Statistical appendix

Payment behaviour in the arrears phase, study in collaboration with in3

In short - This statistical appendix provides more details on the design, analyses and results of the study conducted in collaboration between the AFM and in3. The information in this document is an appendix to the main report entitled *'Payment behaviour in the arrears phase. Study in collaboration with in3*', which contains more information on the background to the experiment, the procedure and the main results. The AFM and in3 jointly designed the experiment and before starting it they defined the hypotheses, an analysis plan and the criteria for inclusion in the sample.

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AFM

Experiment

Formal hypotheses

The outcome variable of this experiment is the percentage of customers who have not paid their arrears in full at a certain point in the customer process, relative to all customers who have not paid in full by day 64. We denote this variable with R and calculate it as follows:

$$R^t = \frac{number\ of\ customers\ in\ arrears\ at\ time\ t}{number\ of\ customers\ in\ arrears\ on\ day\ 64} * 100\%$$

We look at this percentage on different evaluation dates (t, expressed in days), denoted by R^t. In the study we use a number of key evaluation dates to test hypotheses and perform additional analyses. These are day 78 (before the transfer to the debt collection agency in the control group), day 94 (before the transfer to the debt collection agency in the three later transfer groups) and day 119 (the day before the loan is marked by in3 as 'potentially irrecoverable'). We compare the percentage of customers with an outstanding amount between the *control group* (denoted by R_c), the *later transfer* group (R_l), the *later transfer with extra reminder* group (later transfer + reminder, R_{l+r}) and the *later transfer with extra reminder including information on consequences* group (later transfer + information on consequences, RR_{l+ic}). This allows us to test the main hypotheses.

Below we discuss the formal hypotheses drawn up before the experiment and the associated main analyses. We also discuss some associated additional analyses, where we look at other evaluation dates and results.

Hypothesis 1: The effect of later transfer to the debt collection agency

We test whether customers' payment behaviour changes when the period between the last missed instalment and the transfer to the debt collection agency is extended by 14 days. To this end, we compare the percentage of customers with an outstanding amount on day 119 between the *control group* and the *later transfer, later transfer with extra reminder* and *later transfer with extra reminder including information on consequences* groups. We expect that on day 119 the percentage of customers in arrears will be lower in the groups with a later transfer to the debt collection agency. The associated hypotheses are:

$$R_c^{day\ 119} > R_l^{day\ 119}$$

$$R_c^{day\ 119} > R_{l+r}^{day\ 119}$$

$$R_c^{day\ 119} > R_{l+ic}^{day\ 119}$$

In additional analyses, we also test whether there is a difference between the *control group* and the other three groups over a shorter term, namely on day 94 (before the three later transfer groups have been transferred to the debt collection agency). We also test whether there are differences between the *control group* and the other three groups in the share of customers transferred to the debt collection agency and in the time to payment.

Hypothesis 2: The effect of an extra reminder during the extended transfer period

We assess whether customers' payment behaviour differs when they receive a reminder during the extended transfer period compared to when they do not receive a reminder. To this end, we compare the percentage of customers in arrears between the *later transfer* group and the *later transfer with extra reminder* and *later transfer with extra reminder including information on consequences* groups on day 78. If we see a difference on this day, it is due to the extra reminder. We expect that in the groups with the extra reminder fewer customers will be in arrears on day 78 than in the group that did not receive this extra reminder:

$$R_{l}^{day\ 78} > R_{l+r}^{day\ 78}$$

$$R_{l}^{day\ 78} > R_{l+ic}^{day\ 78}$$

In additional analyses, we also look at the longer-term differences, namely on day 94 and day 119. Here too, we expect that the groups that receive an extra reminder will be less often in arrears than the group that did not receive the extra reminder during the extended period of transfer to the debt collection agency. We also test whether there is a difference in the time to payment and the share of customers transferred to the debt collection agency between the groups with and without an extra reminder.

