Appendices and Supplement to:

Legendre, P., M. De Cáceres, and D. Borcard. 2010. Community surveys through space and time: testing the space-time interaction in the absence of replication. *Ecology* 91(1): 262-272.

APPENDIX A

Ecological Archives E091-019-A1

NUMERICAL SIMULATIONS: METHOD AND RESULTS

Simulated numerical data with known properties were used to assess the type I error rate and power of the proposed test of S-T interaction. Univariate or multivariate data were generated on "maps" or "surfaces" whose abscissa represented a transect in space (S) while the ordinate represented sampling campaigns through time (T). Two main types of simulated data were generated:

Random data. — In the simplest simulations, done in order to assess the rate of type I error, random normal deviates were attributed to all sampling units.

Autocorrelated data.— Data fields were generated containing spatially and/or temporally autocorrelated data; this was accomplished by generating autocorrelated data with known variograms along the abscissa (spatial autocorrelation) and/or the ordinate of the map (temporal autocorrelation). The data generation program has been used in previous papers to study the consequences of spatial structures for the design of ecological field surveys (Legendre et al. 2002) and field experiments (Legendre et al. 2004), and to compare methods for partitioning the variation of a response data table with respect to spatial and environmental components (Legendre et al. 2005). The specific version of the program used for generation of autocorrelated space-time data in the present study is SimSSD4, which is available in ESA's Electronic Data Archive: Ecological Archives M075-017-S1. It was used to generate files containing several thousands of fields of various sizes with known autocorrelation properties. All surfaces had 80 pixels along space and 80 along time. Two types of autocorrelated data were created using variogram ranges: (a) autocorrelated surfaces with ranges of 10 in both directions, and (b) autocorrelated surfaces with range of 20 in the spatial direction and 5 in the temporal direction.

500 replicate data surfaces of each type were generated for the univariate (p = 1) and the multivariate (p = 5) cases. Depending on the simulation scenario, the generated surfaces contained spatial or temporal structure, or both, as well as space-time interaction in some simulations, where the spatial structure changed along time. In order to study intermediate situations of simpler structures, the generated surfaces were modified as explained in the next paragraph. Four scenarios were studied:

a) *Scenario 1*: Random data. Surfaces without any structure, either temporal or spatial.

b) *Scenario 2*: Surfaces with no S-T interaction, no temporal structure, and a spatial autocorrelated structure common to all sampling times. This was obtained by choosing the first transect in a generated autocorrelated surface and duplicating it the stated number of times. Random noise was added to each value, drawn from a standard normal distribution with standard deviation equal to 0.1. An example surface is presented in Fig. A1a.

c) *Scenario 3*: Surfaces with spatial and temporal structures but without space-time interaction. This was obtained as follows: for each autocorrelated surface, choose the first transect and duplicate it for all times. Then take the first time sequence and duplicate it for all spatial points. These two matrices were added up element-wise, and random noise was added to each value, drawn from a standard normal distribution with standard deviation equal to 0.1. An example surface is shown in Fig. A1b.

d) *Scenario 4*: Surfaces were generated with spatial and temporal structures as well as space-time interaction. The autocorrelated data for these surfaces were generated by the program SimSSD4 without further modification. Example surfaces are shown in Fig. A2(a-b).

The surfaces from each scenario were sub-sampled to generate data sets of different sizes. The following combinations of space and sampling campaigns were studied: $s = \{5, 10, 20, 40, 80\}$ and $t = \{5, 10, 40\}$. Smaller data sets were extracted from the original 80×80 data sets: 2 data sets of 80×40, 4 sets of size 40×40, and so on, down to size 5×5. In this way, for each data set size, at least 1000 replicates where produced (500 original data sets × 2, for the largest subsets of size of 80×40).

1000 simulation replicates were produced for all experimental conditions. Tests of significance were carried out by permutation for univariate and multivariate responses. Since the S and T factors are controlled and orthogonal, there is no point in using permutation of residuals of a null or full model (Anderson and Legendre 1999); so, permutation of the raw data was used in all cases. In a crossed ANOVA model, there is no exact permutation test for the interaction term. This is so because there are no possible permutations that would give an F-ratio different from the observed value when permutations are restricted to occur within levels of each of the main effects (Anderson and ter Braak 2003). If the interaction is not significant, exact permutation tests for the main factors are achieved by restricting the permutations to occur within the levels of the non-tested factor. When the interaction is significant, there is no exact test for the main factors either (Anderson and ter Braak 2003). Due to these considerations, all permutation tests for the S-T interaction in the present simulations were unrestricted and only approximate. The test for the main factors under Models 2, 3, 4, and 5 were performed by restricting permutations within levels of the non-tested factor. The rate of rejection of the null hypothesis after 1000 simulations, for significance level $\alpha = 0.05$, was reported in each case.

Simulation results: test of the S-T interaction, Models 3, 4 and 5

Scenario 1 (random normal structure) was used to measure the rates of type I error of the test of the S-T interaction under Models 3, 4 and 5. The results are presented in Appendix B, Tables B1a-c. In the absence of a spatial or temporal structure, all tests of the interaction had correct rates of type I error (i.e. the 95% confidence intervals contained the nominal 5% significance level used in the tests) for all values of *s* and *t* investigated.

In scenario 2, a spatial data transect had been replicated *t* times and random variation was added to the data. Hence, it contained a single common spatial structure and there was no interaction present. Analysis of the space-time interaction (STI) under Models 3 and 4 showed that the interaction was very rarely significant (Tables B2a-b).

Scenario 3 generated data containing common spatial and temporal structures, but again without interaction. The STI test corresponding to Models 3 and 4 never found a significant interaction under scenario 3 (Tables B3a-b). Why is it that the rate of rejection was not close to 5% in all these cases? The explanation is the following: consider scenario 2 and ANOVA Model 4 (Table B2b). Under this scenario, the explanatory S-PCNM variables could not "capture" all the common spatial structure. Hence the residual sum of squares ($SS_{Res.4}$ in Fig. 1) contained two portions: the real residual sum-of-squares (SS_{Res1}) corresponding to the random variation in the data, and a part of the non-modeled common spatial variation (light shading in Fig. 1). Since this sum-of-squares is used in the denominator of the *F*-statistic and it is larger than it should, this reduces the chances to reject the null hypothesis for the STI test, decreasing the rates below the nominal 5% level. The explanation is similar for the results in Tables B2a, B3a, and B3b.

When there is a spatial and a temporal structure (scenario 3), the rate of type I error for the STI test under Model 4 is too low. Similarly, when there is a spatial structure (scenario 2), the rate of type I error for the STI test under Model 3 is also too low. While the tests remain valid in these cases, this conservative behavior will reduce the power of the STI test under Models 3 and 4 to detect an interaction when it is present. Generally speaking, the use of a number of PCNM eigenfunctions to model space and time, which is smaller than (s–1) or (t–1), leads to an overestimation of the residual sum-of-squares which is used in the denominator of the *F*-statistic, and that reduces the number of cases where the associated *P*-value is significant given the significance level α. If that reasoning is correct, ANOVA Model 5 should resolve that problem and provide a test of STI that has a correct level of type I error, that is, a rejection rate approximately equal to the α significance level. Here the results will differ slightly for the univariate and multivariate cases. Results of the simulations for the STI test using ANOVA Model 5 under scenarios 2 and 3 show that the rate of type I error was correct in all cases for univariate response data (p = 1, Tables B2c and B3c). For multivariate response data (p = 5), the rate of rejection was lower than the α significance level, but appeared to become asymptotically correct as *s* and *t* increased. That is, for scenario 2, the rates or rejection increased towards the α significance level with increasing numbers of spatial points *s*. Similarly, for scenario 3, the rates or rejection increase towards the α significance level with increasing number of spatial points s or sampling campaigns t.

As it contains space-time interaction, scenario 4 is the most complex, and so is the interpretation of the power study results. Rates of rejection of the null hypothesis for the STI test under ANOVA Models 3, 4, and 5 are shown in Tables B4a-c and illustrated in Fig. 2 of the paper. To achieve a balanced design in the analyses reported in the "Numerical simulations" section of the paper and in Fig. 2, some results from Table B4 were left out of the analysis; they correspond to the combinations (S=10, T=5), (S=40, T=5), and (S=40, T=10) which duplicated the combinations (S=5, T=10), (S=5, T=40), and (S=10, T=40) for the sum S+T. The rate of significant S-T interaction was only 6-13% for the small 5×5 data sets, but it increased with higher numbers of spatial units and/or sampling times. Multivariate response data provided higher power to the STI test than univariate data. Power of the STI test under ANOVA Model 5 was similar to that under Model 4 for equal amounts of SA and TA, but power was higher in Model 5 for unequal amounts of autocorrelation in the data. The STI test in Model 4 was handicapped by its high lack-of-fit, which produced a large residual sum-of-squares. However, that effect on Model 4 was counter-balanced in the presence of equal amounts of autocorrelation by the larger number of degrees of freedom in the denominator of the F-statistic. When SA and TA were identical, the STI test was less powerful under Model 3 than under Models 4 and 5. Model 3 was, however, equally or more powerful than Model 4 for unequal amounts of autocorrelation; because the variability across spatial units was small, the lack-of-fit of the S fraction in Model 3 may have been reduced. So, Model 5 is preferable because its power was always equal or superior to those of Models 3 and 4.

In summary, our simulation results indicate that in the absence of replication, the space-time interaction can safely be tested using ANOVA Model 5: the rate of type I error corresponds to the nominal significance level and that model provides maximum power in all situations. The simulation results are in agreement with and support the conclusion reached from theoretical considerations at the end of the section on "Models to test the space-time interaction".

Simulation results: testing the effect of factors S and T using Models 2 to 5

If the hypothesis of no interaction is not rejected, spatial and temporal structures should be analyzed using the classical test of S and T without replication, which is our ANOVA Model 2. When the analysis is carried out by regression, the main factors should be described in the analysis using Helmert contrasts or ordinary dummy variables. Using Model 2 for testing the main factors is, however, imperiled by the possibility of a type II error during the test of the interaction, leading to an undetected interaction. We will now compare the simulation results obtained under Models 2, 3, 4 and 5.

Under scenario 1, the tests corresponding to Models 2-5 showed correct rates of type I error (Tables B5a-d). On theoretical grounds, one can assume that, in the absence of interaction, the tests for main factors (S or T) analyzed using Model 3, 4 or 5 should be less powerful than using Model 2. We verified that prediction using scenarios 2 and 3. Indeed, under scenario 2 (presence of a common spatial structure), the test for S was more often significant for Model 2 than for the other models (Tables B6a-d). It was followed by Models 5 and 4. Model 3 was the least powerful when testing factor S in scenario 2, since it shares with Model 4 the lack of fit for the space fraction but it has fewer degrees of freedom for the residuals. Permutation tests for a main factor restricted within the levels of the non-tested factor are theoretically exact in the absence of interaction. Thus, the test for factor T had correct type I error for all models (Tables B6a-d), even for Models 3 and 4. Note that this would not be the same for parametric tests, where the lack of fit for the S fraction in Models 3 and 4 would lower the rate of rejection of the null hypothesis. Under scenario 3 (spatial and temporal structures present, Tables B7a-d), Models 2 and 5 almost always found significant effects for factors S and T, while Models 3 and 4 were less powerful, especially for small data sets. Here Model 3 outperformed Model 4 probably due to a better fitting of the time fraction. From these results, we can conclude that when there is no space-time interaction in the data, Model 2 is the most powerful, followed by Model 5 and, finally, Models 3 and 4.

It may happen that an interaction existed and was not detected using the STI test (i.e. a type II error could have been committed). The presence of an S-T interaction would then hamper testing the main factors under Models 2-5. Not all four models are equally affected, however. Differences are shown in the simulation results for these three models under scenario 4 (Tables B8a-d). In this case the power relationships described in the previous paragraph were inverted: if an undetected interaction existed, then Model 4 appears to be the most powerful to obtain the significance of the main factors, followed by Model 3, Model 5 and, finally, Model 2.

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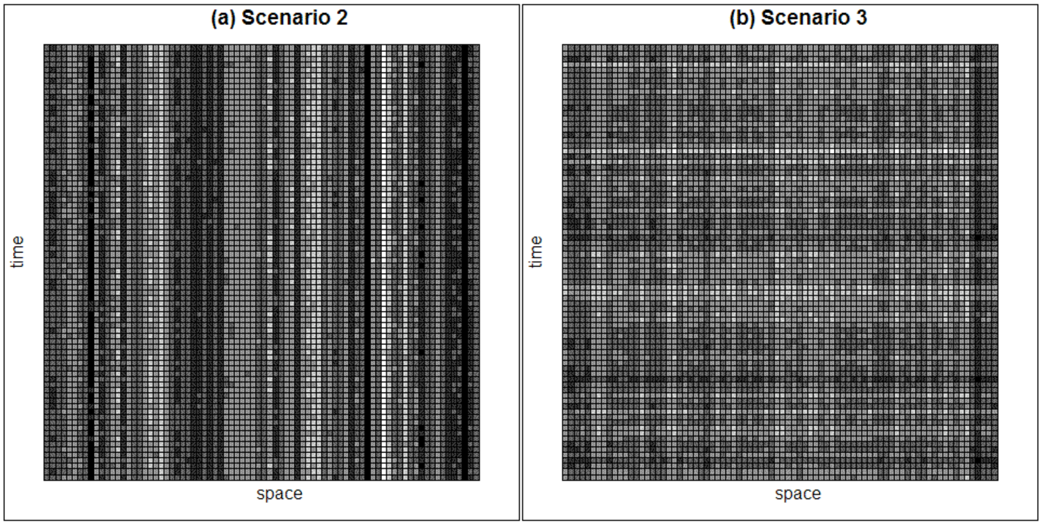

Fig. A1. Examples of surfaces generated for simulation scenarios 2 (no S-T interaction, no temporal structure, and a spatial autocorrelated structure common to all sampling time) and 3 (spatial and temporal structures present, no space-time interaction).

