

Impact of Robotic Process Automation on Future Employment of Accounting Professionals

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Abstract

The COVID-19 pandemic created an increased need for companies to use Robotic Process Automation (RPA) for efficiency and cost cutting. Most companies that utilize RPA usually start with their accounting and finance departments because of the routine and rule-based nature of accounting and finance functions. Consequently, accounting job displacement by the RPA implementation becomes unavoidable. The primary objective of this paper is to explore the perception of accounting students regarding the impact of RPA on the accounting profession. Results show that there is an expectation gap between students' expectation and the real-world scenario of accounting jobs being replaced by RPA. However, after engaging in learning activities in the accounting course used in this study, students become more aware that RPA can displace accountants. Their perceptions become more in line with that of the real-world scenario.

1. Introduction

COVID-19 rapidly and irrevocably reshaped the global business climate. Siderska [1] finds that, during the pandemic, half of the 110 companies surveyed implemented new solutions in the field of robotization of business processes. The pandemic accelerated the adoption of robotic process automation (RPA) in the accounting profession. Accounting firms were well aware of the economic value of RPA even before the pandemic. However, the increasingly mobile workforce, the demand for better remote collaboration, and the need to contain costs have driven the profession further into adopting RPA.

RPA replaces many types of manual processes. Accounting professionals are using it successfully for a variety of tasks, including accounts payable, accounts receivable, financial closing, controller work, financial planning and analysis, expense management, and tax work. According to a survey conducted by Cooper, Holderness, Sorensen, and

Wood [2], all areas within large accounting firms are adopting RPA, with tax services being the furthest along in adoption, followed by advisory services, and then assurance services.

Accountants have valid reasons to worry about losing their jobs to robots. However, university accounting students may not realize that RPA may eliminate many jobs in their future accounting careers. After investing much precious time and financial resources in pursuing higher education, these future accounting graduates may not be ready to cope with the reality that they may have difficulty finding their dream jobs in the field that they have been trained for. Because of the adoption of RPA, these students may not be prepared to face a world in which the accounting profession will be very different from what they expect because they are not equipped to adapt to the changes and take on the new roles of accountants.

The primary objective of this study is to explore the perception of accounting students regarding the impact of RPA on the accounting profession. This study also examines if an expectation gap exists between the perception of students and the real-world scenario of accounting jobs being replaced by RPA, and investigates if college education in financial and managerial accounting changes the students' perception of the impact RPA has on the displacement of accounting professionals in the job market.

Results of this study show that students perceive that manufacturing jobs are the most likely to be replaced by RPA, followed by office clerical jobs, and then by entry-level accounting jobs. Results also show that there is an expectation gap between students' expectation and the real-world scenario of accounting jobs being replaced by RPA. Students underestimate how probable it is that RPA will displace accountants. However, education changes the students' perception. After engaging in twelve weeks of learning activities in the accounting course used in this study, students become more aware that RPA can displace accountants. Their perception become more in line

with that of the real-world scenario, and the expectation gap narrows.

2. Robotic Process Automation

RPA is rule based. It uses software programs to automate repetitive, routine business processes. It enables the building, deployment, and management of software robots that emulate human actions interacting with digital systems and software. RPA is a form of business process automation that allows users to define a set of instructions for a robot to execute routine, pre-defined manual tasks. Software robots can do things that people do, such as understand what is on a screen, complete the right keystrokes, navigate systems, identify and extract data, and perform a wide range of defined actions, and they do it faster, more consistently, and at higher volume than people can. Those processes that are labor intensive, repetitive, high volume, rules based, in digital form using multiple systems and structured data are suitable tasks for automation with RPA [3].

RPA is ultimately about automating some of the most mundane and repetitive computer-based tasks and processes in the workplace. It is an application of technology that aims at automating business processes that are governed by business logic and structured inputs. Software, or a “robot,” is configured to capture and interpret applications for processing transactions, manipulating data, triggering responses, and communicating with other digital systems.

Many organizations are investing in RPA today. It is increasingly becoming an enterprise-level opportunity. Robots are expected to deliver a significant portion of current transactional activities, enabling human workers to be redeployed to perform activities that add more value to the organizations. Forrester Research estimates that there are more than 4 million robots doing office and administrative work as well as sales and related tasks [4]. In addition, the RPA market is estimated to be \$2.9 billion, although it is still just a small fraction of the \$48.5 billion of the overall market spending of Artificial Intelligence (AI) cubicle jobs [5].