Hypothesis 3: The effect of an extra reminder with information on the consequences of late payment during the extended transfer period

We test whether there is a difference in customers' payment behaviour when they receive a regular reminder during the extended transfer period compared to when they receive a reminder that also includes information on the consequences of late payment. In the latter case, an advance notice is sent that customers will be transferred to a debt collection agency if payment is not made, together with details of the associated costs. To this end, we compare the percentage of customers with an outstanding amount between the *later transfer with extra reminder* group and the *later transfer with extra reminder including information on consequences* group on day 78. We have no specific expectations at the outset as to which group will be less likely to go into arrears. If we see a difference on that day, it will be due to the content of the reminder. The associated hypothesis is:

$$R_{l+r}^{day\ 78} \neq R_{l+ic}^{day\ 78}$$

In additional analyses, we also look at the longer-term differences, namely on day 94 and day 119. We also test whether there is a difference between the two groups in the time to payment and the share of customers transferred to the debt collection agency.

Power analysis

A power analysis was performed prior to the experiment to determine the required sample size. See Table 1 for the input used for this analysis. The calculation is based on a two-sided test with one control group and three experimental groups. For the calculation, an estimate was made of payment behaviour in the control group at different points in time (baseline values). We assumed an estimated effect size of *5 percentage points* on the percentage of customers in arrears. To achieve a power of 80% with an α of 0.05 at the different times in the customer journey, we need a minimum sample of 6,296 (4 x 1,574). Based on this calculation, we aim for a total sample size of 7,500 customers (4 x 1,875).

Table 1. Input for power analysis

Variable	Value
Baseline: estimated percentage of customers with outstanding amount around day 64 (R^{64})	100%
Baseline: estimated percentage of customers with outstanding amount around day 82 (R^{82})	65%
Baseline: percentage of customers with outstanding amount around day 97 (R^{97})	45%
Baseline: percentage of customers with outstanding amount around day 120 (R^{120})	40%
Effect size	5 percentage points
Significant level (α)	5%
Required statistical power (1 – β)	80%

Test period

The experiment ran during the period from 5 July to 10 October 2024. From the start of the test period, customers who were in arrears on day 64 of the customer journey were assigned to one of the four groups. This means that customers who had been assigned on or after 5 July already entered into an agreement with in3 on or after 2 May 2024. On the basis of an estimate that the required sample size had been reached, no new customers were assigned to the four groups from 10 October (09:00 hrs). The data collection was completed on 5 December 2024, 56 days later. At that point, all customers assigned within the test period had reached day 120.

Sample

The baseline sample consists of customers in arrears on day 64 during the test period. Before the experiment, criteria were established on the basis of which customers were excluded from the analysis sample. This primarily concerned customers who had more than one open order with in3 during the study (somewhere in the period between day 0 and day 120). In addition, in3 worked with several debt collection agencies during the test period. Since the approaches of the debt collection agencies may differ, it was decided in advance that the analysis sample would only include customers transferred to one specific debt collection agency. Finally, it was agreed in advance that customers who were granted a deferment of payment during the process, whose files were temporarily placed on hold for other reasons or for whom a full refund was made after day 64 were also excluded.

In addition to the predefined and preregistered exclusions, an additional group of 314 customers were also excluded from the analysis sample due to a deviating customer journey. In this group, a deviation in the customer journey arose during the experiment because, after receiving the reminder on day 55, they paid the outstanding second instalment using the payment link in a previous reminder. Due to the exclusions described above, the basic sample of 9,418 customers leaves an analysis sample of 7,425 customers. Table 3 shows the number of customers in each of the four groups.

Variations in procedure

According to the intended (and pre-defined) procedure, communication and transfers would take place at three times: days 67, 82 and 97. Two months after the start of the experiment, we noticed some unexpected variations in the procedure. These variations depended on the number of instalments customers missed and the research group they were assigned to. The actual days on which communication and transfer to the debt collection agency took place are shown in Table 2.

After careful consideration, we decided that we could still use the collected data to examine the effect of the three adjustments on payment behaviour. This nevertheless required some adjustments to the times at which we tested the hypotheses. To assess the effect of the extra reminder (and its content), we look at the

percentage of customers in arrears in the three later transfer groups on day 78. This is at least one and at most three days before customers receive the advance notice of transfer to the debt collection agency. In the additional analyses we also look at the percentage of customers in arrears on day 94. This is at least one and at most three days before customers in the later transfer groups are actually transferred to the debt collection agency.