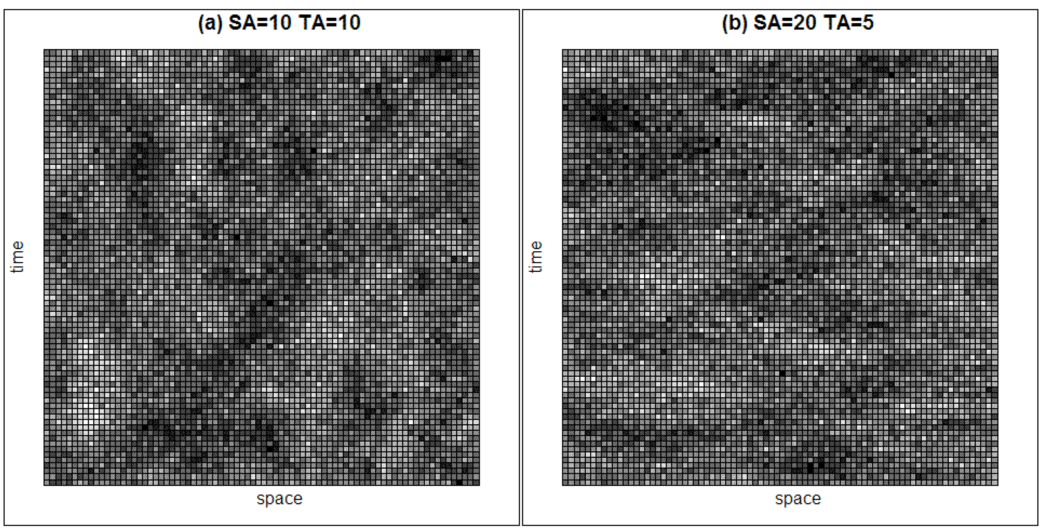

Fig. A2. Example of simulated autocorrelated surfaces with spatial and temporal structures as well as space-time interaction generated for simulation scenario 4. SA: range of the spatial autocorrelation (along abscissa), given in grid units; TA: range of the temporal autocorrelation (along ordinate). (a) SA = TA, so the light and dark patches are isotropic (no preferred direction). (b) SA > TA, so that the light and dark patches are elongated horizontally (along the spatial axis).

APPENDIX B

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TABLES OF SIMULATION RESULTS

Tables B1 to B9 present the simulation results as rates of rejection of the null hypothesis after 1000 simulations (values between 0 and 1). *s* is the number of spatial units, *t* the number of time units in the simulated surface. *p* is the number of response variables: $p = 1$ for univariate data, $p = 5$ for multivariate data. Columns S contain the results of the tests for spatial structures, columns **T** the results of the tests for temporal structures. *SA* indicates the range of the variogram used to generate autocorrelation along space, *TA* the range of the variogram used to generate autocorrelation along time. In the left-hand portions of tables B2 to B4 and B6 to B9, these two amounts are equal (*SA10*, *TA10*) whereas they are unequal in the right-hand portions of these tables (*SA20*, *TA5*).

TABLE B1A. Rate of type I error of the test of the interaction after 1000 simulations, scenario 1, anova model 3. LCL/UCL: Lower/Upper Confidence Limit.

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.051**	**0.058**	**0.031**	*Rate*	**0.039**	**0.060**	**0.067**
s=5	*LCL*	0.037	0.043	0.020	*LCL*	0.026	0.045	0.051
	UCL	0.065	0.073	0.042	*UCL*	0.052	0.075	0.083
	Rate	**0.051**	**0.053**	**0.050**	*Rate*	**0.050**	**0.046**	**0.058**
s=10	*LCL*	0.037	0.039	0.036	*LCL*	0.036	0.033	0.043
	UCL	0.065	0.067	0.064	*UCL*	0.064	0.059	0.073
	Rate	**0.046**	**0.055**	**0.060**	*Rate*	**0.051**	**0.057**	**0.052**
s=20	*LCL*	0.033	0.041	0.045	*LCL*	0.037	0.043	0.038
	UCL	0.059	0.069	0.075	*UCL*	0.065	0.071	0.066
	Rate	**0.053**	**0.043**	**0.066**	*Rate*	**0.054**	**0.040**	**0.047**
s=40	*LCL*	0.039	0.030	0.051	*LCL*	0.040	0.028	0.034
	UCL	0.067	0.056	0.081	*UCL*	0.068	0.052	0.060
	Rate	**0.058**	**0.050**		*Rate*	**0.042**	**0.046**	
s=80	*LCL*	0.043	0.036		*LCL*	0.030	0.033	
	UCL	0.073	0.064		*UCL*	0.054	0.059	

TABLE B1B. Rate of type I error of the test of the interaction after 1000 simulations, scenario 1, anova model 4. LCL/UCL: Lower/Upper Confidence Limit.

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.048**	**0.041**	**0.058**	*Rate*	**0.045**	**0.051**	**0.047**
s=5	*LCL*	0.034	0.028	0.043	*LCL*	0.031	0.037	0.034
	UCL	0.062	0.054	0.073	*UCL*	0.059	0.065	0.060
	Rate	**0.050**	**0.045**	**0.051**	*Rate*	**0.059**	**0.052**	**0.048**
s=10	*LCL*	0.036	0.032	0.037	*LCL*	0.044	0.038	0.035
	UCL	0.064	0.058	0.065	*UCL*	0.074	0.066	0.061
	Rate	**0.055**	**0.056**	**0.050**	*Rate*	**0.062**	**0.046**	**0.051**
s=20	*LCL*	0.041	0.042	0.036	*LCL*	0.047	0.033	0.037
	UCL	0.069	0.070	0.064	*UCL*	0.077	0.059	0.065
	Rate	**0.042**	**0.058**	**0.053**	*Rate*	**0.058**	**0.054**	**0.054**
s=40	*LCL*	0.029	0.043	0.039	*LCL*	0.043	0.040	0.040
	UCL	0.055	0.073	0.067	*UCL*	0.073	0.068	0.068
	Rate	**0.046**	**0.051**		*Rate*	**0.044**	**0.054**	
s=80	*LCL*	0.033	0.037		*LCL*	0.031	0.040	
	UCL	0.059	0.065		*UCL*	0.057	0.068	

TABLE B1C. Rate of type I error of the test of the interaction after 1000 simulations, scenario 1, anova model 5. LCL/UCL: Lower/Upper Confidence Limit.

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.058**	**0.049**	**0.031**	*Rate*	**0.044**	**0.039**	**0.037**
s=5	*LCL*	0.043	0.035	0.020	*LCL*	0.031	0.027	0.025
	UCL	0.073	0.063	0.042	*UCL*	0.057	0.051	0.049
	Rate	**0.045**	**0.044**	**0.059**	*Rate*	**0.050**	**0.047**	**0.051**
s=10	*LCL*	0.032	0.031	0.044	*LCL*	0.036	0.034	0.037
	UCL	0.058	0.057	0.074	*UCL*	0.064	0.060	0.065
	Rate	**0.045**	**0.041**	**0.062**	*Rate*	**0.056**	**0.042**	**0.049**
s=20	*LCL*	0.032	0.029	0.047	*LCL*	0.042	0.029	0.036
	UCL	0.058	0.053	0.077	*UCL*	0.070	0.055	0.062
	Rate	**0.035**	**0.047**	**0.056**	*Rate*	**0.044**	**0.038**	**0.056**
s=40	*LCL*	0.024	0.034	0.042	*LCL*	0.031	0.026	0.042
	UCL	0.046	0.060	0.070	*UCL*	0.057	0.050	0.070
	Rate	**0.050**	**0.052**		*Rate*	**0.044**	**0.042**	
s=80	*LCL*	0.036	0.038		*LCL*	0.031	0.030	
	UCL	0.064	0.066		*UCL*	0.057	0.054	

TABLE B2A. Rate of type I error of the test of the interaction after 1000 simulations, scenario 2, anova model 3. LCL/UCL: Lower/Upper Confidence Limit.

SA10-TA10

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.001**	**0.001**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=5	LCL	-0.001	-0.001	0.000	LCL	0.000	0.000	0.000
	UCL	0.003	0.003	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=10	LCL	0.000	0.000	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=20	LCL	0.000	0.000	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=40	LCL	0.000	0.000	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**		Rate	**0.000**	**0.000**	
s=80	LCL	0.000	0.000		LCL	0.000	0.000	
	UCL	0.000	0.000		UCL	0.000	0.000	

SA20-TA5

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.000**	**0.000**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=5	LCL	0.000	0.000	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=10	LCL	0.000	0.000	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=20	LCL	0.000	0.000	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=40	LCL	0.000	0.000	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**		Rate	**0.000**	**0.000**	
s=80	LCL	0.000	0.000		LCL	0.000	0.000	
	UCL	0.000	0.000		UCL	0.000	0.000	

TABLE B2B. Rate of type I error of the test of the interaction after 1000 simulations, scenario 2, anova model 4. LCL/UCL: Lower/Upper Confidence Limit.

SA10-TA10

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.000**	**0.001**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=5	LCL	0.000	-0.001	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.003	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=10	LCL	0.000	0.000	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=20	LCL	0.000	0.000	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=40	LCL	0.000	0.000	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**		Rate	**0.000**	**0.000**	
s=80	LCL	0.000	0.000		LCL	0.000	0.000	
	UCL	0.000	0.000		UCL	0.000	0.000	

SA20-TA5

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.002**	**0.001**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=5	LCL	-0.001	-0.001	0.000	LCL	0.000	0.000	0.000
	UCL	0.005	0.003	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=10	LCL	0.000	0.000	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=20	LCL	0.000	0.000	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**	**0.000**	Rate	**0.000**	**0.000**	**0.000**
s=40	LCL	0.000	0.000	0.000	LCL	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	UCL	0.000	0.000	0.000
	Rate	**0.000**	**0.000**		Rate	**0.000**	**0.000**	
s=80	LCL	0.000	0.000		LCL	0.000	0.000	
	UCL	0.000	0.000		UCL	0.000	0.000	

TABLE B2C. Rate of type I error of the test of the interaction after 1000 simulations, scenario 2, anova model 5. LCL/UCL: Lower/Upper Confidence Limit.

SA10-TA10

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.039**	**0.053**	**0.051**	Rate	**0.008**	**0.007**	**0.007**
s=5	LCL	0.026	0.039	0.037	LCL	0.002	0.002	0.002
	UCL	0.052	0.067	0.065	UCL	0.014	0.012	0.012
	Rate	**0.030**	**0.047**	**0.044**	Rate	**0.019**	**0.019**	**0.029**
s=10	LCL	0.019	0.034	0.031	LCL	0.010	0.010	0.019
	UCL	0.041	0.060	0.057	UCL	0.028	0.028	0.039
	Rate	**0.044**	**0.046**	**0.055**	Rate	**0.033**	**0.030**	**0.028**
s=20	LCL	0.031	0.033	0.041	LCL	0.022	0.019	0.018
	UCL	0.057	0.059	0.069	UCL	0.044	0.041	0.038
	Rate	**0.052**	**0.046**	**0.037**	Rate	**0.041**	**0.027**	**0.029**
s=40	LCL	0.038	0.033	0.025	LCL	0.029	0.017	0.019
	UCL	0.066	0.059	0.049	UCL	0.053	0.037	0.039
	Rate	**0.052**	**0.038**		Rate	**0.043**	**0.039**	
s=80	LCL	0.038	0.026		LCL	0.030	0.027	
	UCL	0.066	0.050		UCL	0.056	0.051	

SA20-TA5

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.053**	**0.059**	**0.052**	Rate	**0.014**	**0.008**	**0.014**
s=5	LCL	0.038	0.044	0.038	LCL	0.006	0.002	0.007
	UCL	0.068	0.074	0.066	UCL	0.022	0.014	0.021
	Rate	**0.047**	**0.051**	**0.051**	Rate	**0.025**	**0.026**	**0.021**
s=10	LCL	0.034	0.037	0.037	LCL	0.015	0.016	0.012
	UCL	0.060	0.065	0.065	UCL	0.035	0.036	0.030
	Rate	**0.061**	**0.056**	**0.046**	Rate	**0.035**	**0.029**	**0.028**
s=20	LCL	0.046	0.042	0.033	LCL	0.023	0.019	0.018
	UCL	0.076	0.070	0.059	UCL	0.047	0.039	0.038
	Rate	**0.048**	**0.057**	**0.051**	Rate	**0.038**	**0.035**	**0.026**
s=40	LCL	0.035	0.043	0.037	LCL	0.026	0.024	0.016
	UCL	0.061	0.071	0.065	UCL	0.050	0.046	0.036
	Rate	**0.050**	**0.054**		Rate	**0.025**	**0.044**	
s=80	LCL	0.036	0.040		LCL	0.015	0.031	
	UCL	0.064	0.068		UCL	0.035	0.057	

TABLE B3A. Rate of type I error of the test of the interaction after 1000 simulations, scenario 3, anova model 3. LCL/UCL: Lower/Upper Confidence Limit.

		SA10-TA10 p=1			SA10-TA10 p=5			SA20-TA5 p=1			SA20-TA5 p=5		
		t=5	t=10	t=40	t=5	t=10	t=40	t=5	t=10	t=40	t=5	t=10	t=40
s=5	Rate	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	LCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
s=10	Rate	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	LCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
s=20	Rate	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	LCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
s=40	Rate	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	LCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
s=80	Rate	**0.000**	**0.000**		**0.000**	**0.000**		**0.000**	**0.000**		**0.000**	**0.000**	
	LCL	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
	UCL	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	

TABLE B3B. Rate of type I error of the test of the interaction after 1000 simulations, scenario 3, anova model 4. LCL/UCL: Lower/Upper Confidence Limit.

		SA10-TA10 p=1			SA10-TA10 p=5			SA20-TA5 p=1			SA20-TA5 p=5		
		t=5	t=10	t=40	t=5	t=10	t=40	t=5	t=10	t=40	t=5	t=10	t=40
s=5	Rate	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	LCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
s=10	Rate	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	LCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
s=20	Rate	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	LCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
s=40	Rate	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	LCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	UCL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
s=80	Rate	**0.000**	**0.000**		**0.000**	**0.000**		**0.000**	**0.000**		**0.000**	**0.000**	
	LCL	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
	UCL	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	

TABLE B3C. Rate of type I error of the test of the interaction after 1000 simulations, scenario 3, anova model 5. LCL/UCL: Lower/Upper Confidence Limit.