RPA continues to out-perform expectations on non-financial benefits such as accuracy, timeliness, flexibility, and improved compliance. Since RPA streamlines workflows, organizations will be more profitable, flexible, and responsive. According to a report published by Deloitte [6], a Fortune 1000 organization with around \$20 billion revenue and 50,000 employees could improve its net profit by over \$30 million each year if it automates 20% of its addressable activity through RPA. In addition to financial benefits, removing mundane tasks from

employees’ workdays will also increase employee satisfaction, engagement, and productivity. Robots can also enable companies to free up employees for more meaningful work, which will advance the organizations’ digital transformation efforts.

3. How Robotic Process Automation will impact accounting

Manual processes in accounting tend to be time-consuming. Boyle [7] points out five primary areas where manual accounting processes require and consume significant resources: time, cost, risk, audit and compliance, and talent. Boyle states that with automation and behavioral change, 30 to 40 percent of time can be reduced, and by moving from manual processes to automation, organizations can achieve significant cost savings and reduce the chance of employees committing fraud. Furthermore, companies can attract and retain accounting talents by providing opportunities for employees to redirect their efforts toward analyzing data and being productive strategic advisors to the business. Kokina and Blanchette [3] interview RPA users and find that along with cost savings, accounting firms experience improved process documentation, lower error rates, more accurate measurement of process performance, and better report quality.

RPA can handle many standard accounting tasks. It has the potential to remove a lot of the mundane aspects from certain accounting roles. A number of leading accounting software providers (e.g. Xero, Intuit, Sage) incorporated technology into their software to automate basic accounting functions such as bank reconciliations, invoice categorization, risk assessment, audit processes (e.g. expense submissions, invoice payments), etc. Such automation can streamline processes, and turn inefficient, error-prone, labor-intensive processes into efficient, error-free processes that require very little human intervention. Moffitt, Rozario, and Vasarhelyi [8] posit that with its capability to automate rules-based tasks that are repetitive and manual, RPA is expected to repurpose the role of the auditor. Perfunctory tasks will be replaced, higher order thinking skills will be emphasized, leading to enhanced audit quality. The survey conducted by Cooper, Holderness, Sorensen, and Wood [9] reveals that both Big 4 accounting firm leaders and lower-level employees generally find RPA to have a positive influence on the profession. They believe that RPA has and will change the work employees perform from mundane to more value-added tasks. Consequently, it will open new opportunities, thereby increasing job satisfactions. They also believe that career prospects within

accounting firms will significantly improve, increasing the attractiveness of the accounting profession.

In a survey conducted by Kokina, Gilleran, Blanchette, and Stoddard [10], experienced professionals interviewed comment that automation in the accounting profession is not simply already happening but also accelerating. Accountants must adapt in order to navigate these changes.

4. Will accountants be replaced by RPA?

Driven by the pandemic, many organizations transformed their entire workforces to working remotely virtually overnight. The digital workplace advanced by decades in a matter of weeks. In just two months, companies worldwide spent \$34.6 billion on cloud services, which is the equivalent of two years' worth of digital transformation [11]. The increasing use of RPA software in the accounting industry have many accountants across the country worried that RPA will replace the need for companies to work with accountants. Forrester Research estimates that RPA software will threaten the livelihood of more than 230 million knowledge workers, or approximately 9 percent of global workforce [12]. Accountants are certainly among those who will be affected. In fact, according to a calculator developed by Deloitte and Oxford University, accountants have a 95% chance of losing their jobs to robots within the next two decades [13].