For the sake of readability of the report and figures, we refer to day 67 and day 81 when describing the procedure, although the time of communication or transfer to the debt collection agency may differ by up to two days for some customers. Since the communication and transfer times in the group with two missed instalments systematically deviate by two days from the group with one missed instalment, we have delayed the payment dates of the group that missed two instalments by two days in order to visualise the payment behaviour of the different groups over time as clearly as possible (Figure 3 in the report, Figure 1 in the appendix). Customers in these groups who, for example, made a payment in response to the reminder sent on day 65 are included in that figure as customers who paid on day 67. In the tables we report the percentages without these adjustments.

Tabel 2. Communicatie- en overdrachtsdagen in verschillende groepen

		Extra reminder	WIK advance notice	Transfer to debt collection agency
	Number of missed instalments	*day*	*day*	*day*
Control group	One	-	67	83
	Two	-	65	81
Later transfer without extra reminder	One	-	81	97
	Two	-	79	95
Later transfer with extra reminder	One	67	81	97
	Two	65	79	95
Later transfer with extra reminder including information on consequences	One	67	81	97
	Two	65	79	95

Method

To test whether randomisation across the four groups has led to comparable groups, *F*-tests (with continuous dependent variables) and *Chi*-squared (χ^2) tests (with binary dependent variables) are performed. We use *z*-tests to test the differences in the share of customers in arrears at the aforementioned points in time. In additional analyses, we use *z*-tests to test for differences in the percentage of customers transferred to the debt collection agency between the groups. To test for differences in time to payment, log-rank analyses are performed on Kaplan-Meier survival curves. This test compares the survival curves of the different groups, looking at the time at which customers make their payments. Customers who have not paid in full by day 119 are treated as censored observations. For all analyses, a significance level (α) of 5% is used to determine statistical significance.

Results

Descriptive statistics and randomisation checks

As indicated, customers eligible to participate in the experiment were randomly assigned to one of four groups on day 64. We perform randomisation checks to verify that randomisation has been successful, see Tables 3 and 4.

The *F*- and χ^2-tests in Table 3 and Table 4 show that the groups do not differ significantly in terms of the tested characteristics. Customers included in the experiment are on average 36 years old and place an order averaging €500. On average, these customers placed 1.6 previous orders with in3, on which they were previously in arrears an average of 0.2 times (defined as the number of times a customer was still in arrears on previous orders five days after the third instalment was due). In the analysis sample, 39.6% of customers are in arrears on two instalments.

Table 3. Randomisation checks: *F*-test on demographic and transaction characteristics of the four groups.

	Total (*N* = 7,425)	**Control group (*N* = 1,863)**	**Later transfer (*N* = 1,825)**	**Later transfer with extra reminder (*N* = 1,859)**	**Later transfer with extra reminder including information on consequences (*N* = 1,878)**		
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F* (df, df)	*p*
Age	36.1 (11.4)	35.8 (11.1)	35.8 (11.4)	36.3 (11.4)	36.4 (11.7)	1.37 (3, 7,421)	.250
Order amount (day 0, €)	499.9 (453.7)	509.2 (460.1)	495.7 (4577)	508.4 (460.1)	486.5 (436.4)	1.08 (3, 7,421)	.358
Number of previous orders	1.6 (3.7)	1.7 (4.2)	1.6 (3.9)	1.5 (3.5)	1.5 (3.4)	1.17 (3, 7,421)	.320
Number of previous arrears	0.2 (0.6)	0.2 (0.7)	0.2 (0.6)	0.2 (0.6)	0.2 (0.6)	0,19 (3, 7.421)	.906

Table 4. Randomisation check: χ^2-test on share of customers with two missed instalments in the four groups.

	Total (*N* = 7,425)	**Control group (*N* = 1,863)**	**Later transfer (*N* = 1,825)**	**Later transfer with extra reminder (*N* = 1,859)**	**Later transfer with extra reminder incuding information on consequences (*N* = 1,878)**		
	Percentage (%)	Percentage (%)	Percentage (%)	Percentage (%)		χ^2 (df)	*p*
Share of customers that have missed two instalments	39.6	40.1	40.3	3.1	40.0	2.32 (3)	.510

The effect of later transfer to the debt collection agency

Table 5 shows the share of customers in arrears per group on each of the evaluation dates. This table also shows the share of customers in each group that have been transferred to the debt collection agency and the average payment day.