		SA10-TA10 p=1			SA10-TA10 p=5			SA20-TA5 p=1			SA20-TA5 p=5		
		t=5	t=10	t=40	t=5	t=10	t=40	t=5	t=10	t=40	t=5	t=10	t=40
s=5	Rate	**0.049**	**0.051**	**0.060**	**0.020**	**0.025**	**0.041**	**0.049**	**0.058**	**0.057**	**0.026**	**0.032**	**0.039**
	LCL	0.035	0.037	0.045	0.011	0.015	0.029	0.035	0.043	0.043	0.016	0.021	0.027
	UCL	0.063	0.065	0.075	0.029	0.035	0.053	0.063	0.073	0.071	0.036	0.043	0.051
s=10	Rate	**0.055**	**0.054**	**0.048**	**0.030**	**0.039**	**0.036**	**0.050**	**0.051**	**0.059**	**0.023**	**0.030**	**0.033**
	LCL	0.041	0.040	0.035	0.019	0.027	0.024	0.036	0.037	0.044	0.013	0.019	0.022
	UCL	0.070	0.068	0.061	0.041	0.051	0.048	0.064	0.065	0.074	0.033	0.041	0.044
s=20	Rate	**0.056**	**0.047**	**0.057**	**0.057**	**0.040**	**0.036**	**0.044**	**0.054**	**0.048**	**0.017**	**0.036**	**0.032**
	LCL	0.042	0.034	0.043	0.042	0.028	0.024	0.031	0.040	0.035	0.009	0.024	0.021
	UCL	0.070	0.060	0.071	0.072	0.052	0.048	0.057	0.068	0.061	0.025	0.048	0.043
s=40	Rate	**0.048**	**0.056**	**0.062**	**0.047**	**0.035**	**0.033**	**0.050**	**0.050**	**0.059**	**0.030**	**0.041**	**0.044**
	LCL	0.035	0.042	0.047	0.034	0.024	0.022	0.036	0.036	0.044	0.019	0.029	0.031
	UCL	0.061	0.070	0.077	0.060	0.046	0.044	0.064	0.064	0.074	0.041	0.053	0.057
s=80	Rate	**0.055**	**0.058**		**0.042**	**0.043**		**0.045**	**0.045**		**0.048**	**0.035**	
	LCL	0.041	0.043		0.030	0.030		0.032	0.032		0.035	0.024	
	UCL	0.069	0.073		0.054	0.056		0.058	0.058		0.061	0.046	

TABLE B4A. Power of the test of the interaction after 1000 simulations, scenario 4, anova model 3. LCL/UCL: Lower/Upper Confidence Limit.

SA10-TA10

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.055**	**0.081**	**0.272**	Rate	**0.081**	**0.183**	**0.704**
s=5	LCL	0.040	0.064	0.244	LCL	0.063	0.158	0.676
	UCL	0.070	0.098	0.300	UCL	0.099	0.208	0.732
	Rate	**0.098**	**0.230**	**0.794**	Rate	**0.182**	**0.525**	**0.999**
s=10	LCL	0.079	0.204	0.769	LCL	0.157	0.494	0.997
	UCL	0.117	0.256	0.819	UCL	0.207	0.556	1.001
	Rate	**0.182**	**0.520**	**0.998**	Rate	**0.421**	**0.972**	**1.000**
s=20	LCL	0.158	0.489	0.995	LCL	0.390	0.962	1.000
	UCL	0.206	0.551	1.001	UCL	0.452	0.982	1.000
	Rate	**0.341**	**0.840**	**1.000**	Rate	**0.795**	**1.000**	**1.000**
s=40	LCL	0.311	0.817	1.000	LCL	0.770	1.000	1.000
	UCL	0.371	0.863	1.000	UCL	0.820	1.000	1.000
	Rate	**0.573**	**0.991**		Rate	**0.984**	**1.000**	
s=80	LCL	0.542	0.985		LCL	0.976	1.000	
	UCL	0.604	0.997		UCL	0.992	1.000	

SA20-TA5

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.079**	**0.078**	**0.175**	Rate	**0.091**	**0.146**	**0.404**
s=5	LCL	0.061	0.061	0.151	LCL	0.072	0.124	0.373
	UCL	0.097	0.095	0.199	UCL	0.110	0.168	0.435
	Rate	**0.121**	**0.216**	**0.588**	Rate	**0.259**	**0.544**	**0.994**
s=10	LCL	0.100	0.190	0.557	LCL	0.231	0.513	0.989
	UCL	0.142	0.242	0.619	UCL	0.287	0.575	0.999
	Rate	**0.299**	**0.621**	**0.995**	Rate	**0.769**	**0.989**	**1.000**
s=20	LCL	0.270	0.591	0.991	LCL	0.743	0.982	1.000
	UCL	0.328	0.651	0.999	UCL	0.795	0.996	1.000
	Rate	**0.634**	**0.953**	**1.000**	Rate	**0.998**	**1.000**	**1.000**
s=40	LCL	0.605	0.940	1.000	LCL	0.995	1.000	1.000
	UCL	0.664	0.966	1.000	UCL	1.001	1.000	1.000
	Rate	**0.948**	**1.000**		Rate	**1.000**	**1.000**	
s=80	LCL	0.934	1.000		LCL	1.000	1.000	
	UCL	0.962	1.000		UCL	1.000	1.000	

TABLE B4B. Power of the test of the interaction after 1000 simulations, scenario 4, anova model 4. LCL/UCL: Lower/Upper Confidence Limit.

SA10-TA10

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.084**	**0.129**	**0.487**	Rate	**0.116**	**0.307**	**0.963**
s=5	LCL	0.066	0.108	0.456	LCL	0.095	0.278	0.951
	UCL	0.102	0.150	0.518	UCL	0.137	0.336	0.975
	Rate	**0.131**	**0.341**	**0.963**	Rate	**0.310**	**0.838**	**1.000**
s=10	LCL	0.110	0.311	0.951	LCL	0.281	0.815	1.000
	UCL	0.152	0.371	0.975	UCL	0.339	0.861	1.000
	Rate	**0.290**	**0.748**	**1.000**	Rate	**0.679**	**1.000**	**1.000**
s=20	LCL	0.262	0.721	1.000	LCL	0.650	1.000	1.000
	UCL	0.318	0.775	1.000	UCL	0.708	1.000	1.000
	Rate	**0.519**	**0.974**	**1.000**	Rate	**0.965**	**1.000**	**1.000**
s=40	LCL	0.488	0.964	1.000	LCL	0.954	1.000	1.000
	UCL	0.550	0.984	1.000	UCL	0.976	1.000	1.000
	Rate	**0.765**	**1.000**		Rate	**0.999**	**1.000**	
s=80	LCL	0.739	1.000		LCL	0.997	1.000	
	UCL	0.791	1.000		UCL	1.001	1.000	

SA20-TA5

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.067**	**0.073**	**0.130**	Rate	**0.057**	**0.077**	**0.245**
s=5	LCL	0.051	0.056	0.109	LCL	0.042	0.060	0.218
	UCL	0.083	0.090	0.151	UCL	0.072	0.094	0.272
	Rate	**0.112**	**0.216**	**0.612**	Rate	**0.224**	**0.509**	**0.990**
s=10	LCL	0.092	0.190	0.582	LCL	0.197	0.478	0.984
	UCL	0.132	0.242	0.642	UCL	0.251	0.540	0.996
	Rate	**0.316**	**0.647**	**0.999**	Rate	**0.745**	**0.995**	**1.000**
s=20	LCL	0.287	0.617	0.997	LCL	0.718	0.991	1.000
	UCL	0.345	0.677	1.001	UCL	0.772	0.999	1.000
	Rate	**0.663**	**0.965**	**1.000**	Rate	**0.994**	**1.000**	**1.000**
s=40	LCL	0.634	0.954	1.000	LCL	0.989	1.000	1.000
	UCL	0.692	0.976	1.000	UCL	0.999	1.000	1.000
	Rate	**0.935**	**0.999**		Rate	**1.000**	**1.000**	
s=80	LCL	0.920	0.997		LCL	1.000	1.000	
	UCL	0.950	1.001		UCL	1.000	1.000	

TABLE B4C. Power of the test of the interaction after 1000 simulations, scenario 4, anova model 5. LCL/UCL: Lower/Upper Confidence Limit.

SA10-TA10

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.071**	**0.132**	**0.481**	Rate	**0.126**	**0.324**	**0.954**
s=5	LCL	0.054	0.110	0.450	LCL	0.104	0.294	0.941
	UCL	0.088	0.154	0.512	UCL	0.148	0.354	0.967
	Rate	**0.130**	**0.345**	**0.962**	Rate	**0.313**	**0.832**	**1.000**
s=10	LCL	0.109	0.315	0.950	LCL	0.284	0.809	1.000
	UCL	0.151	0.375	0.974	UCL	0.342	0.855	1.000
	Rate	**0.289**	**0.752**	**1.000**	Rate	**0.688**	**0.999**	**1.000**
s=20	LCL	0.261	0.725	1.000	LCL	0.659	0.997	1.000
	UCL	0.317	0.779	1.000	UCL	0.717	1.001	1.000
	Rate	**0.516**	**0.971**	**1.000**	Rate	**0.961**	**1.000**	**1.000**
s=40	LCL	0.485	0.961	1.000	LCL	0.949	1.000	1.000
	UCL	0.547	0.981	1.000	UCL	0.973	1.000	1.000
	Rate	**0.762**	**1.000**		Rate	**0.999**	**1.000**	
s=80	LCL	0.736	1.000		LCL	0.997	1.000	
	UCL	0.788	1.000		UCL	1.001	1.000	

SA20-TA5

	p=1	t=5	t=10	t=40	p=5	t=5	t=10	t=40
	Rate	**0.064**	**0.077**	**0.190**	Rate	**0.086**	**0.130**	**0.437**
s=5	LCL	0.048	0.060	0.166	LCL	0.068	0.109	0.406
	UCL	0.080	0.094	0.214	UCL	0.104	0.151	0.468
	Rate	**0.134**	**0.231**	**0.675**	Rate	**0.253**	**0.567**	**0.995**
s=10	LCL	0.112	0.205	0.646	LCL	0.225	0.536	0.991
	UCL	0.156	0.257	0.704	UCL	0.281	0.598	0.999
	Rate	**0.317**	**0.668**	**0.999**	Rate	**0.766**	**0.997**	**1.000**
s=20	LCL	0.288	0.639	0.997	LCL	0.739	0.994	1.000
	UCL	0.346	0.697	1.001	UCL	0.793	1.000	1.000
	Rate	**0.653**	**0.961**	**1.000**	Rate	**0.997**	**1.000**	**1.000**
s=40	LCL	0.623	0.949	1.000	LCL	0.994	1.000	1.000
	UCL	0.683	0.973	1.000	UCL	1.000	1.000	1.000
	Rate	**0.931**	**1.000**		Rate	**1.000**	**1.000**	
s=80	LCL	0.915	1.000		LCL	1.000	1.000	
	UCL	0.947	1.000		UCL	1.000	1.000	

TABLE B5A. Rate of type I error for space and time tests after 1000 simulations, scenario 1, anova model 2. LCL/UCL: Lower/Upper Confidence Limit.

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
	Rate	**0.052**	**0.051**	**0.048**	**0.049**	**0.062**	**0.060**	Rate	**0.064**	**0.049**	**0.043**	**0.043**	**0.050**	**0.056**
s=5	LCL	0.038	0.037	0.034	0.035	0.047	0.045	LCL	0.048	0.035	0.030	0.030	0.036	0.042
	UCL	0.067	0.065	0.062	0.063	0.077	0.075	UCL	0.080	0.063	0.056	0.056	0.064	0.070
	Rate	**0.045**	**0.041**	**0.061**	**0.043**	**0.050**	**0.050**	Rate	**0.041**	**0.048**	**0.044**	**0.053**	**0.057**	**0.046**
s=10	LCL	0.032	0.028	0.046	0.030	0.036	0.036	LCL	0.028	0.034	0.031	0.039	0.043	0.033
	UCL	0.058	0.054	0.076	0.056	0.064	0.064	UCL	0.054	0.062	0.057	0.067	0.071	0.059
	Rate	**0.059**	**0.049**	**0.048**	**0.056**	**0.047**	**0.056**	Rate	**0.048**	**0.052**	**0.047**	**0.057**	**0.050**	**0.046**
s=20	LCL	0.044	0.035	0.035	0.042	0.034	0.042	LCL	0.035	0.038	0.034	0.043	0.036	0.033
	UCL	0.074	0.063	0.061	0.070	0.060	0.070	UCL	0.061	0.066	0.060	0.071	0.064	0.059
	Rate	**0.049**	**0.047**	**0.051**	**0.046**	**0.056**	**0.059**	Rate	**0.044**	**0.041**	**0.044**	**0.050**	**0.057**	**0.053**
s=40	LCL	0.036	0.034	0.037	0.033	0.042	0.044	LCL	0.031	0.029	0.031	0.036	0.043	0.039
	UCL	0.062	0.060	0.065	0.059	0.070	0.074	UCL	0.057	0.053	0.057	0.064	0.071	0.067
	Rate	**0.043**	**0.043**	**0.048**	**0.053**			Rate	**0.051**	**0.051**	**0.052**	**0.042**		
s=80	LCL	0.030	0.030	0.035	0.039			LCL	0.037	0.037	0.038	0.030		
	UCL	0.056	0.056	0.061	0.067			UCL	0.065	0.065	0.066	0.054		

TABLE B5B. Rate of type I error for space and time tests after 1000 simulations, scenario 1, anova model 3. LCL/UCL: Lower/Upper Confidence Limit.

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
	Rate	**0.048**	**0.052**	**0.034**	**0.052**	**0.056**	**0.056**	Rate	**0.054**	**0.056**	**0.041**	**0.054**	**0.045**	**0.050**
s=5	LCL	0.034	0.038	0.022	0.038	0.042	0.042	LCL	0.039	0.041	0.028	0.040	0.032	0.036
	UCL	0.062	0.067	0.046	0.066	0.070	0.070	UCL	0.069	0.071	0.054	0.068	0.058	0.064
	Rate	**0.054**	**0.054**	**0.045**	**0.067**	**0.067**	**0.044**	Rate	**0.054**	**0.054**	**0.050**	**0.049**	**0.050**	**0.051**
s=10	LCL	0.040	0.040	0.032	0.051	0.051	0.031	LCL	0.040	0.040	0.036	0.035	0.036	0.037
	UCL	0.068	0.068	0.058	0.083	0.083	0.057	UCL	0.068	0.068	0.064	0.063	0.064	0.065
	Rate	**0.045**	**0.039**	**0.043**	**0.050**	**0.042**	**0.054**	Rate	**0.051**	**0.044**	**0.057**	**0.047**	**0.052**	**0.054**
s=20	LCL	0.032	0.027	0.030	0.036	0.030	0.040	LCL	0.037	0.031	0.043	0.034	0.038	0.040
	UCL	0.058	0.051	0.056	0.064	0.054	0.068	UCL	0.065	0.057	0.071	0.060	0.066	0.068
	Rate	**0.048**	**0.055**	**0.044**	**0.050**	**0.044**	**0.048**	Rate	**0.058**	**0.056**	**0.048**	**0.053**	**0.047**	**0.043**
s=40	LCL	0.035	0.041	0.031	0.036	0.031	0.035	LCL	0.043	0.042	0.035	0.039	0.034	0.030
	UCL	0.061	0.069	0.057	0.064	0.057	0.061	UCL	0.073	0.070	0.061	0.067	0.060	0.056
	Rate	**0.044**	**0.067**	**0.047**	**0.047**			Rate	**0.053**	**0.046**	**0.049**	**0.053**		
s=80	LCL	0.031	0.051	0.034	0.034			LCL	0.039	0.033	0.036	0.039		
	UCL	0.057	0.083	0.060	0.060			UCL	0.067	0.059	0.062	0.067		

TABLE B5C. Rate of type I error for space and time tests after 1000 simulations, scenario 1, anova model 4. LCL/UCL: Lower/Upper Confidence Limit.