With modern technology leading the transformation of the future digital workplace, the organizational structure of the finance and accounting profession will gradually change from its current traditional pyramidal shape (Figure 1) to an inverted diamond shape (Figure 2) [14]. Traditionally, a Chief Financial Officer (CFO) is at the top of a pyramid. He/she is supported by a layer of leadership in functional areas such as treasury, reporting, and financial control and planning. These leaders share their insights on risk management and performance evaluation with the CFO. Beneath them is a larger layer of technical experts who perform analysis to help the leaders create those insights. At the base of the pyramid are large teams of workers who gather data and perform basic processing and analysis. But with sophisticated technologies processing data automatically, the bottom layer of workers is not needed as much as before anymore. The pyramid now has a new shape that looks more like an inverted diamond. Senior decision-makers and strategic influencers will occupy the small top layer. Technical experts in the layer beneath those leaders work together with employees who have softer skills –

business partnering, influencing, and innovating. The experts and workers in this second layer are increasingly supported by a third layer of AI-based technologies that increase their ability to support other functions across the whole organization. The bottom layer of data processing and collection is now much smaller due to automation. And this bottom layer will continue to get smaller as new technologies become more commonplace.



Figure 1. Traditional finance and accounting organizational structure.

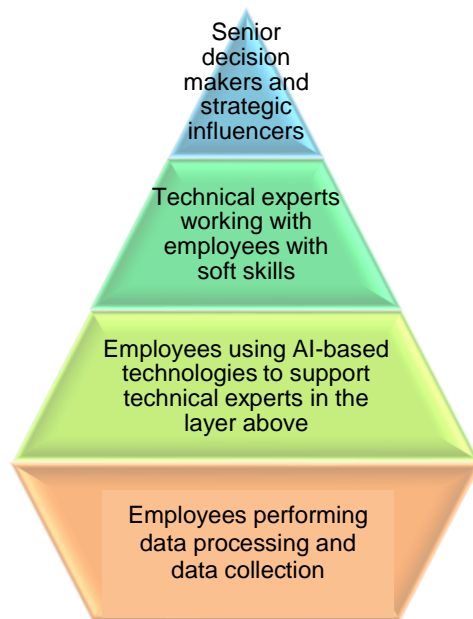


Figure 2. Inverted diamond shape of future finance and accounting digital workplace.

As a result of the shrinking bottom layer of the organizational structure of the finance and accounting profession, a large number of jobs that are repetitive and incorporate manual undertakings will be displaced. That means entry-level accountants will likely be replaced by RPA. Are university accounting students prepared for this unavoidable trend of future employment? This study explores accounting students' perception of the impact of RPA on future accounting employment. It also investigates if an expectation gap exists between students' perception of the probability of accounting jobs being displaced by RPA versus the real-world scenario. In addition, it examines if college education narrows the expectation gap if it exists.

5. Hypotheses

A significant acceleration in the adoption of RPA for accounting tasks is expected, and substantial changes are on the horizon [7]. Are accounting students aware that automation has been happening in the accounting profession? Do they realize that RPA may eliminate many jobs in their future accounting careers? This study aims to explore the perception of accounting students regarding the impact of RPA on the accounting profession. The following three hypotheses are examined in this study:

H1. There is no significant difference in students'

perception of the probability RPA will replace humans in manufacturing, office clerical, and entry-level accounting jobs.

H2. There is no significant difference in students' perception and experienced accounting managers' perception of the probability RPA will replace humans in entry-level accounting jobs.

H3. Accounting education/training alters students' perception of the probability RPA will replace humans in entry-level accounting jobs.

The verification of these three hypotheses will help determine whether or not accounting education/training may narrow the expectation gap between students' perception and real-world scenario of humans being displaced from accounting jobs by RPA.

6. Methodology

The subjects in this study were first-year business students who enrolled in a year-one Accounting Principles course at a university in England in 2021. Two questionnaires were used in a survey to collect data from these students. The first questionnaire was a pre-test administered on January 4, 2021, the first day of the course, and the second was a post-test administered at the end of the course on April 12, 2021. In this study, students' responses from the pre-test and post-test were paired up. Responses from those students who did not complete both tests were discarded. To ensure anonymity, each student was asked to choose a secret code to identify himself/herself. Each student's responses to the two questionnaires were then matched using the code. Paired Sample t-Test and Independent Sample t-Test were used for analyses.

6.1. Pre-test survey on first day of the course

To examine whether there is a difference in students' perception of the probability RPA will replace humans in manufacturing, office clerical, and entry-level accounting jobs, students were asked to answer the following three questions as a pre-test on the first day of the course:

Question 1: What is the probability that robots will replace manufacturing jobs?

Question 2: What is the probability that robots will replace office clerical jobs?

Question 3: What is the probability that robots will replace entry-level accounting jobs?