Table 5. Share of customers in arrears on the various evaluation dates, share of customers transferred to the debt collection agency and average payment day per group.

Group	Share customers in arrears on day 64	Share customers in arrears on day 78	Share customers in arrears on day 94	Share customers in arrears on day 119	Share of customers transferred to debt collection agency	Average payment day (*SD*)[1]
Control group	100.0%	54.0%	31.5%	23.8%	48.8%	78.4 (11.9)
Later transfer without extra reminder	100.0%	75.9%	46.2%	26.6%	44.8%	85.8 (13.3)
Later transfer with extra reminder	100.0%	60.4%	39.3%	25.1%	38.7%	80.9 (14.2)
Later transfer with extra reminder including information on consequences	100.0%	51.7%	3.6%	22.3%	35.1%	78.6 (14.3)

Table 6 shows the results of the *z*-tests that compare the share of customers in arrears at a given time between two groups. To test the effect of later transfer to the debt collection agency, the share of customers in arrears on day 119 was compared between the *control group* and each of the three later transfer groups. There are no significant differences between the groups. Therefore, the later transfer does not lead to significant differences in the share of people who had paid on day 119. The difference between the *control group* and the *later transfer without extra reminder* group is nearly significant, but in the opposite direction to the predetermined hypothesis ($z = -1.96$, $p = 0.0504$).[2]

[1] Only customers with full payment by day 119 are included in the calculation of the average payment day.

[2] Additional logistic regression analyses show that conclusions about the effect of later transfer remain the same when controlling for age, order amount, number of previous orders, previous arrears and missing one or two instalments. The only exception to this is that customers in the *later transfer without extra reminder* group were significantly more likely to be in arrears on day 119 compared to customers in the control group when controlling for these variables (odds ratio = 1.20, $p = .030$).

Table 6. Results of *z*-tests on the share of customers in arrears on different evaluation dates and the share of customers transferred to the debt collection agency in Group 1 versus Group 2 (see Table 5 for percentages).

		Share customers in arrears on day 78	Share customers in arrears on day 94	Share customers in arrears on day 119	Share customers transferred to debt collection agency
Group 1	***Group 2***	z *(p)*	z *(p)*	z *(p)*	z *(p)*
Control group vs.	Later transfer without extra reminder	N/A	-9.5 (<.001)	**-1.96** **(.050)**	2.48 (<.001)
	Later transfer with extra reminder	N/A	-4.95 (<.001)	**-0.95** **(.341)**	6.22 (<.001)
	Later transfer with extra reminder including information on consequences	N/A.	-2.66 (.008)	**1.07** **(.286)**	8.52 (.013)
Later transfer without extra reminder vs.	Later transfer without extra reminder	**10.05** **(<.001)**	4.25 (<.001)	1.01 (.313)	3.72 (<.001)
	Later transfer with extra reminder including information on consequences	**15.33** **(<.001)**	6.54 (<.001)	3.02 (.003)	6.01 (<.001)
Later transfer without extra reminder vs.	Later transfer with extra reminder including information on consequences	**5.43** **(<.001)**	2.30 (.021)	2.02 (.043)	2.31 (.020)

Note: 'N/A' denotes that this comparison has not been tested. The results in bold correspond to the main analyses, the results in non-bold to additional analyses.

Additionally, we also test the effect of a later transfer to the debt collection agency on payment behaviour in the shorter term, namely on day 94. Tables 5 and 6 show that the percentage of customers in arrears on day 94 is significantly higher in the three later transfer groups than in the *control group*. This means that – even though there were no significant differences on day 119 – customers in these three groups were less likely to have paid in full on day 94. In the *control group*, in which customers had already been transferred to the debt collection agency almost two weeks earlier, the share of customers in arrears is 31.5%. This percentage is much higher on day 94, especially in the *later transfer without extra reminder* group: 46.2%

In additional analyses, we are interested in the differences in payment timing between the four groups. Table 5 shows the average payment day per group. This is highest in the *later transfer without extra reminder group* (M = 85.8) and lowest in the *control group* (M = 78.4).