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
	Rate	**0.054**	**0.065**	**0.045**	**0.042**	**0.053**	**0.050**	Rate	**0.051**	**0.038**	**0.053**	**0.047**	**0.048**	**0.064**
s=5	LCL	0.039	0.049	0.032	0.029	0.039	0.036	LCL	0.037	0.026	0.039	0.034	0.035	0.049
	UCL	0.069	0.081	0.058	0.055	0.067	0.064	UCL	0.065	0.050	0.067	0.060	0.061	0.079
	Rate	**0.038**	**0.040**	**0.052**	**0.041**	**0.051**	**0.041**	Rate	**0.047**	**0.060**	**0.051**	**0.060**	**0.053**	**0.055**
s=10	LCL	0.026	0.028	0.038	0.029	0.037	0.029	LCL	0.034	0.045	0.037	0.045	0.039	0.041
	UCL	0.050	0.052	0.066	0.053	0.065	0.053	UCL	0.060	0.075	0.065	0.075	0.067	0.069
	Rate	**0.054**	**0.050**	**0.044**	**0.041**	**0.047**	**0.054**	Rate	**0.048**	**0.056**	**0.052**	**0.056**	**0.046**	**0.043**
s=20	LCL	0.040	0.036	0.031	0.029	0.034	0.040	LCL	0.035	0.042	0.038	0.042	0.033	0.030
	UCL	0.068	0.064	0.057	0.053	0.060	0.068	UCL	0.061	0.070	0.066	0.070	0.059	0.056
	Rate	**0.054**	**0.038**	**0.048**	**0.048**	**0.053**	**0.060**	Rate	**0.043**	**0.050**	**0.039**	**0.055**	**0.035**	**0.051**
s=40	LCL	0.040	0.026	0.035	0.035	0.039	0.045	LCL	0.030	0.036	0.027	0.041	0.024	0.037
	UCL	0.068	0.050	0.061	0.061	0.067	0.075	UCL	0.056	0.064	0.051	0.069	0.046	0.065
	Rate	**0.062**	**0.055**	**0.055**	**0.053**			Rate	**0.051**	**0.057**	**0.050**	**0.056**		
s=80	LCL	0.047	0.041	0.041	0.039			LCL	0.037	0.043	0.036	0.042		
	UCL	0.077	0.069	0.069	0.067			UCL	0.065	0.071	0.064	0.070		

TABLE B5D. Rate of type I error for space and time tests after 1000 simulations, scenario 1, anova model 5. LCL/UCL: Lower/Upper Confidence Limit.

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
	Rate	**0.049**	**0.041**	**0.051**	**0.055**	**0.043**	**0.052**	Rate	**0.044**	**0.044**	**0.052**	**0.048**	**0.045**	**0.051**
s=5	LCL	0.035	0.028	0.037	0.041	0.030	0.038	LCL	0.031	0.031	0.038	0.034	0.032	0.037
	UCL	0.063	0.054	0.065	0.070	0.056	0.066	UCL	0.057	0.057	0.066	0.062	0.058	0.065
	Rate	**0.049**	**0.055**	**0.065**	**0.039**	**0.046**	**0.057**	Rate	**0.048**	**0.058**	**0.044**	**0.034**	**0.046**	**0.055**
s=10	LCL	0.035	0.041	0.050	0.027	0.033	0.043	LCL	0.034	0.043	0.031	0.023	0.033	0.041
	UCL	0.063	0.070	0.080	0.051	0.059	0.071	UCL	0.062	0.073	0.057	0.045	0.059	0.069
	Rate	**0.066**	**0.051**	**0.047**	**0.057**	**0.064**	**0.050**	Rate	**0.045**	**0.046**	**0.044**	**0.060**	**0.067**	**0.052**
s=20	LCL	0.050	0.037	0.034	0.043	0.049	0.036	LCL	0.032	0.033	0.031	0.045	0.051	0.038
	UCL	0.082	0.065	0.060	0.071	0.079	0.064	UCL	0.058	0.059	0.057	0.075	0.083	0.066
	Rate	**0.043**	**0.046**	**0.053**	**0.052**	**0.045**	**0.044**	Rate	**0.054**	**0.050**	**0.052**	**0.054**	**0.042**	**0.059**
s=40	LCL	0.030	0.033	0.039	0.038	0.032	0.031	LCL	0.040	0.036	0.038	0.040	0.030	0.044
	UCL	0.056	0.059	0.067	0.066	0.058	0.057	UCL	0.068	0.064	0.066	0.068	0.054	0.074
	Rate	**0.030**	**0.056**	**0.050**	**0.044**			Rate	**0.055**	**0.057**	**0.043**	**0.047**		
s=80	LCL	0.019	0.042	0.036	0.031			LCL	0.041	0.043	0.030	0.034		
	UCL	0.041	0.070	0.064	0.057			UCL	0.069	0.071	0.056	0.060		

TABLE B6A. Rate of type I error for time test and power for space test after 1000 simulations, scenario 2, anova model 2.

SA10-TA10

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
	Rate	1.000	0.046	1.000	0.042	1.000	0.031	Rate	1.000	0.055	1.000	0.040	1.000	0.042
s=5	LCL	1.000	0.032	1.000	0.029	1.000	0.020	LCL	1.000	0.040	1.000	0.028	1.000	0.029
	UCL	1.000	0.060	1.000	0.055	1.000	0.042	UCL	1.000	0.070	1.000	0.052	1.000	0.055
	Rate	1.000	0.034	1.000	0.046	1.000	0.040	Rate	1.000	0.045	1.000	0.041	1.000	0.047
s=10	LCL	1.000	0.022	1.000	0.033	1.000	0.028	LCL	1.000	0.032	1.000	0.029	1.000	0.034
	UCL	1.000	0.046	1.000	0.059	1.000	0.052	UCL	1.000	0.058	1.000	0.053	1.000	0.060
	Rate	1.000	0.052	1.000	0.048	1.000	0.055	Rate	1.000	0.060	1.000	0.060	1.000	0.049
s=20	LCL	1.000	0.038	1.000	0.035	1.000	0.041	LCL	1.000	0.045	1.000	0.045	1.000	0.036
	UCL	1.000	0.066	1.000	0.061	1.000	0.069	UCL	1.000	0.075	1.000	0.075	1.000	0.062
	Rate	1.000	0.046	1.000	0.039	1.000	0.050	Rate	1.000	0.047	1.000	0.056	1.000	0.059
s=40	LCL	1.000	0.033	1.000	0.027	1.000	0.036	LCL	1.000	0.034	1.000	0.042	1.000	0.044
	UCL	1.000	0.059	1.000	0.051	1.000	0.064	UCL	1.000	0.060	1.000	0.070	1.000	0.074
	Rate	1.000	0.045	1.000	0.041			Rate	1.000	0.035	1.000	0.049		
s=80	LCL	1.000	0.032	1.000	0.029			LCL	1.000	0.024	1.000	0.036		
	UCL	1.000	0.058	1.000	0.053			UCL	1.000	0.046	1.000	0.062		

SA20-TA5

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
	Rate	1.000	0.048	1.000	0.040	1.000	0.051	Rate	1.000	0.059	1.000	0.055	1.000	0.063
s=5	LCL	1.000	0.034	1.000	0.028	1.000	0.037	LCL	1.000	0.044	1.000	0.041	1.000	0.048
	UCL	1.000	0.062	1.000	0.052	1.000	0.065	UCL	1.000	0.074	1.000	0.070	1.000	0.078
	Rate	1.000	0.058	1.000	0.044	1.000	0.046	Rate	1.000	0.046	1.000	0.051	1.000	0.048
s=10	LCL	1.000	0.043	1.000	0.031	1.000	0.033	LCL	1.000	0.033	1.000	0.037	1.000	0.035
	UCL	1.000	0.073	1.000	0.057	1.000	0.059	UCL	1.000	0.059	1.000	0.065	1.000	0.061
	Rate	1.000	0.041	1.000	0.043	1.000	0.049	Rate	1.000	0.037	1.000	0.048	1.000	0.042
s=20	LCL	1.000	0.029	1.000	0.030	1.000	0.036	LCL	1.000	0.025	1.000	0.035	1.000	0.030
	UCL	1.000	0.053	1.000	0.056	1.000	0.062	UCL	1.000	0.049	1.000	0.061	1.000	0.054
	Rate	1.000	0.056	1.000	0.053	1.000	0.063	Rate	1.000	0.056	1.000	0.065	1.000	0.048
s=40	LCL	1.000	0.042	1.000	0.039	1.000	0.048	LCL	1.000	0.042	1.000	0.050	1.000	0.035
	UCL	1.000	0.070	1.000	0.067	1.000	0.078	UCL	1.000	0.070	1.000	0.080	1.000	0.061
	Rate	1.000	0.052	1.000	0.051			Rate	1.000	0.046	1.000	0.054		
s=80	LCL	1.000	0.038	1.000	0.037			LCL	1.000	0.033	1.000	0.040		
	UCL	1.000	0.066	1.000	0.065			UCL	1.000	0.059	1.000	0.068		

TABLE B6B. Rate of type I error for time test and power for space test after 1000 simulations, scenario 2, anova model 3.

SA10-TA10

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
	Rate	0.627	0.061	0.796	0.048	0.958	0.045	Rate	0.925	0.047	0.988	0.052	1.000	0.048
s=5	LCL	0.595	0.045	0.770	0.034	0.945	0.032	LCL	0.908	0.033	0.981	0.038	1.000	0.035
	UCL	0.659	0.077	0.822	0.062	0.971	0.058	UCL	0.942	0.061	0.995	0.066	1.000	0.061
	Rate	0.790	0.041	0.960	0.056	0.998	0.046	Rate	1.000	0.058	1.000	0.062	1.000	0.049
s=10	LCL	0.764	0.028	0.948	0.042	0.995	0.033	LCL	1.000	0.043	1.000	0.047	1.000	0.036
	UCL	0.816	0.054	0.972	0.070	1.001	0.059	UCL	1.000	0.073	1.000	0.077	1.000	0.062
	Rate	0.985	0.055	1.000	0.042	1.000	0.044	Rate	1.000	0.051	1.000	0.061	1.000	0.046
s=20	LCL	0.977	0.041	1.000	0.029	1.000	0.031	LCL	1.000	0.037	1.000	0.046	1.000	0.033
	UCL	0.993	0.069	1.000	0.055	1.000	0.057	UCL	1.000	0.065	1.000	0.076	1.000	0.059
	Rate	1.000	0.058	1.000	0.055	1.000	0.048	Rate	1.000	0.055	1.000	0.048	1.000	0.045
s=40	LCL	1.000	0.043	1.000	0.041	1.000	0.035	LCL	1.000	0.041	1.000	0.035	1.000	0.032
	UCL	1.000	0.073	1.000	0.069	1.000	0.061	UCL	1.000	0.069	1.000	0.061	1.000	0.058
	Rate	1.000	0.043	1.000	0.050			Rate	1.000	0.058	1.000	0.048		
s=80	LCL	1.000	0.030	1.000	0.036			LCL	1.000	0.043	1.000	0.035		
	UCL	1.000	0.056	1.000	0.064			UCL	1.000	0.073	1.000	0.061		

SA20-TA5

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
	Rate	0.649	0.050	0.838	0.051	0.945	0.064	Rate	0.850	0.054	0.977	0.064	1.000	0.049
s=5	LCL	0.618	0.036	0.815	0.037	0.931	0.049	LCL	0.827	0.039	0.967	0.048	1.000	0.036
	UCL	0.680	0.064	0.861	0.065	0.959	0.079	UCL	0.873	0.069	0.987	0.080	1.000	0.062
	Rate	0.837	0.049	0.971	0.058	0.998	0.045	Rate	1.000	0.053	1.000	0.053	1.000	0.057
s=10	LCL	0.814	0.035	0.960	0.043	0.995	0.032	LCL	1.000	0.039	1.000	0.039	1.000	0.043
	UCL	0.860	0.063	0.982	0.073	1.001	0.058	UCL	1.000	0.067	1.000	0.067	1.000	0.071
	Rate	0.975	0.031	1.000	0.058	1.000	0.046	Rate	1.000	0.051	1.000	0.056	1.000	0.036
s=20	LCL	0.965	0.020	1.000	0.043	1.000	0.033	LCL	1.000	0.037	1.000	0.042	1.000	0.024
	UCL	0.985	0.042	1.000	0.073	1.000	0.059	UCL	1.000	0.065	1.000	0.070	1.000	0.048
	Rate	1.000	0.035	1.000	0.052	1.000	0.038	Rate	1.000	0.049	1.000	0.053	1.000	0.055
s=40	LCL	1.000	0.024	1.000	0.038	1.000	0.026	LCL	1.000	0.036	1.000	0.039	1.000	0.041
	UCL	1.000	0.046	1.000	0.066	1.000	0.050	UCL	1.000	0.062	1.000	0.067	1.000	0.069
	Rate	1.000	0.050	1.000	0.068			Rate	1.000	0.044	1.000	0.051		
s=80	LCL	1.000	0.036	1.000	0.052			LCL	1.000	0.031	1.000	0.037		
	UCL	1.000	0.064	1.000	0.084			UCL	1.000	0.057	1.000	0.065		

TABLE B6C. Rate of type I error for time test and power for space test after 1000 simulations, scenario 2, anova model 4.