Since all subjects were required to answer the three questions, Paired Sample t-Test is used to assess

if there is any significant difference in their perception of how probable these three types of jobs will be replaced by robots.

With respect to learning, students engaged in the following activities during the twelve weeks of class meetings:

1. The focus of Module One (the first six classes of the course) was on Financial Accounting. In this Module, students were required to do homework assignments on accounting equation, journal entry, posting, trial balance, income statement, balance sheet, and statement of cash flows by using EXCEL spreadsheet. The objective of these assignments was to have students complete these basic accounting processes manually.
2. From week four to week six, students were introduced to Mind Your Own Business (MYOB), an Australian bookkeeping and accounting software. Students learned that such software could complete the accounting processes in a much more efficient and error-free manner than doing it manually using EXCEL spreadsheet.
3. At the end of Module One, students were required to work on a simulation case. The Bach case was about a company that produced hair dryers. It included information on production, human resources, financing, and other aspects of company operation. Other forecasted information such as quantity produced and sold, selling price, marketing expenses, dividends, etc., were also given. Using EXCEL spreadsheet, students were asked to construct financial statements (balance sheet, income statement, statement of cash flows) for eight different scenarios. Based on these financial statements, students had to make business decisions such as whether or not equipment should be purchased, or hiring and termination of employees. Students again gained experience in manually completing basic accounting processes through this simulation case.
4. Module Two, week 7 to week 12 of the course, focused on Managerial Accounting. Each lesson started with a five- to seven-minute video provided by the publisher of the textbook. Real companies were used in the videos to reinforce principles and concepts of managerial accounting that students learned in class, demonstrating how relevant they are when making business decisions in the real world.
5. Students were required to answer case questions for each lesson in Module Two. Many of these questions were presented in the form of simulation games. Students were given EXCEL templates to help them evaluate multiple

scenarios and assumptions before making any decisions.

6.2. Post-test survey on last day of the course

To examine whether or not accounting education/training alters students' perception of the impact of robots on the displacement of accounting jobs, students were asked the following post-test question at the end of the course:

Question 4: What is the probability that robots will replace entry-level accounting jobs?

Paired Samples t-Test is used to compare students' pre-test perception and post-test perception to assess if education plays a role in changing students' perception in regard to accounting jobs being replaced by robots.

To investigate if there is any expectation gap between students' perception of the probability of accountants being displaced by robots, responses from students' pre- and post-test is compared with responses from experienced accounting managers currently in the workforce. Fifty-two management-level accountants were surveyed. They were asked to indicate their perception of how probable robots would displace human workers at entry-level accounting jobs.

7. Results and findings

7.1. Descriptive statistics

Descriptive statistics of respondents are presented in Table 1. As shown in Panel A, 126 students completed both the pre-test and post-test. Exactly half of the respondents are female and half of them are male. The average age of the students is 19.4 years. They have worked for only 0.61 years on the average. Panel B shows that of the 52 accounting managers in the survey, 29 (56%) are female and 23 (44%) are male. Their average age is 52.3 years. They are very seasoned professionals, with an average of 29.26 years of working experience.

Perception of the respondents regarding the probability selected jobs will be replaced by RPA is presented in Table 2. As shown in Panel A, in the pre-test, students think there is a 20% to 100% probability (mean 56.53%, standard deviation 19.28%) that manufacturing jobs will be replaced by RPA. For office clerical jobs, the probability is between 6% and 90% (mean 36.99%, standard deviation 17.61%). And for entry-level accounting job, the probability is between 5% and 78% (mean 28.64%, standard deviation 18.04%). It appears that students consider

Table 1. Descriptive statistics of respondents.			
Panel A. Descriptive statistics of students (N=126)			
	Min.	Max.	Average
Age (year)	18	22	19.4
Work Age (year)	0.5	2	0.61
Gender	F= 63 (50%), M = 63 (50%)		
Panel B. Descriptive statistics of managers (N=52)			
	Min.	Max.	Average
Age (year)	35	65	52.3
Work Age (year)	12	42	29.26
Gender	F = 29 (56%), M = 23 (44%)		

manufacturing jobs the most likely to be replaced by RPA, whereas accounting jobs are the least likely to be replaced. After receiving accounting education/training, their perception regarding accounting jobs changed. The perceived probability is now higher at between 10% and 90% (mean 44.24%, standard deviation 19.28%).