A log-rank test was performed to compare the Kaplan-Meier survival curves of the four groups. The overall log-rank test showed a significant difference between the groups, $\chi^2(3) = 83.16$, p <.001, indicating that time to payment differed systematically by group. Table 7 shows post-hoc analyses comparing the *control group* and the later transfer groups. The analyses show that *the later transfer without extra reminder* and *later transfer with extra reminder* groups paid significantly later than the control group. There is no significant difference in the time to payment between the *control group* and the *later transfer with extra reminder including information on consequences* group. This suggests that the group without the extra reminder shows

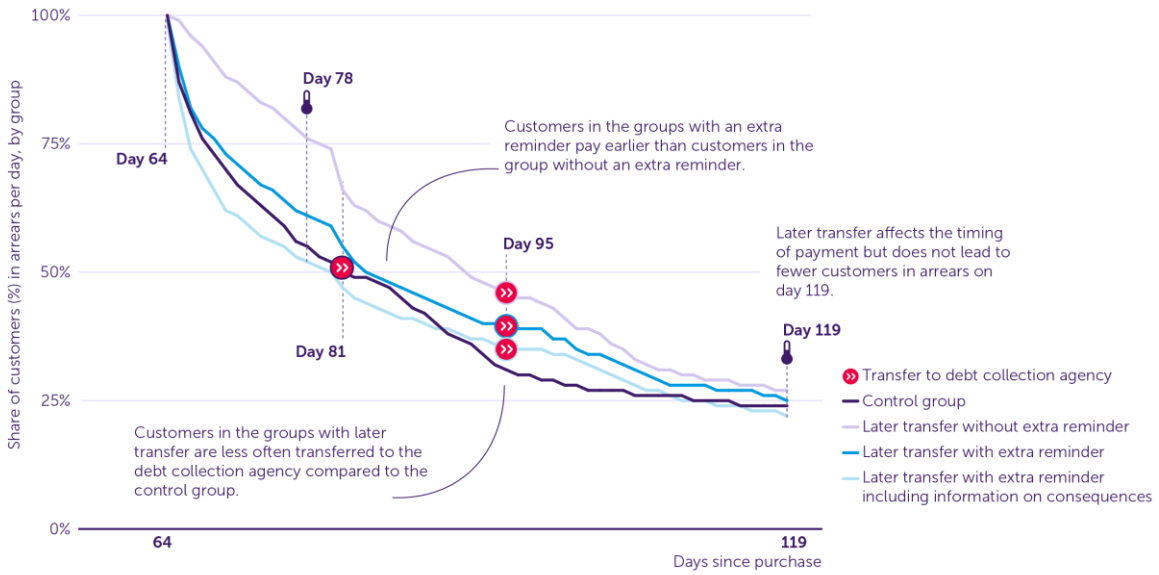
the longest time to payment, while the control group and the *later transfer with extra reminder including information on consequences* group do not differ significantly from each other.

Figure 1 shows the share of customers in arrears per day by group. This shows, among other things, that the payment curves of the *control group* and the *later transfer with extra reminder including information on consequences* group cross around day 90. This indicates that customers in the *later transfer with extra reminder including information on consequences* group initially pay better than customers in the *control group*, but later pay worse. The non-significant log-rank test can be explained by the fact that early and late differences cancel each other out. This is consistent with the fact that on day 119 there is no significant difference between the two groups in the share of customers in arrears.

Table 7. Results of post-hoc analyses of log-rank test Group 1 versus Group 2

Group 1	Group 2	χ^2 (p)
Control group vs.	Later transfer without extra reminder	58.12 (<.001)
	Later transfer with extra reminder	6.42 (.011)
	Later transfer with extra reminder including information on consequences	2.01 (.156)
Later transfer without extra reminder vs.	Later transfer with extra reminder	71.97 (<.001)
	Later transfer with extra reminder including information on consequences	21.30 (<.001)
Later transfer with extra reminder vs.	Later transfer with extra reminder including information on consequences	14.81 (<.001)

Figure 1. Share of customers in arrears per day by group



Note: To visualise payment behaviour as clearly as possible, the data in the figure has been edited. For explanatory notes, see the section 'Variations in procedure'.

Table 5 also shows the share of customers transferred to the debt collection agency by group. Table 6 contains the results of three *z*-tests comparing this share between the *control group* and the three later transfer groups. The share of customers transferred to the debt collection agency is significantly lower in each of the three later transfer groups than in the *control group*. As a result, customers in each of these groups are less likely to face debt collection fees.