SA10-TA10

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
s=5	Rate	0.712	0.036	0.812	0.044	0.944	0.043	Rate	0.977	0.050	0.993	0.049	1.000	0.054
	LCL	0.682	0.024	0.787	0.031	0.930	0.030	LCL	0.967	0.036	0.988	0.035	1.000	0.040
	UCL	0.742	0.048	0.837	0.057	0.958	0.056	UCL	0.987	0.064	0.998	0.063	1.000	0.068
s=10	Rate	0.877	0.040	0.988	0.062	1.000	0.052	Rate	1.000	0.046	1.000	0.048	1.000	0.044
	LCL	0.856	0.028	0.981	0.047	1.000	0.038	LCL	1.000	0.033	1.000	0.035	1.000	0.031
	UCL	0.898	0.052	0.995	0.077	1.000	0.066	UCL	1.000	0.059	1.000	0.061	1.000	0.057
s=20	Rate	1.000	0.048	1.000	0.054	1.000	0.052	Rate	1.000	0.045	1.000	0.051	1.000	0.053
	LCL	1.000	0.035	1.000	0.040	1.000	0.038	LCL	1.000	0.032	1.000	0.037	1.000	0.039
	UCL	1.000	0.061	1.000	0.068	1.000	0.066	UCL	1.000	0.058	1.000	0.065	1.000	0.067
s=40	Rate	1.000	0.045	1.000	0.054	1.000	0.041	Rate	1.000	0.046	1.000	0.047	1.000	0.041
	LCL	1.000	0.032	1.000	0.040	1.000	0.029	LCL	1.000	0.033	1.000	0.034	1.000	0.029
	UCL	1.000	0.058	1.000	0.068	1.000	0.053	UCL	1.000	0.059	1.000	0.060	1.000	0.053
s=80	Rate	1.000	0.047	1.000	0.049			Rate	1.000	0.043	1.000	0.051		
	LCL	1.000	0.034	1.000	0.036			LCL	1.000	0.030	1.000	0.037		
	UCL	1.000	0.060	1.000	0.062			UCL	1.000	0.056	1.000	0.065		

SA20-TA5

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
s=5	Rate	0.764	0.053	0.873	0.059	0.954	0.058	Rate	0.917	0.052	0.994	0.060	1.000	0.065
	LCL	0.736	0.038	0.852	0.044	0.941	0.043	LCL	0.899	0.038	0.989	0.045	1.000	0.050
	UCL	0.792	0.068	0.894	0.074	0.967	0.073	UCL	0.935	0.067	0.999	0.075	1.000	0.080
s=10	Rate	0.946	0.046	0.995	0.041	1.000	0.045	Rate	1.000	0.063	1.000	0.062	1.000	0.053
	LCL	0.932	0.033	0.991	0.029	1.000	0.032	LCL	1.000	0.048	1.000	0.047	1.000	0.039
	UCL	0.960	0.059	0.999	0.053	1.000	0.058	UCL	1.000	0.078	1.000	0.077	1.000	0.067
s=20	Rate	0.992	0.059	1.000	0.053	1.000	0.057	Rate	1.000	0.052	1.000	0.043	1.000	0.066
	LCL	0.986	0.044	1.000	0.039	1.000	0.043	LCL	1.000	0.038	1.000	0.030	1.000	0.051
	UCL	0.998	0.074	1.000	0.067	1.000	0.071	UCL	1.000	0.066	1.000	0.056	1.000	0.081
s=40	Rate	1.000	0.057	1.000	0.062	1.000	0.056	Rate	1.000	0.062	1.000	0.051	1.000	0.064
	LCL	1.000	0.043	1.000	0.047	1.000	0.042	LCL	1.000	0.047	1.000	0.037	1.000	0.049
	UCL	1.000	0.071	1.000	0.077	1.000	0.070	UCL	1.000	0.077	1.000	0.065	1.000	0.079
s=80	Rate	1.000	0.060	1.000	0.045			Rate	1.000	0.048	1.000	0.045		
	LCL	1.000	0.045	1.000	0.032			LCL	1.000	0.035	1.000	0.032		
	UCL	1.000	0.075	1.000	0.058			UCL	1.000	0.061	1.000	0.058		

TABLE B6D. Rate of type I error for time test and power for space test after 1000 simulations, scenario 2, anova model 5.

SA10-TA10

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
s=5	Rate	1.000	0.051	1.000	0.048	1.000	0.044	Rate	1.000	0.048	1.000	0.052	1.000	0.051
	LCL	1.000	0.037	1.000	0.034	1.000	0.031	LCL	1.000	0.034	1.000	0.038	1.000	0.037
	UCL	1.000	0.065	1.000	0.062	1.000	0.057	UCL	1.000	0.062	1.000	0.066	1.000	0.065
s=10	Rate	1.000	0.063	1.000	0.055	1.000	0.053	Rate	1.000	0.048	1.000	0.053	1.000	0.047
	LCL	1.000	0.048	1.000	0.041	1.000	0.039	LCL	1.000	0.034	1.000	0.039	1.000	0.034
	UCL	1.000	0.078	1.000	0.069	1.000	0.067	UCL	1.000	0.062	1.000	0.067	1.000	0.060
s=20	Rate	1.000	0.053	1.000	0.051	1.000	0.060	Rate	1.000	0.040	1.000	0.054	1.000	0.046
	LCL	1.000	0.039	1.000	0.037	1.000	0.045	LCL	1.000	0.028	1.000	0.040	1.000	0.033
	UCL	1.000	0.067	1.000	0.065	1.000	0.075	UCL	1.000	0.052	1.000	0.068	1.000	0.059
s=40	Rate	1.000	0.056	1.000	0.055	1.000	0.062	Rate	1.000	0.052	1.000	0.049	1.000	0.059
	LCL	1.000	0.042	1.000	0.041	1.000	0.047	LCL	1.000	0.038	1.000	0.036	1.000	0.044
	UCL	1.000	0.070	1.000	0.069	1.000	0.077	UCL	1.000	0.066	1.000	0.062	1.000	0.074
s=80	Rate	1.000	0.055	1.000	0.052			Rate	1.000	0.044	1.000	0.048		
	LCL	1.000	0.041	1.000	0.038			LCL	1.000	0.031	1.000	0.035		
	UCL	1.000	0.069	1.000	0.066			UCL	1.000	0.057	1.000	0.061		

SA20-TA5

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
s=5	Rate	1.000	0.039	1.000	0.062	1.000	0.049	Rate	1.000	0.055	1.000	0.047	1.000	0.067
	LCL	1.000	0.026	1.000	0.047	1.000	0.036	LCL	1.000	0.040	1.000	0.034	1.000	0.051
	UCL	1.000	0.052	1.000	0.077	1.000	0.062	UCL	1.000	0.070	1.000	0.060	1.000	0.083
s=10	Rate	1.000	0.048	1.000	0.055	1.000	0.047	Rate	1.000	0.045	1.000	0.046	1.000	0.052
	LCL	1.000	0.034	1.000	0.041	1.000	0.034	LCL	1.000	0.032	1.000	0.033	1.000	0.038
	UCL	1.000	0.062	1.000	0.069	1.000	0.060	UCL	1.000	0.058	1.000	0.059	1.000	0.066
s=20	Rate	1.000	0.052	1.000	0.053	1.000	0.052	Rate	1.000	0.046	1.000	0.051	1.000	0.047
	LCL	1.000	0.038	1.000	0.039	1.000	0.038	LCL	1.000	0.033	1.000	0.037	1.000	0.034
	UCL	1.000	0.066	1.000	0.067	1.000	0.066	UCL	1.000	0.059	1.000	0.065	1.000	0.060
s=40	Rate	1.000	0.039	1.000	0.043	1.000	0.040	Rate	1.000	0.050	1.000	0.048	1.000	0.051
	LCL	1.000	0.027	1.000	0.030	1.000	0.028	LCL	1.000	0.036	1.000	0.035	1.000	0.037
	UCL	1.000	0.051	1.000	0.056	1.000	0.052	UCL	1.000	0.064	1.000	0.061	1.000	0.065
s=80	Rate	1.000	0.052	1.000	0.049			Rate	1.000	0.045	1.000	0.055		
	LCL	1.000	0.038	1.000	0.036			LCL	1.000	0.032	1.000	0.041		
	UCL	1.000	0.066	1.000	0.062			UCL	1.000	0.058	1.000	0.069		

TABLE B7A. Power for space and time tests after 1000 simulations, scenario 3, anova model 2.

SA10-TA10

s	p=1	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T
s=5	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=10	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=20	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=40	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=80	Rate	**1.000**	**1.000**	**1.000**	**1.000**		
	LCL	1.000	1.000	1.000	1.000		
	UCL	1.000	1.000	1.000	1.000		

s	p=5	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T
s=5	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=10	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=20	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=40	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=80	Rate	**1.000**	**1.000**	**1.000**	**1.000**		
	LCL	1.000	1.000	1.000	1.000		
	UCL	1.000	1.000	1.000	1.000		

SA20-TA5

s	p=1	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T
s=5	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=10	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=20	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=40	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=80	Rate	**1.000**	**1.000**	**1.000**	**1.000**		
	LCL	1.000	1.000	1.000	1.000		
	UCL	1.000	1.000	1.000	1.000		

s	p=5	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T
s=5	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=10	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=20	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=40	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=80	Rate	**1.000**	**1.000**	**1.000**	**1.000**		
	LCL	1.000	1.000	1.000	1.000		
	UCL	1.000	1.000	1.000	1.000		

TABLE B7B. Power for space and time tests after 1000 simulations, scenario 3, anova model 3.

SA10-TA10

s	p=1	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T
s=5	Rate	**0.684**	**0.998**	**0.890**	**1.000**	**0.941**	**1.000**
	LCL	0.654	0.995	0.870	1.000	0.926	1.000
	UCL	0.714	1.001	0.910	1.000	0.956	1.000
s=10	Rate	**0.856**	**1.000**	**0.968**	**1.000**	**1.000**	**1.000**
	LCL	0.834	1.000	0.957	1.000	1.000	1.000
	UCL	0.878	1.000	0.979	1.000	1.000	1.000
s=20	Rate	**0.975**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	0.965	1.000	1.000	1.000	1.000	1.000
	UCL	0.985	1.000	1.000	1.000	1.000	1.000
s=40	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=80	Rate	**1.000**	**1.000**	**1.000**	**1.000**		
	LCL	1.000	1.000	1.000	1.000		
	UCL	1.000	1.000	1.000	1.000		

s	p=5	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T
s=5	Rate	**0.904**	**1.000**	**0.990**	**1.000**	**1.000**	**1.000**
	LCL	0.885	1.000	0.984	1.000	1.000	1.000
	UCL	0.923	1.000	0.996	1.000	1.000	1.000
s=10	Rate	**0.994**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	0.989	1.000	1.000	1.000	1.000	1.000
	UCL	0.999	1.000	1.000	1.000	1.000	1.000
s=20	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=40	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=80	Rate	**1.000**	**1.000**	**1.000**	**1.000**		
	LCL	1.000	1.000	1.000	1.000		
	UCL	1.000	1.000	1.000	1.000		

SA20-TA5

s	p=1	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T
s=5	Rate	**0.605**	**0.999**	**0.755**	**1.000**	**0.926**	**1.000**
	LCL	0.573	0.997	0.728	1.000	0.910	1.000
	UCL	0.637	1.001	0.782	1.000	0.942	1.000
s=10	Rate	**0.810**	**0.999**	**0.920**	**1.000**	**0.995**	**1.000**
	LCL	0.785	0.997	0.903	1.000	0.991	1.000
	UCL	0.835	1.001	0.937	1.000	0.999	1.000
s=20	Rate	**0.997**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	0.994	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=40	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=80	Rate	**1.000**	**1.000**	**1.000**	**1.000**		
	LCL	1.000	1.000	1.000	1.000		
	UCL	1.000	1.000	1.000	1.000		

s	p=5	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T
s=5	Rate	**0.852**	**1.000**	**0.996**	**1.000**	**1.000**	**1.000**
	LCL	0.829	1.000	0.992	1.000	1.000	1.000
	UCL	0.875	1.000	1.000	1.000	1.000	1.000
s=10	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=20	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=40	Rate	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	LCL	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000
s=80	Rate	**1.000**	**1.000**	**1.000**	**1.000**		
	LCL	1.000	1.000	1.000	1.000		
	UCL	1.000	1.000	1.000	1.000		

TABLE B7C. Power for space and time tests after 1000 simulations, scenario 3, anova model 4.

SA10-TA10

		p=1, t=5 S	p=1, t=5 T	p=1, t=10 S	p=1, t=10 T	p=1, t=40 S	p=1, t=40 T	p=5, t=5 S	p=5, t=5 T	p=5, t=10 S	p=5, t=10 T	p=5, t=40 S	p=5, t=40 T
	Rate	0.760	0.739	0.863	0.939	0.963	1.000	0.947	0.969	0.999	1.000	1.000	1.000
s=5	LCL	0.732	0.710	0.841	0.924	0.951	1.000	0.932	0.958	0.997	1.000	1.000	1.000
	UCL	0.788	0.768	0.885	0.954	0.975	1.000	0.962	0.980	1.001	1.000	1.000	1.000
	Rate	0.939	0.867	0.987	0.989	1.000	1.000	1.000	0.996	1.000	1.000	1.000	1.000
s=10	LCL	0.924	0.845	0.980	0.982	1.000	1.000	1.000	0.992	1.000	1.000	1.000	1.000
	UCL	0.954	0.889	0.994	0.996	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	0.929	1.000	0.998	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
s=20	LCL	1.000	0.913	1.000	0.995	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	0.945	1.000	1.001	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	0.969	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
s=40	LCL	1.000	0.958	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	0.980	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	0.989	1.000	1.000			1.000	1.000	1.000	1.000		
s=80	LCL	1.000	0.983	1.000	1.000			1.000	1.000	1.000	1.000		
	UCL	1.000	0.995	1.000	1.000			1.000	1.000	1.000	1.000		

SA20-TA5

		p=1, t=5 S	p=1, t=5 T	p=1, t=10 S	p=1, t=10 T	p=1, t=40 S	p=1, t=40 T	p=5, t=5 S	p=5, t=5 T	p=5, t=10 S	p=5, t=10 T	p=5, t=40 S	p=5, t=40 T
	Rate	0.674	0.742	0.825	0.950	0.949	1.000	0.960	0.985	1.000	1.000	1.000	1.000
s=5	LCL	0.643	0.713	0.801	0.936	0.935	1.000	0.947	0.977	1.000	1.000	1.000	1.000
	UCL	0.705	0.771	0.849	0.964	0.963	1.000	0.973	0.993	1.000	1.000	1.000	1.000
	Rate	0.919	0.862	0.976	0.993	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
s=10	LCL	0.902	0.840	0.966	0.988	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	0.936	0.884	0.986	0.998	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	0.924	1.000	0.997	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
s=20	LCL	1.000	0.907	1.000	0.994	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	0.941	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	0.956	1.000	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
s=40	LCL	1.000	0.943	1.000	0.997	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	0.969	1.000	1.001	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	0.974	1.000	1.000			1.000	1.000	1.000	1.000		
s=80	LCL	1.000	0.964	1.000	1.000			1.000	1.000	1.000	1.000		
	UCL	1.000	0.984	1.000	1.000			1.000	1.000	1.000	1.000		

TABLE B7D. Power for space and time tests after 1000 simulations, scenario 3, anova model 5.

SA10-TA10

		p=1, t=5 S	p=1, t=5 T	p=1, t=10 S	p=1, t=10 T	p=1, t=40 S	p=1, t=40 T	p=5, t=5 S	p=5, t=5 T	p=5, t=10 S	p=5, t=10 T	p=5, t=40 S	p=5, t=40 T
	Rate	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
s=5	LCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
s=10	LCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
s=20	LCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
s=40	LCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	1.000	1.000	1.000			1.000	1.000	1.000	1.000		
s=80	LCL	1.000	1.000	1.000	1.000			1.000	1.000	1.000	1.000		
	UCL	1.000	1.000	1.000	1.000			1.000	1.000	1.000	1.000		

SA20-TA5

		p=1, t=5 S	p=1, t=5 T	p=1, t=10 S	p=1, t=10 T	p=1, t=40 S	p=1, t=40 T	p=5, t=5 S	p=5, t=5 T	p=5, t=10 S	p=5, t=10 T	p=5, t=40 S	p=5, t=40 T
	Rate	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
s=5	LCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
s=10	LCL	1.000	0.997	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.001	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
s=20	LCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
s=40	LCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	UCL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Rate	1.000	1.000	1.000	1.000			1.000	1.000	1.000	1.000		
s=80	LCL	1.000	1.000	1.000	1.000			1.000	1.000	1.000	1.000		
	UCL	1.000	1.000	1.000	1.000			1.000	1.000	1.000	1.000		

TABLE B8A. Power for space and time tests after 1000 simulations, scenario 4, anova model 2.