Panel B of Table 2 presents the perception of accounting managers. They perceive that the probability of accounting jobs being replaced by RPA is between 10% and 80% (mean 46.05%, standard deviation 17.88%).

Table 2. Perception of students and accounting managers: Probability of manufacturing, clerical, and accounting jobs being replaced by RPA.				
Panel A. Perception of students				
	Min.	Max.	Mean	Std. Dev.
Prob_pretest-manufacturing (%)	20.00	100.00	56.53	19.28
Prob_pretest-clerical (%)	6.00	90.00	36.99	17.61
Prob_pre-test_accounting (%)	5.00	78.00	28.64	18.04
Prob_post-test_accounting (%)	10.00	90.00	44.24	19.28
Panel B. Perception of accounting managers				
	Min.	Max.	Mean	Std. Dev.
Manager_prob_accounting (%)	10.00	80.00	46.05	17.88

7.2. Results and discussions

For the testing of H1, Paired Samples t-Test-is performed to assess if there is any significant difference in students' perception of how probable manufacturing, clerical, and accounting jobs will be replaced by robots. Table 3 shows the results of all possible pairwise comparisons of those three types of jobs.

Table 3. Paired Samples t-Test of students' perception of probability of RPA replacing manufacturing, office clerical, and entry-level accounting jobs.		
	t	Sig.
Pair 1 Prob_pretest_accounting versus Prob_pretest_clerical	-6.39*	.000
Pair 2 Prob_pretest_accounting versus Prob_pretest_manufacturing	-15.49*	.000
Pair 3 Prob_pretest_clerical versus Prob_pretest_manufacturing	-11.92*	.000
*significant at the 0.01 level		

As shown in Table 3, there are significant differences in pre-test means for manufacturing, office clerical, and entry-level accounting jobs. Therefore, H1 cannot be accepted. Results also reveal that students perceive that manufacturing jobs are the most likely to be replaced by RPA, followed by office clerical jobs, and then by entry-level accounting jobs.

H2 states that there is no significant difference in students' perception and experienced managers' perception of the probability RPA will replace humans in entry-level accounting jobs. To test whether H2 is valid, pre-test data collected from students is compared with data collected from experienced accounting managers. Independent Samples t-test is used to examine if there is any difference in the variance between students' pre-test mean score and that of the managers' sample. Table 4 presents the results of the Independent Samples t-Test. Levene's Test for Equality of Variances is conducted to check the equality of variances.

Results shown in Table 4 reveal that there is statistically significant difference between students' pre-test perceived probability of RPA replacing accounting jobs and the perception of the experienced accounting managers (t_{176} , $p < .001$). Therefore, H2 cannot be accepted. This difference suggests that

Table 4. Comparison of students' perception in the pre-test and accounting managers' perception.

	N	Mean	Std. Dev.	Mean difference
Prob_ pre-test_ accounting (Student)	126	28.64	1.60	-17.41*
Manager_ prob_ accounting	52	46.05	2.48	
*mean difference is significant at the 0.01 level; t=-5.87; df=176				

students underestimated how probable it is that RPA will displace accountants in the real world, and an expectation gap exists between the students and the accounting professionals.

H3 states that accounting education/training alters students' perception of the probability RPA will replace humans in entry-level accounting jobs. Paired Samples t-Test is used to test this hypothesis. This test is used because each student's pre-test and post-test perception regarding accounting jobs can be paired up and compared. Table 5 presents the results of the paired t-test for students' pre-test and post-test mean scores.

Table 5. Comparison of students' perception in the pre-test and post-test.

	N	Mean	Std. Dev.	Mean difference
Prob_ pre-test_ accounting (Student)	126	28.64	1.60	-15.6*
Prob_ post-test_ accounting (Student)	126	44.25	19.29	
*mean difference is significant at the 0.01 level; t=-10.545, df=125				

As shown in Table 5, there is significant difference in the pre-test and post-test mean scores. Therefore, H3 cannot be rejected. This difference suggests that education/training during the twelve-week course increases students' awareness of the probability of accounting jobs being replaced by RPA.

