-02

Table 5.18: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Baseline* for seasonal change every 5k iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.2.5 Experiment: Perfect, Season: 5k -

	300	625	1150
1	0.5043	0.4995	0.5034

Table 5.19: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Perfect* for seasonal change every 5k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	> 4.23e-02	= 2.01e-01
count:625 value:625		= 7.76e-02

Table 5.20: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Perfect* for seasonal change every 5k iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.3 Season: 15k -

5.3.1 Experiment: Evo, Season: 15k -

	300	625	1150
1	0.4960	0.4950	0.4981

Table 5.21: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo* for seasonal change every 15k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	< 4.78e-02	< 1.58e-04
count:625 value:625		< 1.09e-08

Table 5.22: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo* for seasonal change every 15k iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.3.2 Experiment: IL, Season: 15k -

	300	625	1150
1	0.4973	0.4993	0.5011

Table 5.23: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *IL* for seasonal change every 15k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	= 6.51e-01	< 4.11e-04
count:625 value:625		< 1.44e-12

Table 5.24: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *IL* for seasonal change every 15k iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.3.3 Experiment: Evo + IL, Season: 15k -

	300	625	1150
1	0.4981	0.5136	0.5121

Table 5.25: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo + IL* for seasonal change every 15k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	< 1.94e-16	< 9.56e-30
count:625 value:625		= 2.61e-01

Table 5.26: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo + IL* for seasonal change every 15k iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.3.4 Experiment: Baseline, Season: 15k -

	300	625	1150
1	0.4929	0.4990	0.5001

Table 5.27: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Baseline* for seasonal change every 15k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	< 6.05e-28	< 6.35e-27
count:625 value:625		= 6.21e-01

Table 5.28: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Baseline* for seasonal change every 15k iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.3.5 Experiment: Perfect, Season: 15k -

	300	625	1150
1	0.4877	0.4924	0.5032

Table 5.29: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Perfect* for seasonal change every 15k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	< 1.08e-03	< 6.24e-31
count:625 value:625		< 2.41e-28

Table 5.30: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Perfect* for seasonal change every 15k iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.4 Season: 30k -

5.4.1 Experiment: Evo, Season: 30k -

	300	625	1150
1	0.5038	0.5056	0.5032

Table 5.31: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo* for seasonal change every 30k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	= 6.73e-01	= 4.04e-01
count:625 value:625		= 8.4e-01

Table 5.32: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo* for seasonal change every 30k iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.4.2 Experiment: IL, Season: 30k -

	300	625	1150
1	0.5031	0.5012	0.5003

Table 5.33: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *IL* for seasonal change every 30k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	> 1.87e-04	> 4.62e-09
count:625 value:625		> 3.55e-02

Table 5.34: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *IL* for seasonal change every 30k iterations. The symbols =, ≠, <, >, indicate whether the median values for totalPucksRatio are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.4.3 Experiment: Evo + IL, Season: 30k -

	300	625	1150
1	0.5093	0.5159	0.5334

Table 5.35: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Evo + IL* for seasonal change every 30k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	< 4.7e-09	< 2.64e-31
count:625 value:625		< 3.59e-14

Table 5.36: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Evo + IL* for seasonal change every 30k iterations. The symbols =, ≠, <, >, indicate whether the median values for *totalPucksRatio* are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.4.4 Experiment: Baseline, Season: 30k -

	300	625	1150
1	0.5056	0.5015	0.5003

Table 5.37: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Baseline* for seasonal change every 30k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	> 4.77e-33	> 9.37e-42
count:625 value:625		> 4.81e-03

Table 5.38: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Baseline* for seasonal change every 30k iterations. The symbols =, ≠, <, >, indicate whether the median values for *totalPucksRatio* are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.

5.4.5 Experiment: Perfect, Season: 30k -

	300	625	1150
1	0.5079	0.5087	0.5130

Table 5.39: Median value of *totalPucksRatio* over the last 5000 iteration (N:30). Experiment *Perfect* for seasonal change every 30k iterations.

	count:625 value:625	count:1150 value:425
count:300 value:1150	= 1.6e-01	< 6.76e-09
count:625 value:625		< 3.43e-06

Table 5.40: Showing p-values of pairwise comparison of seasonal change for *totalPucksRatio* (row vs. column) over the last 5000 iteration (N:30). Experiment *Perfect* for seasonal change every 30k iterations. The symbols =, ≠, <, >, indicate whether the median values for *totalPucksRatio* are equal, not equal (but not significantly larger or smaller), significantly smaller or significantly larger respectively. p-values below the significance level of 0.05 are written in bold.