SA10-TA10

	p=1	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T	p=5	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T
s=5	Rate	0.156	0.157	0.206	0.408	0.242	0.942	Rate	0.379	0.364	0.499	0.846	0.597	1.000
	LCL	0.132	0.133	0.180	0.377	0.215	0.927	LCL	0.347	0.333	0.467	0.823	0.566	1.000
	UCL	0.180	0.181	0.232	0.439	0.269	0.957	UCL	0.411	0.395	0.531	0.869	0.628	1.000
s=10	Rate	0.408	0.222	0.506	0.487	0.542	0.967	Rate	0.858	0.501	0.946	0.933	0.955	1.000
	LCL	0.377	0.196	0.475	0.456	0.511	0.956	LCL	0.836	0.469	0.932	0.917	0.942	1.000
	UCL	0.439	0.248	0.537	0.518	0.573	0.978	UCL	0.880	0.533	0.960	0.949	0.968	1.000
s=20	Rate	0.718	0.263	0.807	0.517	0.802	0.967	Rate	0.996	0.558	1.000	0.947	1.000	1.000
	LCL	0.690	0.235	0.782	0.486	0.777	0.956	LCL	0.992	0.527	1.000	0.933	1.000	1.000
	UCL	0.746	0.291	0.832	0.548	0.827	0.978	UCL	1.000	0.589	1.000	0.961	1.000	1.000
s=40	Rate	0.948	0.247	0.969	0.557	0.963	0.969	Rate	1.000	0.577	1.000	0.957	1.000	1.000
	LCL	0.934	0.220	0.958	0.526	0.951	0.958	LCL	1.000	0.546	1.000	0.944	1.000	1.000
	UCL	0.962	0.274	0.980	0.588	0.975	0.980	UCL	1.000	0.608	1.000	0.970	1.000	1.000
s=80	Rate	0.999	0.242	1.000	0.554			Rate	1.000	0.584	1.000	0.952		
	LCL	0.997	0.215	1.000	0.523			LCL	1.000	0.553	1.000	0.939		
	UCL	1.001	0.269	1.000	0.585			UCL	1.000	0.615	1.000	0.965		

SA20-TA5

	p=1	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T	p=5	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T
s=5	Rate	0.060	0.374	0.073	0.692	0.066	0.998	Rate	0.101	0.848	0.092	0.995	0.113	1.000
	LCL	0.044	0.342	0.056	0.663	0.051	0.995	LCL	0.081	0.825	0.074	0.991	0.093	1.000
	UCL	0.076	0.406	0.090	0.721	0.081	1.001	UCL	0.121	0.871	0.110	0.999	0.133	1.000
s=10	Rate	0.132	0.534	0.158	0.829	0.173	1.000	Rate	0.302	0.962	0.347	1.000	0.389	1.000
	LCL	0.110	0.502	0.135	0.805	0.149	1.000	LCL	0.273	0.950	0.317	1.000	0.359	1.000
	UCL	0.154	0.566	0.181	0.853	0.197	1.000	UCL	0.331	0.974	0.377	1.000	0.419	1.000
s=20	Rate	0.340	0.602	0.376	0.888	0.432	1.000	Rate	0.763	0.989	0.820	1.000	0.827	1.000
	LCL	0.310	0.571	0.346	0.868	0.401	1.000	LCL	0.736	0.982	0.796	1.000	0.804	1.000
	UCL	0.370	0.633	0.406	0.908	0.463	1.000	UCL	0.790	0.996	0.844	1.000	0.850	1.000
s=40	Rate	0.634	0.640	0.658	0.906	0.690	1.000	Rate	0.980	0.983	0.988	1.000	0.986	1.000
	LCL	0.604	0.610	0.628	0.888	0.661	1.000	LCL	0.971	0.975	0.981	1.000	0.979	1.000
	UCL	0.664	0.670	0.688	0.924	0.719	1.000	UCL	0.989	0.991	0.995	1.000	0.993	1.000
s=80	Rate	0.876	0.644	0.880	0.915			Rate	1.000	0.987	1.000	1.000		
	LCL	0.856	0.614	0.860	0.898			LCL	1.000	0.980	1.000	1.000		
	UCL	0.897	0.674	0.900	0.932			UCL	1.000	0.994	1.000	1.000		

TABLE B8B. Power for space and time tests after 1000 simulations, scenario 4, anova model 3.

SA10-TA10

	p=1	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T	p=5	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T
s=5	Rate	0.174	0.151	0.261	0.392	0.324	0.951	Rate	0.502	0.373	0.636	0.880	0.776	1.000
	LCL	0.149	0.128	0.233	0.361	0.295	0.938	LCL	0.469	0.341	0.605	0.859	0.750	1.000
	UCL	0.199	0.174	0.289	0.423	0.353	0.964	UCL	0.535	0.405	0.667	0.901	0.802	1.000
s=10	Rate	0.488	0.235	0.616	0.536	0.713	0.988	Rate	0.945	0.552	0.988	0.969	0.992	1.000
	LCL	0.456	0.208	0.585	0.505	0.685	0.981	LCL	0.931	0.520	0.981	0.958	0.986	1.000
	UCL	0.520	0.262	0.647	0.567	0.741	0.995	UCL	0.960	0.584	0.995	0.980	0.998	1.000
s=20	Rate	0.835	0.288	0.919	0.629	0.944	0.996	Rate	1.000	0.645	1.000	0.988	1.000	1.000
	LCL	0.812	0.260	0.902	0.599	0.930	0.992	LCL	1.000	0.615	1.000	0.981	1.000	1.000
	UCL	0.858	0.316	0.936	0.659	0.958	1.000	UCL	1.000	0.675	1.000	0.995	1.000	1.000
s=40	Rate	0.991	0.299	0.996	0.652	0.998	0.997	Rate	1.000	0.692	1.000	0.991	1.000	1.000
	LCL	0.985	0.270	0.992	0.622	0.995	0.994	LCL	1.000	0.663	1.000	0.985	1.000	1.000
	UCL	0.997	0.328	1.000	0.682	1.001	1.000	UCL	1.000	0.721	1.000	0.997	1.000	1.000
s=80	Rate	1.000	0.294	1.000	0.685			Rate	1.000	0.702	1.000	0.992		
	LCL	1.000	0.266	1.000	0.656			LCL	1.000	0.674	1.000	0.986		
	UCL	1.000	0.322	1.000	0.714			UCL	1.000	0.730	1.000	0.998		

SA20-TA5

	p=1	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T	p=5	t=5 S	t=5 T	t=10 S	t=10 T	t=40 S	t=40 T
s=5	Rate	0.077	0.325	0.103	0.660	0.106	0.997	Rate	0.151	0.837	0.158	0.996	0.210	1.000
	LCL	0.060	0.294	0.084	0.630	0.087	0.994	LCL	0.128	0.813	0.135	0.992	0.185	1.000
	UCL	0.094	0.356	0.122	0.690	0.125	1.000	UCL	0.174	0.861	0.181	1.000	0.235	1.000
s=10	Rate	0.202	0.546	0.257	0.854	0.317	1.000	Rate	0.558	0.971	0.622	1.000	0.734	1.000
	LCL	0.176	0.514	0.230	0.832	0.288	1.000	LCL	0.526	0.960	0.592	1.000	0.707	1.000
	UCL	0.228	0.578	0.284	0.876	0.346	1.000	UCL	0.590	0.982	0.652	1.000	0.761	1.000
s=20	Rate	0.563	0.650	0.620	0.938	0.687	1.000	Rate	0.965	0.996	0.988	1.000	0.996	1.000
	LCL	0.532	0.620	0.590	0.923	0.658	1.000	LCL	0.953	0.992	0.981	1.000	0.992	1.000
	UCL	0.594	0.680	0.650	0.953	0.716	1.000	UCL	0.977	1.000	0.995	1.000	1.000	1.000
s=40	Rate	0.894	0.702	0.913	0.956	0.961	1.000	Rate	1.000	0.994	1.000	1.000	1.000	1.000
	LCL	0.875	0.673	0.895	0.943	0.949	1.000	LCL	1.000	0.989	1.000	1.000	1.000	1.000
	UCL	0.913	0.731	0.931	0.969	0.973	1.000	UCL	1.000	0.999	1.000	1.000	1.000	1.000
s=80	Rate	0.998	0.734	0.998	0.965			Rate	1.000	0.996	1.000	1.000		
	LCL	0.995	0.707	0.995	0.954			LCL	1.000	0.992	1.000	1.000		
	UCL	1.001	0.761	1.001	0.976			UCL	1.000	1.000	1.000	1.000		

TABLE B8C. Power for space and time tests after 1000 simulations, scenario 4, anova model 4.

SA10-TA10

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
	Rate	0.211	0.213	0.279	0.483	0.323	0.985	Rate	0.508	0.489	0.648	0.951	0.774	1.000
s=5	LCL	0.184	0.186	0.250	0.451	0.294	0.977	LCL	0.475	0.456	0.618	0.937	0.748	1.000
	UCL	0.238	0.240	0.308	0.515	0.352	0.993	UCL	0.541	0.522	0.678	0.965	0.800	1.000
	Rate	0.517	0.273	0.628	0.625	0.707	0.997	Rate	0.950	0.674	0.990	0.993	0.991	1.000
s=10	LCL	0.485	0.245	0.598	0.595	0.679	0.994	LCL	0.936	0.644	0.984	0.988	0.985	1.000
	UCL	0.549	0.301	0.658	0.655	0.735	1.000	UCL	0.964	0.704	0.996	0.998	0.997	1.000
	Rate	0.852	0.333	0.920	0.692	0.944	1.000	Rate	1.000	0.722	1.000	0.995	1.000	1.000
s=20	LCL	0.830	0.303	0.903	0.663	0.930	1.000	LCL	1.000	0.694	1.000	0.991	1.000	1.000
	UCL	0.874	0.363	0.937	0.721	0.958	1.000	UCL	1.000	0.750	1.000	0.999	1.000	1.000
	Rate	0.984	0.321	0.994	0.714	0.998	1.000	Rate	1.000	0.765	1.000	0.998	1.000	1.000
s=40	LCL	0.976	0.292	0.989	0.686	0.995	1.000	LCL	1.000	0.739	1.000	0.995	1.000	1.000
	UCL	0.992	0.350	0.999	0.742	1.001	1.000	UCL	1.000	0.791	1.000	1.001	1.000	1.000
	Rate	1.000	0.345	1.000	0.745			Rate	1.000	0.770	1.000	0.998		
s=80	LCL	1.000	0.315	1.000	0.718			LCL	1.000	0.744	1.000	0.995		
	UCL	1.000	0.375	1.000	0.772			UCL	1.000	0.796	1.000	1.001		

SA20-TA5

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
	Rate	0.084	0.392	0.097	0.709	0.093	0.997	Rate	0.147	0.853	0.142	0.998	0.182	1.000
s=5	LCL	0.066	0.360	0.078	0.680	0.075	0.994	LCL	0.124	0.830	0.120	0.995	0.158	1.000
	UCL	0.102	0.424	0.116	0.738	0.111	1.000	UCL	0.170	0.876	0.164	1.001	0.206	1.000
	Rate	0.201	0.537	0.249	0.858	0.298	1.000	Rate	0.521	0.965	0.584	1.000	0.682	1.000
s=10	LCL	0.176	0.505	0.222	0.836	0.270	1.000	LCL	0.489	0.953	0.553	1.000	0.653	1.000
	UCL	0.226	0.569	0.276	0.880	0.326	1.000	UCL	0.553	0.977	0.615	1.000	0.711	1.000
	Rate	0.540	0.641	0.587	0.944	0.658	1.000	Rate	0.954	0.990	0.985	1.000	0.992	1.000
s=20	LCL	0.509	0.611	0.556	0.930	0.629	1.000	LCL	0.941	0.984	0.977	1.000	0.986	1.000
	UCL	0.571	0.671	0.618	0.958	0.687	1.000	UCL	0.967	0.996	0.993	1.000	0.998	1.000
	Rate	0.869	0.694	0.905	0.952	0.941	1.000	Rate	1.000	0.993	1.000	1.000	1.000	1.000
s=40	LCL	0.848	0.665	0.887	0.939	0.926	1.000	LCL	1.000	0.988	1.000	1.000	1.000	1.000
	UCL	0.890	0.723	0.923	0.965	0.956	1.000	UCL	1.000	0.998	1.000	1.000	1.000	1.000
	Rate	0.997	0.693	0.998	0.954			Rate	1.000	0.993	1.000	1.000		
s=80	LCL	0.994	0.664	0.995	0.941			LCL	1.000	0.988	1.000	1.000		
	UCL	1.000	0.722	1.001	0.967			UCL	1.000	0.998	1.000	1.000		

TABLE B8D. Power for space and time tests after 1000 simulations, scenario 4, anova model 5.