Further statistical test is conducted to examine if education/training contributes to the narrowing of expectation gap between students' perception of the probability of RPA replacing accounting jobs. Using Independent Samples t-Test, students' post-test

perception is compared to accounting managers' perception. Levene's Test for Equality of Variances is conducted to check the equality of variances in this statistical procedure. Table 6 shows the results of this test.

Table 6. Comparison of students' perception in the post-test and accounting managers' perception.

	N	Mean	Std. Dev.	Mean difference
Prob_ post-test_ accounting (Student)	126	44.14	19.28	-1.811
Manager_ prob_ accounting	52	46.05	2.48	
mean difference reports no statistical significance; t=-0.6; df=176				

Results shown in Table 6 suggest that education changes the students' perception. After engaging in twelve weeks of learning activities in the course, students become more aware that RPA can displace accountants. Their perception is now more realistic and in line with that of the experienced accounting managers, which is used as a proxy for the real-world scenario.

8. Conclusion

Many repetitive and tedious tasks that are currently performed by humans are expected to be replaced by machines and robots. As the use of RPA increases in the accounting profession, routine jobs normally performed by accountants will be done by machines instead. However, as revealed in the pre-test results in the survey conducted in this study, university accounting students did not fully comprehend the potential impact of automation on the accounting profession. Although they realized that it is likely manufacturing jobs will be replaced by automation (probability of 56.53%), they did not consider it very likely that accounting jobs would be replaced (probability of 28.64%). However, after being introduced to both manual, tedious accounting tasks of the accounting process (from journal entry to the final products of financial statements) and MYOB (Mind Your Own Business), an accounting software that automates the same manual tasks, the students' perception changed. At the end of the course, they realized that the probability accounting jobs would be replaced by RPA (44.24%) was higher than they thought.

Will accountants survive the world of RPA? Will their jobs be replaced by RPA? It is not likely that automation will eliminate all jobs. Although there may not be any need for physical labor, and millions of middle- and low-level positions will be eliminated, more new jobs will be created with automation. According to a report by Gartner research firm, two million net new automation-related jobs will be created from 2020 to 2025 [15]. Technological adoption by companies will transform tasks, jobs, and skills. As a result, a large number of people may need to shift occupational categories and learn new skill in order to find their way into these new jobs. Although RPA can handle many basic accounting tasks faster, more efficiently, and without human error, it does not mean that it will replace accountants. It just means that the accounting profession will evolve, and the role of accountants will be changed. Automation will free accountants from mundane, repetitive tasks to devote more time to analyze, interpret and understand information and data, and focus on other parts of their job that are more challenging. There will always be a need for human intelligence. Instead of displacing accountants, RPA will just transform the duties performed by accountants.

For those accountants who are already in the workforce, it is imperative for them to future-proof their jobs. They must embrace new technology and learn how to maximize its use to enhance their ability to better serve their clients. They need to gain a better understanding of automation and coding, and have the additional skill of understanding and operating robots. They must develop technical competence in the areas of data analytics, data science, business intelligence, and information systems. They have to find ways to acquire these skills in order to remain relevant. Those who are willing to expand their skills to work alongside machines and robots will not have to fear that they will be displaced by technologies.

Just as the responsibilities and duties of accountants will be transformed due to the implementation of RPA, accounting education will also need to adapt and be modified to meet the current trends and needs in the working world. It is crucial for educational institutions to enhance their accounting curriculum to better prepare students for the changing profession. To equip graduating accounting students joining the workforce with skills they need for future accounting work, many universities have already incorporated information technology and data management courses into their accounting curriculum. However, even with education, students might still not be ready to face the real world when they graduate because it is expected that around 35% of skills needed for all jobs will be different in the near future [16].

Therefore, current university accounting students need to understand that they have to be ready to re-skill when they join the workforce. They also need to be aware that in order to stay current and relevant in their future accounting profession, they will have to be trained and re-trained, and embrace a culture of lifelong learning.

As with all research, this study is subject to certain limitation. Although the number of accounting students surveyed in this study (126) is sufficiently large, the authors of this study acknowledge that the sample size of experienced accounting managers surveyed (52) is relatively small. The authors look forward to future research that expands readers' understanding of student perception of the impact of RPA on accounting profession by including larger sample sizes. As RPA gains more recognition and being adopted more widely over time, a follow-up study, preferably with larger sample sizes, could reveal whether an expectation gap still exists.

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