Table 8 shows the data used to make a rough estimate of the debt collection fees saved by customers during this experiment as a result of the adjustments in the three later transfer groups. By calculating the difference in the share of customers transferred to the debt collection agency between the *control group* and the other three groups (column 2) and multiplying it by the number of customers in the three later transfer groups (column 3), an estimate was made of the number of customers that were *not* transferred to the debt collection agency as a result of the adjustments made (column 4). This number of customers is multiplied by the minimum amount (excluding VAT) of €40.00 charged for a transfer to the debt collection agency. This calculation shows that at least €20,832 in debt collection fees was saved during the experiment. This is an underestimation, because the actual debt collection fees charged for some customers will exceed €40.00.

Tabel 8. Rough estimate of debt collection fees saved during the experiment

	1. Share of customers transferred to the debt collection agency	2. Differences in share of customers transferred to the debt collection agency (vs. control group)	3. *N*	4. Estimate of number of customers not transferred to the debt collection agency due to adjustments (column 2 * 3)	5. Estimate of saved debt collection fees (column 4 * minimal cost of €40.00)
Control group	48.8%	-	-	-	-
Later transfer without extra reminder	44.8%	4.1%	1,825	74.4	€2,976.00
Later transfer with extra reminder	38.7%	10.1%	1,859	188.1	€ 7,524.00
Later transfer with extra reminder including information on consequences	35.1%	13.8%	1,878	258.3	€10,332.00
Total	-	-	-	-	€20,832.00

The effect of an extra reminder during the extended transfer period

To test the effect of the extra reminder, we compare the *later transfer without extra reminder* group with the *later transfer with extra reminder* group and the *later transfer with extra reminder including information on consequences* group. Table 6 shows the results of two *z*-tests comparing the share of customers in arrears on day 78 (see Table 5). The percentage of customers with an outstanding amount at this time is significantly lower in the two groups with an extra reminder than in the group without an extra reminder.

Table 6 also shows the results of additional analyses testing the effect of the reminder on payment behaviour at two later times (day 94 and day 119). The *z*-tests show that on day 94, in both groups with an extra reminder, significantly more customers have paid than in the group without an extra reminder. On day 119, there is only a significant difference between the *later transfer with extra reminder including information on consequences* group and the *later transfer without extra reminder* group.

In additional analyses we test the effect of the extra reminder on the time to payment. The results of the post-hoc analyses of the log-rank test in Table 7 show that customers in the groups with a reminder paid significantly earlier than the group without a reminder.

We also test the effect of the extra reminder on the share of customers transferred to the debt collection agency. Table 6 contains the results of two *z*-tests showing that the share of customers transferred to the debt collection agency is significantly lower in the two groups with an extra reminder than in the group without an extra reminder. Due to the extra reminder during the extended transfer period, customers are therefore less likely to be confronted with debt collection fees.

The effect of an extra reminder with information on the consequences of late payment

To test the effect of the content of the reminder, we compare the *later transfer with extra reminder* group with the *later transfer with extra reminder including information on consequences* group. Table 6 shows the results of a *z*-test comparing the share of customers in arrears on day 78. There is a significant difference between the two groups, with customers who received a reminder including information on the consequences of late payment being less likely to be in arrears on day 78 than customers who did not receive this information (see Table 5 for percentages).

Table 6 also shows the results of additional analyses testing the effect of the content of the reminder on payment behaviour at two later times (day 94 and day 119). These *z*-tests show that on both day 94 and day 119 there remains a significant difference between customers who received an extra reminder with and without information on the consequences of late payment.

In additional analyses we test the effect of the content of the reminder on the time to payment. Table 7 contains the results of the post-hoc analysis of the log-rank test, which shows that customers in the *later transfer with extra reminder including information on consequences* group paid significantly earlier than customers in the *later transfer with extra reminder* group.

We also test the effect that the content of the extra reminder has on the share of customers transferred to the debt collection agency. Table 6 contains the results of the z-test showing that the share of customers transferred to the debt collection agency is significantly lower in the *later transfer with extra reminder including information on consequences* group than in the *later transfer with extra reminder* group. As a result of the additional information customers are less likely to be confronted with debt collection fees.

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