SA10-TA10

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
	Rate	0.172	0.156	0.232	0.411	0.295	0.960	Rate	0.390	0.395	0.578	0.893	0.705	1.000
s=5	LCL	0.147	0.132	0.205	0.380	0.267	0.948	LCL	0.358	0.363	0.547	0.873	0.677	1.000
	UCL	0.197	0.180	0.259	0.442	0.323	0.972	UCL	0.422	0.427	0.609	0.913	0.733	1.000
	Rate	0.437	0.240	0.580	0.550	0.666	0.994	Rate	0.899	0.569	0.978	0.978	0.989	1.000
s=10	LCL	0.405	0.213	0.549	0.519	0.637	0.989	LCL	0.880	0.538	0.969	0.969	0.983	1.000
	UCL	0.469	0.267	0.611	0.581	0.695	0.999	UCL	0.918	0.600	0.987	0.987	0.995	1.000
	Rate	0.775	0.304	0.891	0.633	0.924	0.997	Rate	0.999	0.662	1.000	0.986	1.000	1.000
s=20	LCL	0.749	0.275	0.872	0.603	0.908	0.994	LCL	0.997	0.632	1.000	0.979	1.000	1.000
	UCL	0.801	0.333	0.910	0.663	0.940	1.000	UCL	1.001	0.692	1.000	0.993	1.000	1.000
	Rate	0.977	0.303	0.991	0.667	0.997	0.997	Rate	1.000	0.708	1.000	0.990	1.000	1.000
s=40	LCL	0.968	0.274	0.985	0.638	0.994	0.994	LCL	1.000	0.680	1.000	0.984	1.000	1.000
	UCL	0.986	0.332	0.997	0.696	1.000	1.000	UCL	1.000	0.736	1.000	0.996	1.000	1.000
	Rate	1.000	0.304	1.000	0.694			Rate	1.000	0.722	1.000	0.995		
s=80	LCL	1.000	0.275	1.000	0.665			LCL	1.000	0.694	1.000	0.991		
	UCL	1.000	0.333	1.000	0.723			UCL	1.000	0.750	1.000	0.999		

SA20-TA5

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
	Rate	0.067	0.355	0.087	0.687	0.079	0.996	Rate	0.100	0.835	0.119	0.996	0.136	1.000
s=5	LCL	0.051	0.324	0.069	0.658	0.062	0.992	LCL	0.080	0.811	0.098	0.992	0.115	1.000
	UCL	0.083	0.386	0.105	0.716	0.096	1.000	UCL	0.120	0.859	0.140	1.000	0.157	1.000
	Rate	0.168	0.544	0.200	0.855	0.233	1.000	Rate	0.358	0.973	0.461	1.000	0.563	1.000
s=10	LCL	0.144	0.512	0.175	0.833	0.207	1.000	LCL	0.328	0.963	0.430	1.000	0.532	1.000
	UCL	0.192	0.576	0.225	0.877	0.259	1.000	UCL	0.388	0.983	0.492	1.000	0.594	1.000
	Rate	0.414	0.656	0.494	0.933	0.580	1.000	Rate	0.882	0.995	0.946	1.000	0.968	1.000
s=20	LCL	0.383	0.626	0.463	0.917	0.549	1.000	LCL	0.862	0.991	0.932	1.000	0.957	1.000
	UCL	0.445	0.686	0.525	0.949	0.611	1.000	UCL	0.902	0.999	0.960	1.000	0.979	1.000
	Rate	0.758	0.687	0.830	0.947	0.899	1.000	Rate	0.995	0.992	1.000	1.000	1.000	1.000
s=40	LCL	0.731	0.658	0.807	0.933	0.880	1.000	LCL	0.991	0.986	1.000	1.000	1.000	1.000
	UCL	0.785	0.716	0.853	0.961	0.918	1.000	UCL	0.999	0.998	1.000	1.000	1.000	1.000
	Rate	0.969	0.727	0.992	0.956			Rate	1.000	0.996	1.000	1.000		
s=80	LCL	0.958	0.699	0.986	0.943			LCL	1.000	0.992	1.000	1.000		
	UCL	0.980	0.755	0.998	0.969			UCL	1.000	1.000	1.000	1.000		

TABLE B9A. Rate of type I error for space and time tests after 1000 simulations, scenario 1, anova model 6b.

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
s=5	Rate	**0.061**	**0.065**	**0.043**	**0.044**	**0.046**	**0.047**	Rate	**0.062**	**0.059**	**0.048**	**0.041**	**0.052**	**0.043**
	LCL	0.045	0.049	0.030	0.031	0.033	0.034	LCL	0.046	0.044	0.034	0.028	0.038	0.030
	UCL	0.077	0.081	0.056	0.057	0.059	0.060	UCL	0.078	0.074	0.062	0.054	0.066	0.056
s=10	Rate	**0.046**	**0.037**	**0.036**	**0.045**	**0.043**	**0.060**	Rate	**0.064**	**0.048**	**0.051**	**0.047**	**0.043**	**0.055**
	LCL	0.033	0.025	0.024	0.032	0.030	0.045	LCL	0.048	0.034	0.037	0.034	0.030	0.041
	UCL	0.059	0.049	0.048	0.058	0.056	0.075	UCL	0.080	0.062	0.065	0.060	0.056	0.069
s=20	Rate	**0.043**	**0.062**	**0.055**	**0.058**	**0.047**	**0.046**	Rate	**0.045**	**0.042**	**0.042**	**0.047**	**0.043**	**0.038**
	LCL	0.030	0.047	0.041	0.043	0.034	0.033	LCL	0.032	0.029	0.029	0.034	0.030	0.026
	UCL	0.056	0.077	0.069	0.073	0.060	0.059	UCL	0.058	0.055	0.055	0.060	0.056	0.050
s=40	Rate	**0.048**	**0.048**	**0.045**	**0.055**	**0.046**	**0.061**	Rate	**0.053**	**0.073**	**0.045**	**0.056**	**0.053**	**0.043**
	LCL	0.035	0.035	0.032	0.041	0.033	0.046	LCL	0.039	0.057	0.032	0.042	0.039	0.030
	UCL	0.061	0.061	0.058	0.069	0.059	0.076	UCL	0.067	0.089	0.058	0.070	0.067	0.056
s=80	Rate	**0.056**	**0.042**	**0.050**	**0.061**			Rate	**0.057**	**0.046**	**0.040**	**0.052**		
	LCL	0.042	0.030	0.036	0.046			LCL	0.043	0.033	0.028	0.038		
	UCL	0.070	0.054	0.064	0.076			UCL	0.071	0.059	0.052	0.066		

TABLE B9B. Rate of type I error for time test and power for space test after 1000 simulations, scenario 2, anova model 6b.

SA 10-TA 10

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
s=5	Rate	**0.298**	**0.049**	**0.383**	**0.061**	**0.485**	**0.049**	Rate	**0.435**	**0.039**	**0.523**	**0.052**	**0.543**	**0.057**
	LCL	0.268	0.035	0.352	0.046	0.454	0.036	LCL	0.403	0.026	0.491	0.038	0.512	0.043
	UCL	0.328	0.063	0.414	0.076	0.516	0.062	UCL	0.467	0.052	0.555	0.066	0.574	0.071
s=10	Rate	**0.405**	**0.050**	**0.464**	**0.051**	**0.595**	**0.041**	Rate	**0.637**	**0.049**	**0.715**	**0.057**	**0.784**	**0.053**
	LCL	0.374	0.036	0.433	0.037	0.564	0.029	LCL	0.606	0.035	0.687	0.042	0.758	0.039
	UCL	0.436	0.064	0.495	0.065	0.626	0.053	UCL	0.668	0.063	0.743	0.072	0.810	0.067
s=20	Rate	**0.541**	**0.041**	**0.641**	**0.057**	**0.737**	**0.048**	Rate	**0.894**	**0.044**	**0.945**	**0.057**	**0.975**	**0.043**
	LCL	0.510	0.029	0.611	0.043	0.710	0.035	LCL	0.875	0.031	0.931	0.043	0.965	0.030
	UCL	0.572	0.053	0.671	0.071	0.764	0.061	UCL	0.913	0.057	0.959	0.071	0.985	0.056
s=40	Rate	**0.799**	**0.052**	**0.820**	**0.062**	**0.880**	**0.049**	Rate	**0.999**	**0.050**	**1.000**	**0.050**	**1.000**	**0.042**
	LCL	0.774	0.038	0.796	0.047	0.860	0.036	LCL	0.997	0.036	1.000	0.036	1.000	0.030
	UCL	0.824	0.066	0.844	0.077	0.900	0.062	UCL	1.001	0.064	1.000	0.064	1.000	0.054
s=80	Rate	**0.946**	**0.062**	**1.000**	**0.061**			Rate	**1.000**	**0.046**	**1.000**	**0.051**		
	LCL	0.932	0.047	1.000	0.046			LCL	1.000	0.033	1.000	0.037		
	UCL	0.960	0.077	1.000	0.076			UCL	1.000	0.059	1.000	0.065		

SA 20-TA 5

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
s=5	Rate	**0.323**	**0.058**	**0.427**	**0.040**	**0.451**	**0.051**	Rate	**0.401**	**0.044**	**0.407**	**0.047**	**0.505**	**0.050**
	LCL	0.292	0.043	0.396	0.028	0.420	0.037	LCL	0.369	0.031	0.376	0.034	0.474	0.036
	UCL	0.354	0.073	0.458	0.052	0.482	0.065	UCL	0.433	0.057	0.438	0.060	0.536	0.064
s=10	Rate	**0.264**	**0.049**	**0.441**	**0.047**	**0.507**	**0.046**	Rate	**0.449**	**0.056**	**0.571**	**0.044**	**0.695**	**0.058**
	LCL	0.236	0.035	0.410	0.034	0.476	0.033	LCL	0.417	0.041	0.540	0.031	0.666	0.043
	UCL	0.292	0.063	0.472	0.060	0.538	0.059	UCL	0.481	0.071	0.602	0.057	0.724	0.073
s=20	Rate	**0.423**	**0.049**	**0.569**	**0.059**	**0.652**	**0.052**	Rate	**0.846**	**0.041**	**0.916**	**0.050**	**0.942**	**0.053**
	LCL	0.392	0.035	0.538	0.044	0.622	0.038	LCL	0.823	0.029	0.899	0.036	0.927	0.039
	UCL	0.454	0.063	0.600	0.074	0.682	0.066	UCL	0.869	0.053	0.933	0.064	0.957	0.067
s=40	Rate	**0.752**	**0.055**	**0.809**	**0.048**	**0.871**	**0.067**	Rate	**1.000**	**0.033**	**1.000**	**0.043**	**0.998**	**0.040**
	LCL	0.725	0.041	0.785	0.035	0.850	0.051	LCL	1.000	0.022	1.000	0.030	0.995	0.028
	UCL	0.779	0.069	0.833	0.061	0.892	0.083	UCL	1.000	0.044	1.000	0.056	1.001	0.052
s=80	Rate	**0.940**	**0.051**	**0.962**	**0.058**			Rate	**1.000**	**0.042**	**1.000**	**0.052**		
	LCL	0.925	0.037	0.950	0.043			LCL	1.000	0.030	1.000	0.038		
	UCL	0.955	0.065	0.974	0.073			UCL	1.000	0.054	1.000	0.066		

TABLE B9C. Power for space and time tests after 1000 simulations, scenario 3, anova model 6b.

SA10-TA10

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
s=5	Rate	0.341	0.346	0.369	0.437	0.513	0.825	Rate	0.357	0.416	0.413	0.657	0.566	0.997
	LCL	0.310	0.315	0.338	0.405	0.482	0.801	LCL	0.326	0.384	0.382	0.627	0.535	0.994
	UCL	0.372	0.377	0.400	0.469	0.544	0.849	UCL	0.388	0.448	0.444	0.687	0.597	1.000
s=10	Rate	0.452	0.422	0.491	0.503	0.614	0.858	Rate	0.606	0.488	0.699	0.736	0.791	0.998
	LCL	0.420	0.391	0.460	0.472	0.584	0.836	LCL	0.575	0.456	0.670	0.708	0.766	0.995
	UCL	0.484	0.453	0.522	0.534	0.644	0.880	UCL	0.637	0.520	0.728	0.764	0.816	1.001
s=20	Rate	0.589	0.470	0.652	0.561	0.739	0.887	Rate	0.887	0.542	0.935	0.777	0.969	0.999
	LCL	0.558	0.439	0.622	0.530	0.712	0.867	LCL	0.867	0.511	0.920	0.751	0.958	0.997
	UCL	0.620	0.501	0.682	0.592	0.766	0.907	UCL	0.907	0.573	0.950	0.803	0.980	1.001
s=40	Rate	0.847	0.510	0.884	0.594	0.908	0.910	Rate	1.000	0.577	1.000	0.816	1.000	0.999
	LCL	0.825	0.479	0.864	0.563	0.890	0.892	LCL	1.000	0.546	1.000	0.792	1.000	0.997
	UCL	0.869	0.541	0.904	0.625	0.926	0.928	UCL	1.000	0.608	1.000	0.840	1.000	1.001
s=80	Rate	0.968	0.534	0.989	0.617			Rate	1.000	0.597	1.000	0.833		
	LCL	0.957	0.503	0.983	0.587			LCL	1.000	0.566	1.000	0.810		
	UCL	0.979	0.565	0.995	0.647			UCL	1.000	0.628	1.000	0.856		

SA20-TA5

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
s=5	Rate	0.267	0.352	0.347	0.445	0.473	0.808	Rate	0.306	0.475	0.342	0.698	0.464	0.996
	LCL	0.238	0.321	0.317	0.413	0.442	0.783	LCL	0.276	0.442	0.312	0.669	0.433	0.992
	UCL	0.296	0.383	0.377	0.477	0.504	0.833	UCL	0.336	0.508	0.372	0.727	0.495	1.000
s=10	Rate	0.313	0.423	0.434	0.538	0.547	0.846	Rate	0.554	0.558	0.593	0.775	0.654	0.999
	LCL	0.284	0.392	0.403	0.507	0.516	0.824	LCL	0.522	0.526	0.562	0.749	0.624	0.997
	UCL	0.342	0.454	0.465	0.569	0.578	0.868	UCL	0.586	0.590	0.624	0.801	0.684	1.001
s=20	Rate	0.428	0.476	0.546	0.593	0.707	0.878	Rate	0.905	0.612	0.907	0.820	0.929	0.999
	LCL	0.397	0.445	0.515	0.562	0.679	0.858	LCL	0.887	0.581	0.889	0.796	0.913	0.997
	UCL	0.459	0.507	0.577	0.624	0.735	0.898	UCL	0.923	0.643	0.925	0.844	0.945	1.001
s=40	Rate	0.778	0.509	0.804	0.633	0.899	0.902	Rate	1.000	0.645	1.000	0.848	1.000	0.999
	LCL	0.752	0.478	0.779	0.603	0.880	0.884	LCL	1.000	0.615	1.000	0.826	1.000	0.997
	UCL	0.804	0.540	0.829	0.663	0.918	0.920	UCL	1.000	0.675	1.000	0.870	1.000	1.001
s=80	Rate	0.973	0.529	0.969	0.656			Rate	1.000	0.677	1.000	0.864		
	LCL	0.963	0.498	0.958	0.627			LCL	1.000	0.648	1.000	0.843		
	UCL	0.983	0.560	0.980	0.686			UCL	1.000	0.706	1.000	0.885		

TABLE B9D. Power for space and time tests after 1000 simulations, scenario 4, anova model 6b.

SA10-TA10

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
s=5	Rate	0.107	0.109	0.122	0.251	0.314	0.927	Rate	0.240	0.218	0.374	0.696	0.817	1.000
	LCL	0.087	0.089	0.101	0.223	0.285	0.911	LCL	0.212	0.191	0.343	0.667	0.793	1.000
	UCL	0.127	0.129	0.143	0.279	0.343	0.943	UCL	0.268	0.245	0.405	0.725	0.841	1.000
s=10	Rate	0.280	0.136	0.433	0.429	0.879	0.998	Rate	0.726	0.336	0.932	0.932	1.000	1.000
	LCL	0.251	0.114	0.402	0.398	0.859	0.995	LCL	0.698	0.306	0.916	0.916	1.000	1.000
	UCL	0.309	0.158	0.464	0.460	0.899	1.001	UCL	0.754	0.366	0.948	0.948	1.000	1.000
s=20	Rate	0.643	0.218	0.864	0.647	1.000	1.000	Rate	0.998	0.548	1.000	0.992	1.000	1.000
	LCL	0.613	0.192	0.843	0.617	1.000	1.000	LCL	0.995	0.517	1.000	0.986	1.000	1.000
	UCL	0.673	0.244	0.885	0.677	1.000	1.000	UCL	1.001	0.579	1.000	0.998	1.000	1.000
s=40	Rate	0.939	0.335	0.993	0.851	1.000	1.000	Rate	1.000	0.799	1.000	1.000	1.000	1.000
	LCL	0.924	0.306	0.988	0.829	1.000	1.000	LCL	1.000	0.774	1.000	1.000	1.000	1.000
	UCL	0.954	0.364	0.998	0.873	1.000	1.000	UCL	1.000	0.824	1.000	1.000	1.000	1.000
s=80	Rate	0.998	0.498	1.000	0.991			Rate	1.000	0.973	1.000	1.000		
	LCL	0.995	0.467	1.000	0.985			LCL	1.000	0.963	1.000	1.000		
	UCL	1.001	0.529	1.000	0.997			UCL	1.000	0.983	1.000	1.000		

SA20-TA5

		t=5		t=10		t=40			t=5		t=10		t=40	
	p=1	S	T	S	T	S	T	p=5	S	T	S	T	S	T
s=5	Rate	0.071	0.169	0.090	0.347	0.184	0.917	Rate	0.123	0.368	0.188	0.799	0.438	1.000
	LCL	0.054	0.145	0.072	0.317	0.160	0.900	LCL	0.102	0.337	0.163	0.774	0.407	1.000
	UCL	0.088	0.193	0.108	0.377	0.208	0.934	UCL	0.144	0.399	0.213	0.824	0.469	1.000
s=10	Rate	0.154	0.228	0.252	0.502	0.625	0.987	Rate	0.431	0.567	0.681	0.949	0.995	1.000
	LCL	0.131	0.201	0.225	0.471	0.595	0.980	LCL	0.400	0.536	0.652	0.935	0.991	1.000
	UCL	0.177	0.255	0.279	0.533	0.655	0.994	UCL	0.462	0.599	0.710	0.963	0.999	1.000
s=20	Rate	0.513	0.338	0.764	0.701	0.999	1.000	Rate	0.968	0.787	1.000	0.994	1.000	1.000
	LCL	0.482	0.308	0.738	0.672	0.997	1.000	LCL	0.957	0.761	1.000	0.989	1.000	1.000
	UCL	0.544	0.368	0.790	0.730	1.001	1.000	UCL	0.979	0.813	1.000	0.999	1.000	1.000
s=40	Rate	0.909	0.495	0.993	0.897	1.000	1.000	Rate	1.000	0.953	1.000	1.000	1.000	1.000
	LCL	0.891	0.464	0.988	0.878	1.000	1.000	LCL	1.000	0.940	1.000	1.000	1.000	1.000
	UCL	0.927	0.526	0.998	0.916	1.000	1.000	UCL	1.000	0.966	1.000	1.000	1.000	1.000
s=80	Rate	0.998	0.703	1.000	0.990			Rate	1.000	0.999	1.000	1.000		
	LCL	0.995	0.675	1.000	0.984			LCL	1.000	0.997	1.000	1.000		
	UCL	1.001	0.731	1.000	0.996			UCL	1.000	1.001	1.000	1.000		

APPENDIX C

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TESTS OF S AND T IN THE PRESENCE OF A SIGNIFICANT INTERACTION: AN EXPLANATION, SIMULATION RESULTS, AND A FIGURE (FIG. C1)

Consider the case where we are testing the space (S) factor; the test of time (T) is similar. In the absence of replication, two strategies can be followed when a significant interaction is detected: one can carry out (a) separate tests of the spatial structure for each sampling time (Zart1999), or (b) a single test of the presence of a spatial structure in at least one of the *t* times.

(a) To test the presence of a spatial structure, one cannot use a standard single-classification ANOVA for each time separately. The null hypothesis (H_0) is that there is no spatial structure at that time. Looking at the analysis as a regression problem, dummy variable coding cannot be used to represent the sampling points through space since there would be $(s - 1)$ of them, leaving no degrees of freedom for the residuals whose mean square forms the denominator of the *F*-statistic. As in Model 3, one can use *u* variables to describe the spatial relationships, where $u < (s - 1)$. S-PCNM eigenfunctions can be used for that purpose.

Model 6a: *one-factor ANOVA model*

This model is a simplified form of Model 3 where $t = 1$. Consider the test of S for the first sampling time, $j = 1$:

$$\mathbf{y} = \mathbf{1}\mu + \mathbf{X}_u \boldsymbol{\alpha} + \boldsymbol{\varepsilon} \ .$$

The total sum of squares partitioning is now (Fig. 1, Model 6a, which is Model 3 simplified):

$$SS_{Total,\, j=1} = SS(\mathbf{1}) + SS(\mathbf{X}_u) + SS_{Res6a}$$

where $SS_{Res6a} = SS_{Res1} + LOF_{6a}$. The partitioning of the degrees of freedom is:

$$s = 1 + u + (s - u - 1) \ .$$

A correction for *t* simultaneous tests will be in order before drawing a conclusion as to the presence of a spatial structure in at least one of the *t* times.

(b) Carry out a single test for the presence of a spatial structure in at least one of the *t* times. The null hypothesis (H_0) is that there is no spatial structure at any one of the *t* times.

Model 6b: *stacked one-factor ANOVA model*

This is a model where the sums of squares are obtained by summing the SS from Model 6a over *t* analyses, and likewise for the degrees of freedom:

$$\mathbf{y} = \sum_{j=1 \ldots t} \mathbf{1}\mu_{(j)} + \sum_{j=1 \ldots t} \mathbf{X}_{u(j)} \boldsymbol{\alpha}_{(j)} + \boldsymbol{\varepsilon} \ .$$

Each time group *j* of response data is centered on the mean of its group, for a total cost of *t* degrees of freedom. The total sum of squares partitioning is now (Fig. 1, Model 6b, which is Model 3 simplified):

$$SS_{Total} = \sum_{j=1 \ldots t} (SS_{Total,\, j}) = \sum_{j=1 \ldots t} SS(\mathbf{1}_{(j)}) + \sum_{j=1 \ldots t} SS(\mathbf{X}_{u(j)}) + SS_{Res6b}$$

where $SS_{Res6b} = \sum_{j=1...t} (SS_{Res(j)} + LOF_j)$ and LOF_j is the lack of fit for time j. The partitioning of the degrees of freedom is:

$$s \times t = t + ut + (st - ut - t) .$$

The implementation of Model 6b, using PCNM eigenfunctions for the u variables describing space, is described in Fig. C1. The arrangement of the PCNM variables representing spatial structure (S-PCNMs) is shown for a test of the hypothesis (H_0) that there is no spatial structure at any one of the different times.

Model 6b can also be seen as a nested model derived from Model 3. The equivalence is:

$$\sum_{j=1...t} SS(\mathbf{1}_{(j)}) = SS(\mathbf{X}_{t-1})$$

$$\sum_{j=1...t} SS(\mathbf{X}_{u(j)}) = SS(\text{space nested within time}) = SS(\mathbf{X}_u) + SS(\mathbf{X}_{Int3})$$

$$\text{and } SS_{Res6b} = \sum_{j=1...t} (SS_{Res(j)} + LOF_j) = SS_{Res3}$$

The advantage of a global test (Model 6b) is that it does not require any correction for multiple testing. We have to run simulations to see which test is the more powerful. Consider t = 5. The situations would be: create a spatial structure in 1, 2, ... 5 of the times with the other times having a random spatial structure. Compare the two tests.

Models 6a and 6b both require that the number of variables coding for space be smaller than (s – 1). Otherwise, the degrees of freedom associated with the residuals would be zero.

Simulation results

Under scenario 1, the tests for factors space (S) and time (T) using Model 6b had correct rates of type I error (Appendix B, Table B9a). Under scenario 4 (presence of S and T effects and of an S-T interaction, Table B9b), the tests, which were expected to be significant, had increased rejection rates with increase in the number of points along the spatial structure and the number of sampling events through time. Power was also higher for multivariate data than it was for univariate data.

LITERATURE CITED

Zar, J. H. 1999. Biostatistical analysis. Fourth edition. Prentice Hall, Upper Saddle River, New Jersey, USA.

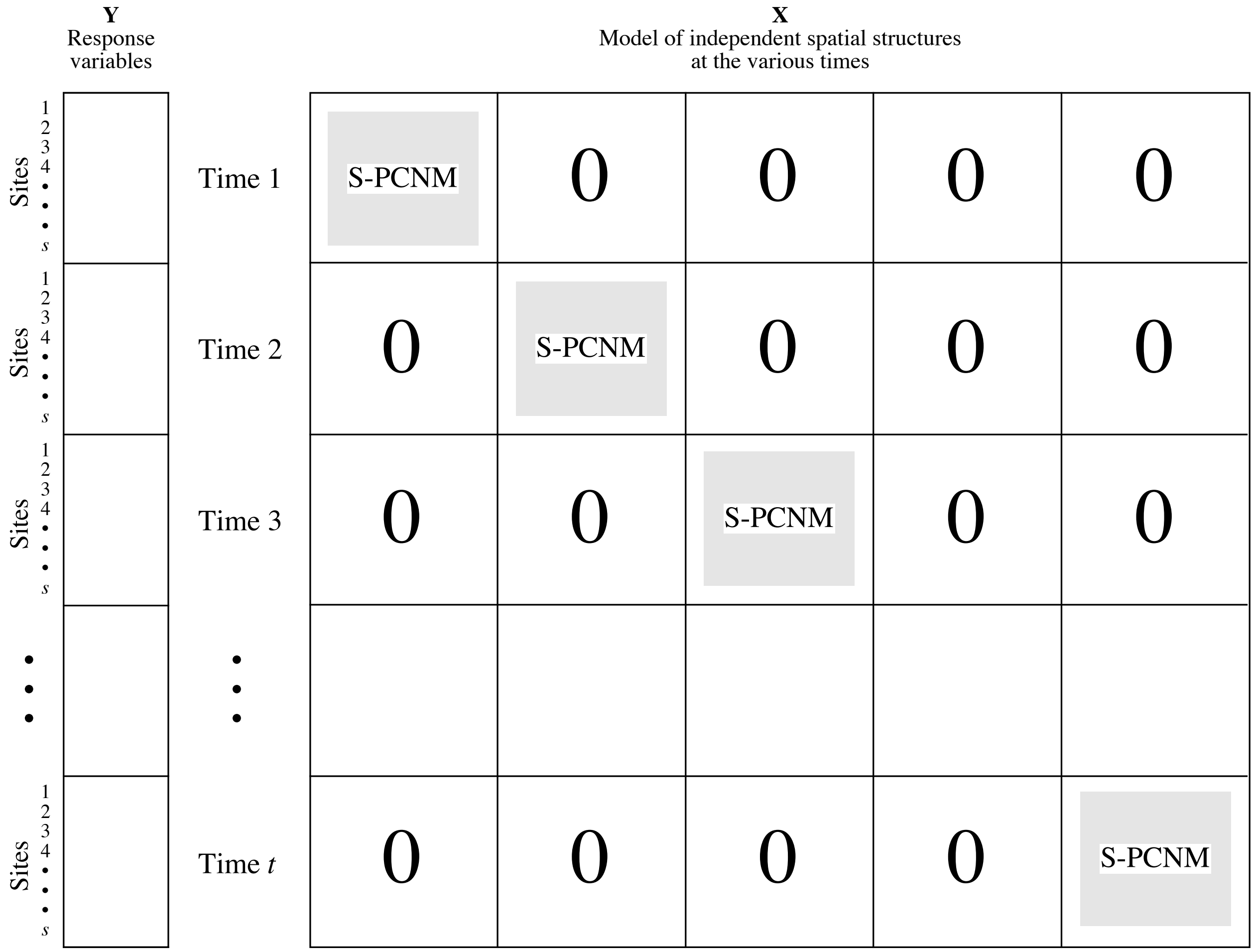

Fig. C1. Implementation of Model 6b, using PCNM eigenfunctions for the variables describing space in the analysis. The response data (matrix **Y**) are centered on their means computed for each time group separately. A large "0" in a cell of matrix **X** indicates that the cell is filled with zeros. Since the S-PCNMs are centered on zero by construction, the blocks of zeros contain values corresponding to the means of their columns.

APPENDIX D

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INDICATOR SPECIES OF THE TRICHOPTERA EXAMPLE

Trichoptera indicator species were identified by indicator species analysis for the 5 space-time groups shown in Fig. 3. Combining indicator values and numerical dominance in each of the 5 groups, one obtains the following scenario:

• Time periods 1-2: group 2 rules along most of the transect. This group is dominated by the shredder *Ceraclea diluta*, the filterer *Hydropsyche sparna*, and the algae piercer *Hydroptila delineata.* The shredder *Lepidostoma pictile* characterizes this group thanks to a localized emergence during the first 10 days in a group of sites near the middle of the transect.

• Time periods 3-5: group 1 occupies most of the transect. Numerically, this group is dominated by the filterer *Cheumatopsyche minuscula,* with high numbers of the algae piercer *Hydroptila valhalla.* Together they form almost 60% of the total number of individuals in this group. The former species emerges during the whole period, while the latter is more concentrated around time period 4. Other species have been found to be significant indicators of this group due to high values of either specificity or fidelity.

• The 5 remaining time periods are characterized by a parcelling out of the transect, which becomes more finely partitioned, mainly among groups 3, 4, and 5. Group 3 is characterized by the algae piercer *Oxyethira grisea.* Group 4 is dominated by the filterer *Cheumatopsyche pettiti* and the algae piercer *Oxyethira grisea.* Group 5 is dominated by the grazer *Neotrichia okopa,* emerging mostly during periods 6 and 7. Another numerically important species is the filterer *Cheumatopsyche minuscula,* dominating group 1.

SUPPLEMENT

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STI PACKAGE FOR THE ANALYSIS OF SPACE, TIME, AND INTERACTION IN SPACE-TIME STUDIES

The STI package, an R-language library for the analysis of the main factors space and time and the interaction in space-time studies using permutation tests, is available on the ESA Web page http://esapubs.org/archive/ecol/E091/019/ and on the Software page of Miquel De Cáceres http://sites.google.com/site/miqueldecaceres/software (source code and compiled libraries for Windows and Mac OS X). The main functions are called STIMODELS and QUICKSTI. Function STIMODELS offers ANOVA models 2 to 6 described in Fig. 1 of the paper.